Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Environmental Impact Statement

Appendix N
Statement of Heritage Impact

Volume 7

N

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1 Introduction

The project would comprise a new multi-lane road between the New M5 Motorway at Arncliffe and President Avenue at Kogarah. The project would connect underground with the New M5 Motorway tunnel and to a new surface level intersection at President Avenue, Kogarah.

1.1 Overview of the project

Key components of the project would include:

- An underground connection to the existing stub tunnels at the New M5 Motorway at Arncliffe
- Twin motorway tunnels (around four kilometres in length) between the New M5 Motorway at Arncliffe and President Avenue, Kogarah
- A tunnel portal and entry and exit ramps connecting the tunnels to a surface intersection with President Avenue
- Intersection improvements at the President Avenue / Princes Highway intersection
- Mainline tunnel stubs to allow for connections to future stages of the F6 Extension
- Shared pedestrian and cycle pathways connecting Bestic Street, Rockdale to Civic Avenue, Kogarah via Rockdale Bicentennial Park (including an on-road cycleway)
- An Operational Motorway Control Centre to be located off West Botany Street, Rockdale
- Ancillary infrastructure and operational facilities for signage (including electronic signage), ventilation structures and systems at Rockdale, fire and safety systems, and emergency evacuation and smoke extraction infrastructure
- A proposed permanent power supply connection from the Ausgrid Canterbury subtransmission substation
- Temporary construction ancillary facilities and temporary works to facilitate the construction of the project.

Once complete, the project would improve connections and travel times between Sydney and the Princes Highway and enhance connections for residents and businesses within the broader regional area as well as promote and support economic development in areas to the south, such as Sutherland and the Illawarra.

Approval for the project is being sought under Part 5, Division 5.2 of the EP&A Act. Future stages of the F6 Extension would be subject to separate planning applications and assessments would be undertaken accordingly.

The configuration and design of the project will be further developed to take into consideration the outcomes of community and stakeholder engagement.

1.2 Project location

This project would be generally located within the Bayside Council local government area. The project commences about 8 kilometres south west of the Sydney central business district (CBD). The proposed President Avenue intersection would be located about 11 kilometres south east of the Sydney CBD.

1.3 Purpose of this report

The purpose of this report is to provide a statement of heritage impact for all heritage items that would be directly or indirectly affected by Project. This assessment has been prepared in accordance with the Heritage Manual, prepared by the Heritage Division, Office of Environment and Heritage (1996) and relevant subsequent guidelines.

This report does not include an assessment the proposed permanent power supply. Refer to the main volume Environmental Impact Statement for a high level assessment.

1.4 SEARs and Agency comments

Table 1-1 SEARs – Heritage

Requirement	Where addressed
The Proponent must identify and assess any direct and/or indirect impacts (including cumulative, vibration and visual impacts) to the heritage significance of listed (and nominated) heritage items inclusive of:	
c) environmental heritage, as defined under the Heritage Act 1977 (including potential items of heritage value, conservation areas, open space heritage landscapes, built heritage landscapes and archaeology);	Potential impacts are assessed in section 6.
d) items listed on the State, National and World Heritage lists; and	Items on these lists identified in section 4.1.3 and impacts are assessed in section 6.
e) heritage items and conservation areas identified in local and regional planning environmental instruments covering the project area.	Items on these lists identified in section 4.1.4 and impacts are assessed in section 6.
Where impacts to State or locally significant heritage items or archaeology are identified, the assessment must:	
a) Include a significance assessment and statement of heritage impact for all heritage items (including any unlisted places that are assessed of heritage value);	Significance assessments and statements of heritage impacts are provided in section 5.
b) Provide a discussion of alternative locations and design options that have been considered to reduce heritage impacts;	Discussion of alternative locations and design options found in Chapter 5.
c) In areas identified as having potential archaeological significance, undertake a comprehensive archaeological assessment and management plan in line with Heritage Council guidelines which includes a methodology and research design to assess the impact of the works on the potential archaeological resource and to guide physical archaeological test excavations and include the results of these excavations. This is to be carried out by a suitably qualified archaeologist and is to discuss the likelihood of significant historical and Aboriginal archaeology on the site, how this may be impacted by the project, and include measures to mitigate any impacts;	A summary of archaeological potential is provided in section 4.4. The assessment was carried out by Mr Chris Lewczak, Senior European Heritage Specialist at AECOM.
d) Consider impacts to the item of significance caused by, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, increased traffic, visual amenity, landscape and vistas, curtilage, subsidence, hydrological changes and architectural noise treatment (as relevant);	Potential impacts are assessed in section 6.
e) Provide a comparative analysis to inform the rarity and representative value of any heritage places proposed for demolition;	A Comparative Analysis is provided in section 6.3.
f) Outline mitigation measures to avoid and minimise identified impacts in accordance with the current guidelines; and	Mitigation measures are outlined in section 7.
g) Be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria).	The assessment was carried out by Mr Chris Lewczak, Senior European Heritage Specialist at AECOM. No archaeological excavation is proposed.

1.5 Structure of this report

This statement of heritage impact report has been set out in the following manner:

- **Chapter 2** details the construction and other project features;
- **Chapter 3** outlines the methodology used in preparing this assessment report;
- **Chapter 4** includes an outline of the existing legislative, historical and current layout of the Project area. A summary of the archaeological potential is also included in **Chapter 4**;
- A significance assessment has been prepared for each of the known and potential heritage items identified to be impacted by the proposed works is undertaken in **Chapter 5**;
- A detailed impacted assessment is presented in **Chapter 6**; and,
- Project management and mitigation of impacts are presented in **Chapter 7**.

2 The Project

2.1 Project features

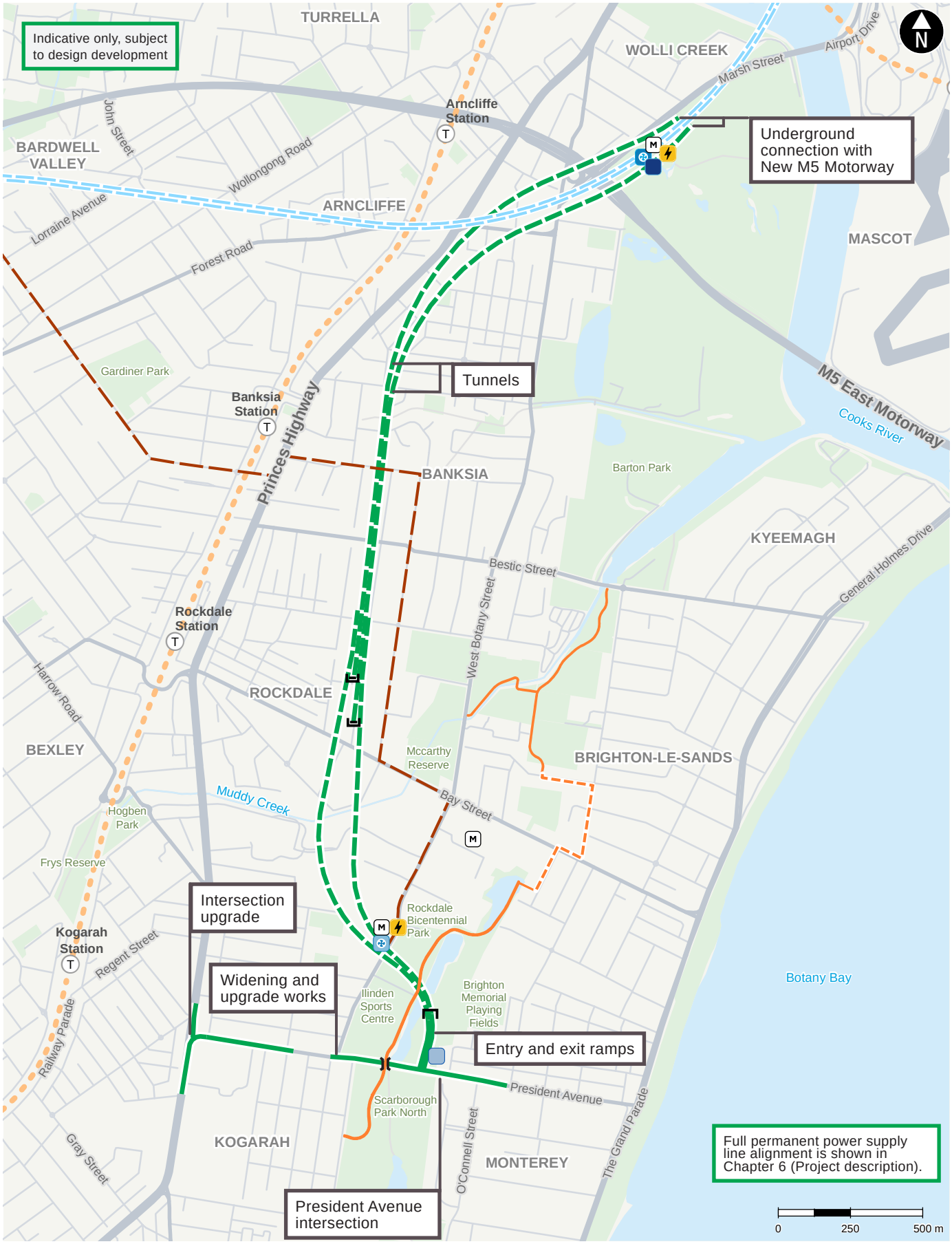
The project would comprise a new multi-lane underground road link between the New M5 Motorway and a surface intersection at President Avenue, Kogarah.

Key components of the project would include:

- Twin mainline tunnels. Each mainline tunnel would be around 2.5 kilometres in length, sized for three lanes of traffic, and line marked for two lanes as part of the project
- A tunnel-to-tunnel connection to the New M5 Motorway southern extension stub tunnels, including line marking of the New M5 Motorway tunnels from St Peters interchange to the New M5 Motorway stub-tunnels
- Entry and exit ramp tunnels about 1.5 kilometres long (making the tunnel four kilometres in length overall) and a tunnel portal connecting the mainline tunnels to the President Avenue intersection
- An intersection with President Avenue including entry and exit ramps and the widening and raising of President Avenue
- Upgrade of the President Avenue / Princes Highway intersection to improve intersection capacity
- Shared cycle and pedestrian pathways connecting Bestic Street, Brighton-Le-Sands to Civic Avenue, Kogarah (including an on-road cycleways)
- Three motorway operation complexes:
  - Arncliffe, including a water treatment plant, substation and fitout (mechanical and electrical) of a ventilation facility currently being constructed as part of the New M5 Motorway project
  - Rockdale (north), including a motorway control centre, deluge tanks, a workshop and an office
  - Rockdale (south), including a ventilation facility, substation and power supply.
- Reinstatement of Rockdale Bicentennial Park and recreational facilities
- In-tunnel ventilation systems including jet fans and ventilation ducts connecting to the ventilation facilities
- Drainage infrastructure to collect surface water and groundwater inflows for treatment
- Ancillary infrastructure for electronic tolling, traffic control and signage (both static and electronic signage)
- Emergency access and evacuation facilities (including pedestrian and vehicular cross and long passages) and fire and life safety systems
- New service utilities, and modifications and connections to existing service utilities
- A proposed permanent power supply connection from the Ausgrid Canterbury subtransmission substation, to Rockdale Motorway Operations Complex south.

The project does not include ongoing motorway maintenance activities during operation or future upgrades to other intersections in the vicinity during operation. These works are permitted under separate existing approvals and / or are subject to separate assessment and approval in accordance with the EP&A Act.

The key features of the project are shown on **Figure 2-1**.



LEGEND

- The project in tunnel
- The project on surface
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Tunnel stub
- Tunnel portal
- Water quality basin
- Water treatment facility
- Rockdale ventilation facility
- Motorway operations complex
- Substation
- Permanent power supply line
- New M5 Tunnel
- Arncliffe ventilation facility*
- * Under construction as part of the New M5 Motorway project
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 2-1 Project features

2.2 Construction activities

2.2.1 Construction activities

The proposed construction activities for the project would include:

- Preparatory investigations
- Site establishment and enabling work
- Tunnelling
- Surface earthworks and structures
- Construction of motorway operations complexes
- Drainage and construction of operational water management infrastructure
- Construction of the permanent power supply connection
- Road pavement works
- Finishing works.

These activities would generally be undertaken within the following construction ancillary facilities:

- Arncliffe construction ancillary facility (C1) at Arncliffe, within the Kogarah Golf Course currently being used for the construction of the New M5 Motorway
- Rockdale construction ancillary facility (C2) at Rockdale, within a Roads and Maritime depot at West Botany Street
- President Avenue construction ancillary facility (C3) at Rockdale, north and south of President Avenue within Rockdale Bicentennial Park and part of Scarborough Park North, and a site west of West Botany Street
- Shared cycle and pedestrian pathways construction ancillary facilities (C4 and C5) at Brighton-le-Sands, within the recreation area between West Botany Street and Francis Avenue, near Muddy Creek
- Princes Highway construction ancillary facility (C6), on the north-east corner of the President Avenue and Princes Highway intersection.

2.2.2 Construction boundary

The area required for project construction is referred to as the ‘construction boundary’. This comprises the surface construction works area, and construction ancillary facilities (refer to **Figure 2-2**). Utility works to support the project would occur within and outside the construction boundary (refer to **Chapter 7** (Construction) of the EIS).

In addition to these works, the underground construction boundary (including mainline tunnel construction and temporary access tunnels) is also shown on **Figure 2-2**.

C1

- Tunnelling and spoil handling
- Construction of MOC1 (Water treatment plant, substation)
- Fitout, testing and commissioning of tunnels and MOC 1

C2

- Construction of the decline tunnel
- Tunnelling and spoil handling
- Pavement works for internal access road
- Construction of MOC2
- Reconfiguration of the site to enable ongoing/future use for maintenance activities

C3

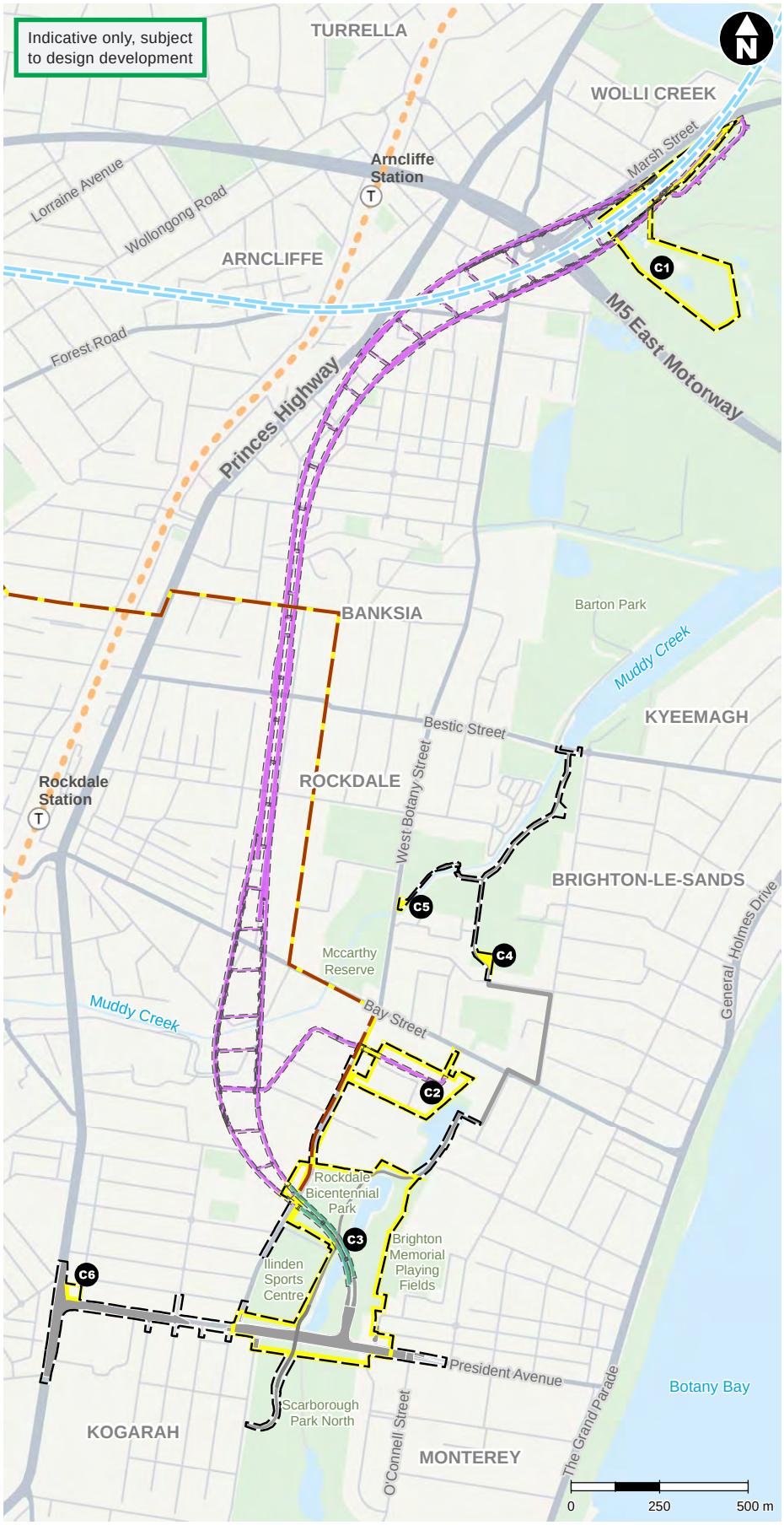
- Demolition of buildings and vegetation clearing and removal
- Relocation of utilities
- Temporary stockpiling of spoil and fill materials
- Management of any contaminated land, including acid sulphate soils
- Construction of cut-and-cover structures
- Construction of MOC3 (Rockdale ventilation facility and substation)
- President Avenue intersection upgrade works
- Construction of shared pedestrian and cyclist path and overpass

C4/C5

- Site establishment
- Vegetation clearing and removal, topsoil stripping areas and land-form shaping
- Temporary stockpiling of materials
- Construction of the shared pedestrian and cyclist path
- Finishing works including lighting, line marking and signage installation

C6

- Property adjustment and demolition
- Relocation of utilities, stormwater infrastructure, underground storage tanks and substation
- Laydown and parking of construction vehicles and equipment
- Reinstatement of site



LEGEND

- Surface works
- Construction boundary
- Cut-and-cover structures
- Underground construction
- Construction ancillary facility
- Permanent power supply line
- Permanent power supply construction route
- New M5 Tunnel
- Road
- Waterway
- Railway line
- Railway station
- Parks and recreation

Figure 2-2 Construction boundary and construction ancillary facilities

2.3 Construction program

The project would be constructed over a period expected to be around four years, including commissioning which would occur concurrently with the final stages of construction (refer to **Figure 2-3**).

The project is expected to be completed towards the end of 2024.

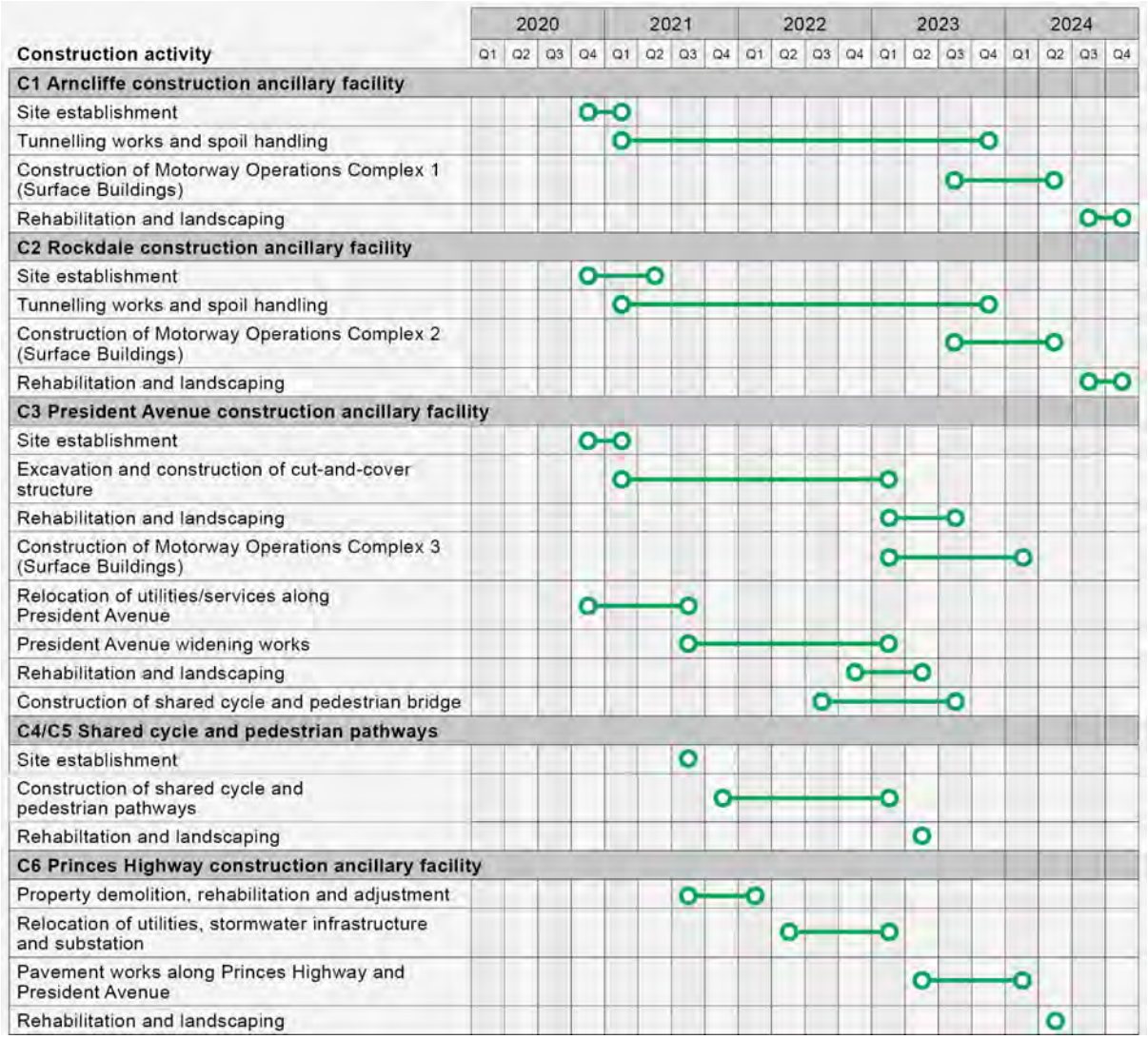


Figure 2-3 Indicative construction program

3 Assessment methodology

3.1 Relevant guidelines and policies

This heritage assessment has been undertaken in accordance with the NSW Heritage Division Heritage Manual[1]; Assessing Heritage Significance[2] and Statements of Heritage Impact[3].

3.2 Key assumptions

The purpose of this report is to identify and assess the impacts of the project against the known and potential built heritage and historical archaeological items and sites within the Project Area. This includes:

- Predictions have been made within this report about the probability of subsurface archaeological materials occurring within the site, based on historical information, surface indications and environmental contexts; however, it is possible that materials may occur in areas without surface indications and/or in any environmental context; and,
- This report is based on concept design for the project. It is noted that during detailed design, details of the project may change or be refined.

A summary of the statutory requirements regarding historical heritage is provided in **Chapter 4**. The summary is provided based on the experience of the authors with the heritage system in Australia and does not purport to be legal advice. It should be noted that legislation, regulations and guidelines change over time and users of the report should satisfy themselves that the statutory requirements have not changed since the report was written.

The Arncliffe tunnel site would utilise tunnel stubs provided by New M5 Motorway to connect the Project to the Sydney Motorway Network approximately 75 metres below ground. Operational facilities for the Project would be located within the operational footprint allocated for the New M5 Motorway.

Construction activities for the Project would be contained within the construction footprint currently being utilised for the New M5 Motorway. No historical or archaeological assessment has been undertaken for this site in this assessment. Vibration and subsidence effects from tunnelling works have been assessed in the assessment for potential impacts to heritage buildings in Section 6.1.2 in this assessment.

[1] NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996
[2] NSW Heritage Office, 2001
[3] (NSW Heritage Office, 2002

3.3 Methodology

This assessment has been carried out using the following methodology;

- Perform a search of statutory and non-statutory heritage databases for all pertinent information. The results of the searches will be tabulated in the report and appended to it in full. The registers are to include:
  - World Heritage List
  - Commonwealth Heritage List
  - National Heritage List
  - Register of the National Estate (non-statutory)
  - NSW State Heritage Register
  - NSW State Heritage Inventory
  - Section 170 Registers
  - Regional Environmental Plan, if relevant
  - Relevant Local Environmental Plans (LEP)

  NSW National Trust Heritage List (non-statutory).
- Map the curtilage of known and potential heritage items and areas on a modern aerial and compare with historical aerials, if available
- Utilise relevant written histories, past assessments and other relevant documentation
- Undertake a site inspection of the project area and examine the area for both known and previously unidentified heritage items and archaeological sites[4]. Should previously unknown heritage items be identified they have been recorded and the significance assessed
- Assess the potential for archaeological deposits within project area according to Heritage Division guidelines
- Provide advice regarding the potential level of impact and outline possible mitigation options to avoid, minimise or mitigate potential adverse impacts
- Prepare a report summarising the results of the above investigation.

[4] Survey was carried out by an AECOM Senior Archaeologist and Heritage Specialist (Qualifications: Bachelor of Archaeology (Hons) Flinders University) on 16 January 2018.

4 Existing Environment

4.1 Legislative Context

4.1.1 Commonwealth Legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) defines 'environment' as both natural and cultural environments and therefore includes Aboriginal and non-Aboriginal historic cultural heritage items. Under the EPBC Act, protected heritage items are listed on the National Heritage List (NHL) (items of significance to the nation) or the Commonwealth Heritage List (CHL) (items belonging to the Commonwealth or its agencies). These two lists replaced the Register of the National Estate (RNE). The RNE has been suspended and is no longer a statutory list; however, it remains as an archive.

Under Part 9 of the EPBC Act, any action that is likely to have a significant impact on a matter of National Environmental Significance (known as a controlled action under the EPBC Act), may only progress with the approval of the Commonwealth Minister for the Department of the Environment and Energy (DotEE). An action is defined as a project, development, undertaking, activity (or series of activities), or alteration. An action would also require approval if:

- It is undertaken on Commonwealth land and would have or is likely to have a significant impact on the environment on Commonwealth land
- It is undertaken by the Commonwealth and would have or is likely to have a significant impact.

There are no previously identified heritage items on the NHL or CHL within the project area or within 2.5 kilometres, the closest known listing being a CHL listed Air Traffic Control Tower at Sydney Airport, approximately 2.5 kilometres to the east of the project area at its closest point.

4.1.2 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act), administered by the NSW Department of Planning and Environment (DP&E), requires that consideration be given to environmental impacts as part of the land use planning process in NSW. In NSW, environmental impacts are interpreted as including impacts to Aboriginal and non-Aboriginal (i.e., European) cultural heritage.

Roads and Maritime is seeking approval for the project under Part 5, Division 5.2 of the EP&A Act. Pursuant to Section 5.2.3 of Division 5.2 of the EP&A Act, approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977* not required. The requirement to undertake heritage assessments is determined in the preparation of the Secretary's Environmental Assessment Requirements (SEARs) as specified under Section 115Y of the EP&A Act.

4.1.3 Heritage Act 1977

The *Heritage Act 1977* (as amended) was enacted to conserve the environmental heritage of NSW. Under Section 32, places, buildings, works, relics, movable objects or precincts of heritage significance are protected by means of either Interim Heritage Orders (IHO) or by listing on the NSW State Heritage Register (SHR). Items that are assessed as having State heritage significance can be listed on the SHR by the Minister on the recommendation of the NSW Heritage Council.

Projects to alter, damage, move or destroy places, buildings, works, relics, movable objects or precincts protected by an IHO or listed on the SHR require an approval under Section 60. The 'relics provision' requires that no archaeological relics be disturbed or destroyed without prior consent from the Heritage Council of NSW. Therefore, no ground disturbance works may proceed in areas identified as having archaeological potential without first obtaining an Excavation Permit pursuant to Section 60 of the *Heritage Act 1977*, or an Archaeological Exemption.

As this project is being undertaken as a SSI project under the EP&A Act, the provision to apply for approvals under the Heritage Act are not required.

Under Section 170 of the *Heritage Act 1977*, NSW Government agencies are required to maintain a register of heritage assets to be known as a Section 170 Heritage and Conservation Register (hereafter Section 170 Register). The register places obligations on the agencies, but not on non-government proponents, beyond their responsibility to assess the impact on surrounding heritage items.

At the Arncliffe end of the project area there are two items listed on the SHR that are located within 250 metres of the proposed works area. These are:

Item Number	Name	Distance from Project Area
01647	Western Outfall Main Sewer	50 metres to the South
01621	Alexandra Canal	250 metres to the Northeast

At the Rockdale tunnel site, there is only one item listed on the SHR that is located within 600 metres of the proposed works area. This is:

Item Number	Name	Distance from Project Area
01394	Toomevara Lane Chinese Market Gardens	580 metres to the South

There are two items listed on the SHR that are located above the tunnel locations. These are:

Item Number	Name	Address
01395	Arncliffe Market Gardens	212 West Botany Street Banksia
00487	Wilsons Farm House	310 West Botany Street Rockdale

There is one additional item that is located above the route of the tunnels listed on the Roads and Maritime Section 170 Heritage and Conservation Register. This is:

Item Number	Name	Address
4305029 (SHI)	Footings of 1933 Pedestrian Bridge at Arncliffe School (Archaeological)	168 Princes Highway, Arncliffe

There are five items that are listed on the SHR that are within 400 metres of the proposed power line connection route. None of these sites will be subject to direct impacts. These are:

Item Number	Name	Distance from Project Area
01395	Arncliffe Market Gardens	390 metres to the East
00638	Dappeto	275 metres to the East
00477	Lydham Hall	355 metres to the West
00487	Wilsons Farm House	300 metres to the East
01238	Rockdale Railway Station	380 m to the Southwest

There are five conservation areas that the proposed power line connection route passes through. These are:

Item Number	Name	Distance from Project Area
RNE Indicative Place 102111	Brighton Le Sands Urban Conservation Area	0 metres
RNE Indicative Place 102110	Banksia Urban Conservation Area	0 metres
RNE Indicative Place 102101	Bardwell Park Urban Conservation Area	0 metres
RNE Indicative Place 102071	Clemton Park Urban Conservation Area	0 metres
RNE Indicative Place 102069	Earlwood Urban Conservation Area	0 metres

There are 55 LEP Listed items within 400 metres of the proposed power line connection route. None of these sites will be subject to direct impacts. These are:

Item Number	Name	Distance from Project Area
I2	Sandstone Federation cottage	<400 metres
I4	Newstead	<400 metres
I14	Palm trees	<400 metres
I16	Californian Bungalow house	<400 metres
I17	Californian Bungalow house	<400 metres
I28	Coburra	<400 metres
I29	Wilga	<400 metres
I30	Californian Bungalow house	<400 metres
I62	Dappeto	<400 metres
I63	Federation house	<400 metres
I65	Federation house	<400 metres
I66	Fairview	<400 metres
I67	House	<400 metres
I68	Federation house	<400 metres
I69	Sandstone Victorian cottage	<400 metres
I70	House	<400 metres
I71	Sandstone Victorian cottage	<400 metres
I72	Sandstone Victorian cottage	<400 metres
I73	Sandstone Victorian cottage	<400 metres
I74	Part of single-storey terraced cottages known as Jackson's Row	<400 metres
I75	Part of single-storey terraced cottages known as Jackson's Row	<400 metres
I76	Stone house	<400 metres
I77	Stone Victorian house	<400 metres
I78	Stone house	<400 metres
I79	Gardiner Park	<400 metres
I80	Stone cottage	<400 metres
I81	Stone Federation house	<400 metres
I82	Californian Bungalow cottage (part of a street precinct)	<400 metres
I83	Californian Bungalow cottage (part of a street precinct)	<400 metres
I84	Californian Bungalow cottage (part of a street precinct)	<400 metres
I88	Californian Bungalow house	<400 metres
I89	Brick Californian Bungalow cottage	<400 metres
I90	Hillsdon's Nursery Cottage	<400 metres
I91	Stone cottage	<400 metres
I92	Stone cottage	<400 metres

Item Number	Name	Distance from Project Area
I93	Market Gardens	<400 metres
I109	Girrahween Park gates	<400 metres
I128	St Andrew's Church	<400 metres
I167	School building (1916) - Brighton-Le-Sands Public School	<400 metres
I169	Kings Wetland	<400 metres
I207	Rock Lynn	<400 metres
I208	Roslyn Hall	<400 metres
I210	Sandstone Victorian cottage	<400 metres
I211	House	<400 metres
I213	Palm trees on verge	<400 metres
I214	Jacaranda trees	<400 metres
I215	Yamba Worra	<400 metres
I216	Victorian house	<400 metres
I217	Lydham Hall	<400 metres
I218	Federation house	<400 metres
I219	Rockdale Public School	<400 metres
I220	Rockdale Town Hall	<400 metres
I222	Brick buildings om platforms, signal box and overhead booking office	<400 metres
I224	Wilson's Farmhouse	<400 metres
I237	Wolli Creek Valley	<400 metres

There are two S170 items within 400 metres of the proposed power line connection route, one of which has the powerline pass through its curtilage. These are:

Item Number	Name	Distance from Project Area
4801160	Banksia Railway Station Group	100 metres to the North
4801896	Bardwell Park Railway Station Group	0 metres

Archaeological features and deposits are afforded statutory protection by the 'relics provision'. Section 4(1) of the *Heritage Act 1977* defines 'relic' as follows:

- any deposit, artefact, object or material evidence that:
  a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and
  b) is of State or local heritage significance.

Under Section 139 (1) of the Heritage Act, it is an offence to disturb or excavate any land knowing or having reasonable cause to suspect that doing so would or is likely to result in relics being disturbed without a permit or exception.

4.1.4 Local Government

The project area is located within the Bayside Council LGA and partially within Canterbury-Bankstown LGA. The project area is located within boundary of the former Rockdale Council area and parts of the former Kogarah Council area. The relevant Local Environmental Plans (LEPs) for this project are the *Rockdale Local Environment Plan 2011* (Rockdale LEP) and the *Kogarah Local Environmental Plan 2012* (Kogarah LEP).

As the Project is being undertaken as a State significant infrastructure project the provisions in LEPs are turned off. As part of identifying known heritage items within the Project corridor, Schedule 5 of the Rockdale LEP was searched for previously listed heritage items.

There are three items listed on Schedule 5 of the Rockdale LEP that are located within the Rockdale tunnel site. These are:

Item Number	Name	Significance	Distance
I169	Kings Wetland	Local	Within the project
I202	Patmore Swamp	Local	Within the project
I167	Brighton-Le-Sands Public School (I167)	Local	Adjacent to the project

There are an additional 17 sites listed on Schedule 5 of the Rockdale LEP 2011 and Kogarah LEP 2012 that are present above the route of the tunnel section between the Arncliffe and Rockdale tunnel sites. See **Figure 4-1** and **Figure 4-2** for mapped curtilages of these items. These items are:

Table 2 Kogarah LEP 2012 listed heritage items

Item Number	Name	Address	Significance
I93	Arncliffe Market Gardens	212 West Botany Street, Banksia	Local
I235	Southern and Western Suburbs Ocean Outfall Sewer (SWSOOS) aqueduct	Various	Local
I34	Sandstone Victorian cottage	15 Kyle Street, Arncliffe	Local
I42	Arncliffe Public School and 'Teluba'	168–170 Princes Highway, Arncliffe	Local
I56	House	73 West Botany Street, Arncliffe	Local
I35	House	31 Kyle Street, Arncliffe	Local
I45	Victorian house	23 Segenhoe Street, Arncliffe	Local
I46	Victorian house	25 Segenhoe Street, Arncliffe	Local
I47	Californian Bungalow house	27 Segenhoe Street, Arncliffe	Local
I70	House	15 Cameron Street, Banksia	Local
I74	Part of single-storey terraced cottages known as Jackson's Row	11 Gibbes Street, Banksia	Local
I75	Part of single-storey terraced cottages known as Jackson's Row	18 Gibbes Street, Banksia	Local
I207	Rock Lynn	58 Bestic Street, Rockdale	Local
I199	Toomevara Lane Chinese Market Gardens	29A Toomevara Street, Kogarah	State
I4	House and garden	177 Rocky Point Road, Beverley Park	Local
I5	Former Ramsgate Methodist Church - Ramsgate Community Church	181 Rocky Point Road, Beverley Park	Local

LEGEND

- The project in tunnel
- Shared cycle and pedestrian pathways
- Substation
- Water treatment facility
- Permanent power supply line
- New M5 Tunnel
- Arncliffe ventilation facility*
- State Heritage Register
- Rockdale LEP
- S170 RMS heritage item
- S170 RMS heritage area
- Railway station
- Railway line

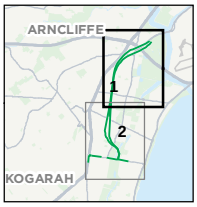
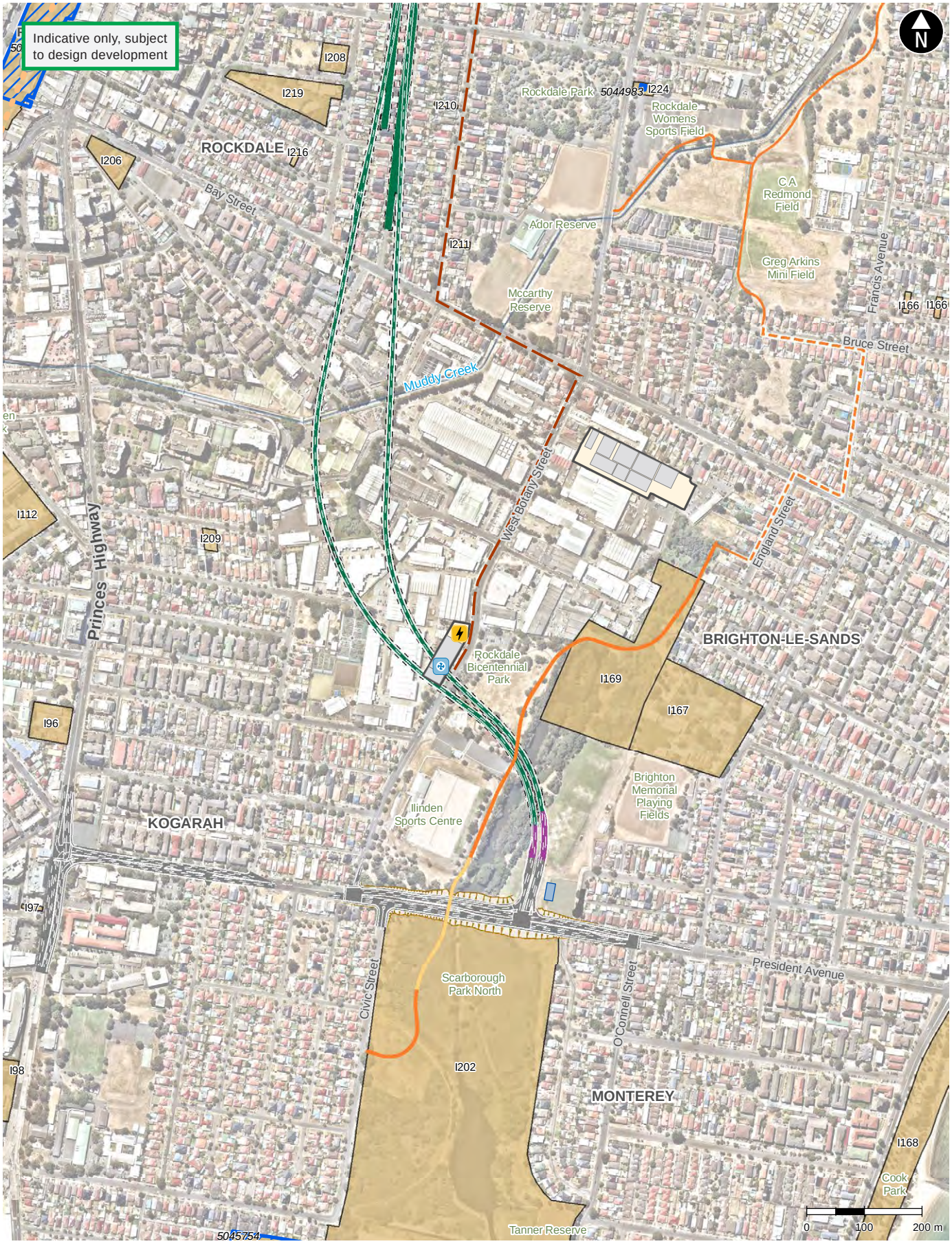


Figure 4-1 Non-Aboriginal heritage items within the vicinity of the project (north)



LEGEND

- The project in tunnel
- The project on surface
- The project as an open slot
- Water quality basin
- On-road cycleway
- Shared cycle and pedestrian pathways
- President Avenue shared cycle and pedestrian bridge
- Building
- Embankment
- Water quality basin
- Substation
- Rockdale ventilation facility
- Permanent power supply line
- State Heritage Register
- Rockdale LEP
- Railway station
- Railway line

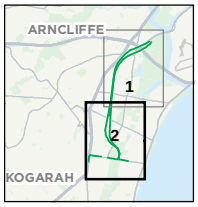


Figure 4-2 Non-Aboriginal heritage items within the vicinity of the project (south)

4.2 Historical Context

The historical context of the project area around President Avenue is directly related to the settlement along the coastal area along Brighton-Le-Sands and encroachment of early to mid-twentieth century residential development.

The first land grant awarded south of the initial European settlement was to Robert Campbell in 1803. He purchased a large estate on the northern bank of the Cooks River called "Canterbury". This was soon followed by a grant to Hanna Laycock of 500 acres called “Kings Grove Farm”. The track to her property became the major route south, and by 1830 this route became the main road south of the settlement at Sydney.[5]

Patrick Moore was granted 60 acres on 28 August 1812, and William Packer was granted two parcels, one 30 acres and the other 100 acres, on 1 January 1810 (see **Figure 4-3**). The Cooks River was the main factor preventing settlement expanding further to the south. A dam crossing Cooks River was opened in 1839 that travellers were able to use to cross into what is now the Rockdale area. A direct road to the Illawarra was planned and constructed, and in 1843 the Illawarra Road was opened. The formation of a formal government road allowed for more effective travel and communication outside of Sydney.[6]

Figure 4-3 Parish of St. George ca.1840, showing T. Moore’s early allotment boundary. Rockdale tunnel site outline in red (Source Trove https://nla.gov.au/nla.obj-229950367/view)

By 1848 the Parish of St George was created and the population at that time was 611 persons living in 132 houses.[7] Most of the occupations were believed to be rural occupations, including for cattle, horses and agriculture. Most subdivisions, or sales of subdivided land until the 1870s, were aimed at providing sizeable acreages of land, suitable for farms, villas and other large area activities. Along with these subdivisions, many of them did not require houses to be constructed. Many of these were for the creation of market gardens and other rural properties.

[5] A.O. Map 5123 in Walker and Kass, 1991
[6] Walker and Kass, 1991
[7] Wells, 1848

Growth and development along the coastal fringe south of the Cooks River was slower. This was mainly due to the gentrification of the area. Robert Cooper, jnr, son of Robert Cooper of Juniper Hall, Paddington, built a house on the end of Rocky Point (Sans Souci). Thomas Holt, a notable merchant and entrepreneur further developed *Sans Souci,* and William Rust developed a tourist destination in the 1860s. Due to the proximity of the waters of Botany Bay, then in an unpolluted state, the area became the resort of the wealthy and fashionable of Sydney.[8] By the late 1860s more houses were being built along the coastal strip. The more notable land owners, including Thomas Holt, persuaded the government to dedicate low-lying land alongside Scarborough Park for development (see **Figure 4-4**).[9]

Figure 4-4 Parish of St George 1886, showing the change of ownership and the formation of Patmore Swamp. Rockdale tunnel site outline in red.

The Illawarra line railway was opened in 1884 bringing greater and easier access to the area. Thomas Saywell, tobacconist, purchased land adjacent to the railway and successfully promoted an Act of Parliament to permit him to erect a private tramway from the railway along Bay Street, a public thoroughfare. He commenced construction of a substantial hotel facing the Bay in 1886.[10] This was later followed in 1888 by the construction of a government tram from Kogarah to Sans Souci. This was immediately followed by major development periods in the Kogarah and Sans Souci areas, including the Saywell Public Baths and Cottages, two race-courses, and private 'pleasure grounds' where holiday makers would retreat to over the summer months. Included was the establishment of Patrick Moore's race-course "Moorfield" to the west of what is now Patmore Swamp (see **Figure 4-6**) .[11]

[8] Walker and Kass, 1991
[9] Geeves and Jervis, 1954
[10] Geeves and Jervis, 1954
[11] Walker and Kass, 1991

The attraction for people to live closer to the coast lead to low lying lands that were set back between the coast and the train line to be used for market gardens, piggeries and poultry farms. By 1906 pressure for more land for residential needs was increasing. Larger plots of land, including the existing private race courses and pleasure grounds were being subdivided from 1910 onwards (see **Figure 4-5** and **Figure 4-6**). This allowed for smaller allotments that allowed modest residential houses to be built. These subdivisions began to encroach on the swamp and low-lying areas, however, the market gardens along Muddy Creek and adjacent to the swamp areas continued to be used .[12] By the end of the 19th century the swamp remained as an undeveloped area with only marginal encroachment around its edges.

Figure 4-5 Portion of West Botany – Parish of St George lithographed & published by Higinbotham & Robinson C1890. Note the plan shows roads and subdivisions deviated around the swamp areas. President Avenue has not crossed the swamp at this stage. President Avenue intersection is outline in red (Source: Trove https://nla.gov.au/nla.obj-229916244/view)

[12] *Ibid*

Pressure to reclaim Patmore Swamp began in the 1890s with petitions sent to the government to reclaim the swamp areas to make way for housing .[13] It was noted at the time that the surrounding water run off drained into Patmore Swamp and that filling the swamp would create other greater issues. These plans never eventuated but pressure was maintained on Rockdale Council. In 1916 the NSW Government proposed buying the swamp area to maintain the wetlands and protect them from development.[14] This may have been attributed to the original development of Brighton-Le-Sands and surrounding beach areas being designed for holiday 'private pleasure grounds' and the desire to maintain the natural state of the area. It may have also been associated with pressure put on by notable locals who still maintained houses and estates in the area in an attempt to separate the beach foreshore area from development pressures by maintaining this swamp. The sale of the swamp to the NSW government does not seem to have eventuated, with Rockdale Council continually taking petitions from local residents to drain the swamp.

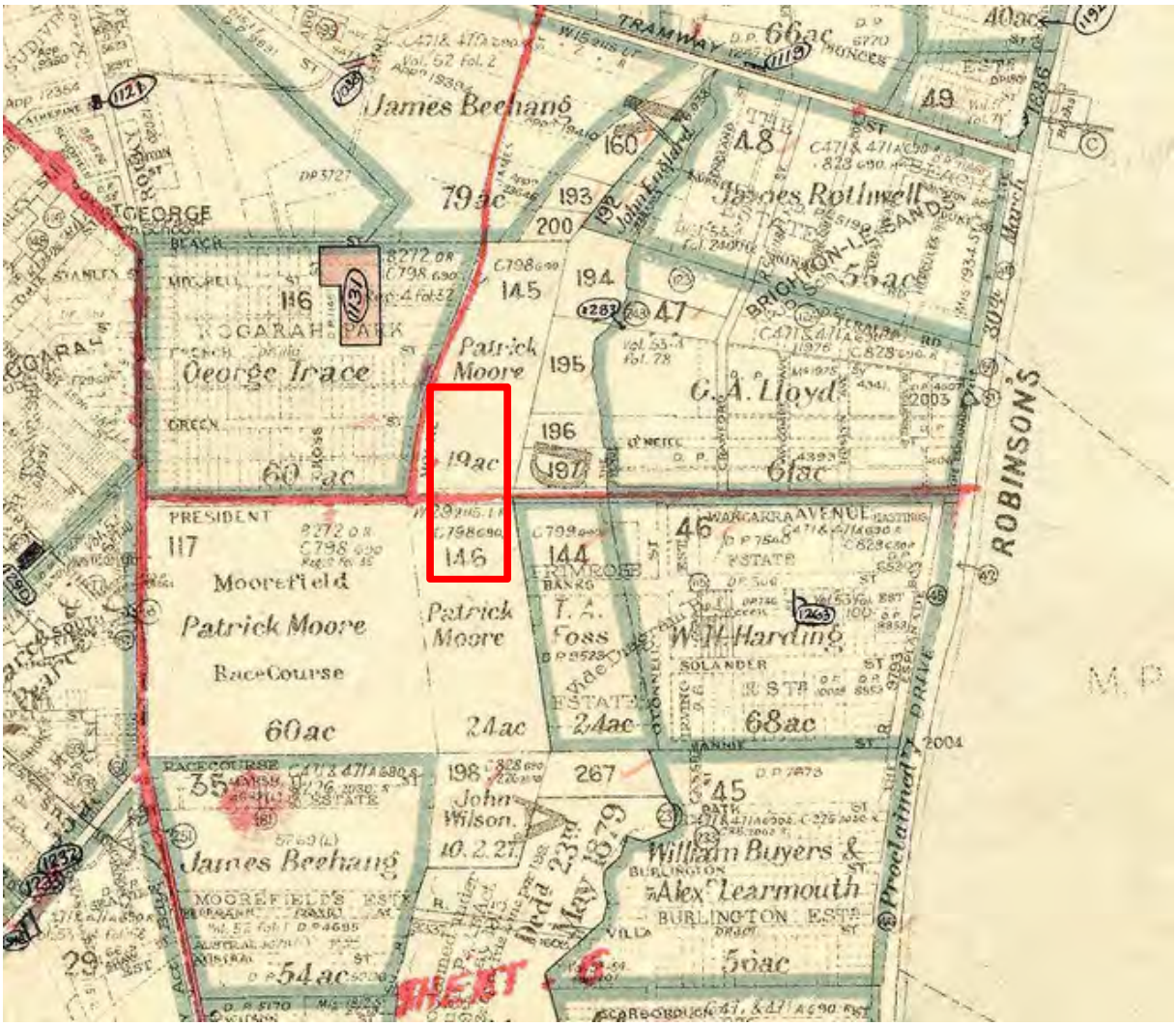


Figure 4-6 1906 Parish of St George showing the subdivisions that were occurring. Note that Patrick Moore's allotments forming the swamps were not subdivided and roads were deviated around this area. President Avenue intersection outline in red.

The health of the swamp area was called into question in 1929 when the Department of Health was called to take water samples of Patmore Swamp. Offensive odours were noted by local residents and samples revealed that the water was found to be "offensive". The cause was deemed to be decomposing vegetation and animals.[15]

[13] Daily Telegraph 19 May 1892
[14] Sydney Morning Herald 1 July 1916
[15] St George Call newspaper 22 March 1929

Eventual pressuring of Rockdale Council to drain and reclaim the swamp areas saw the calling for tenders to reclaim four acres of the swamp and for the potential digging of a channel.[16] Details relating to the eventual successful tender are scant however, a description from the opening of the new "Scarborough Park" in November 1934 describes the extent of the works. This included extensive reclamation works that created 15 cricket pitches and a large artificial lake through the draining of the swamp.[17]

Plate 1 Scarborough Park c1934 (Source : Government Printing Office 1 – 01702 from online source)

Other notable developments in the area include the subdivision and eventual development of the western side of West Botany Street. The allotments appear to have been subdivided sometime between 1890 and c1906 for the creation of residential housing. The allotments along what later becomes West Botany Street appear at this time to be larger and irregularly shaped, and as seen in the 1943 aerial, with a market garden located in this area.

The 1943 aerial shows there is a shed or possibly a house present in the location of 439 West Botany Street. The remainder of this area consists of possible lightweight sheds and market gardens (see **Plate 3**).

These allotments were later subdivided in 1969 to create six allotments fronting West Botany Street that become known as Numbers 431 to 439. It is after this date that the current brick warehouses that occupy these sites were built. A brick warehouse at 431 West Botany Street was demolished in 2016, however the other brick warehouse shops remain.

Between 1970 and the early 1980s there were not development changes to Patmore's Swamp on either side of President Avenue. The next phase of changes to the area were in the lead up to the Australian Bicentenary where Rockdale Council upgraded the then swamp are north of President Avenue to include the new open grassed field, carpark on the western side of the watercourse, and new playing fields on the eastern side. The redesign included large scale landscaping works that redefined the layout of Patmore Swamp. Once completed the northern side of Patmore Swamp was renamed Bicentennial Park and Bicentennial Park East. A bridge was constructed linking the two parks over the watercourse that remained from the swamp as a result of the works. Smaller additions have since been made to the park, including adding of the skate park and playground.

[16] St George Call 21 Oct 1932
[17] St George Call 30 Nov 1934

Plate 2 Artificial Lake 1934 (Government Printing Office 1 – 01701)

Plate 3 1943 aerial of the Patmore Swamp (Source: Six Viewer Online)

4.3 Physical Description

A site inspection of the project area was undertaken on 16 January 2018 by Chris Lewczak, AECOM Senior European Heritage Specialist. An inspection of the Kogarah Golf Course was not undertaken as part of this inspection as the site is currently a work compound for the New M5 Motorway project.

4.3.1 President Avenue Intersection

The site inspection for the Southern Project Area concentrated on Rockdale Bicentennial Park and Rockdale Bicentennial Park East, Patmore Swamp and the properties listed at 431 to 439 West Botany Street, Rockdale. Rockdale Bicentennial Park East is not part of the construction area associated with this Project.

The Southern Project Area consists of a series of open grassed playing fields and separate individual playing areas, including a skate park and playground. A portion of Rockdale Bicentennial Park makes up the north-western component of this Southern Project Area. Rockdale Bicentennial Park is an open grassed parkland that is built up approximately 1.8 metres above West Botany Street (see **Plate 4** to **Plate 6**). The boundary of the park includes tree plantings surroundings a walking track that extends around the full length of the park and links up with the footpath along West Botany Street (see **Plate 5**).

Plate 4 View of Rockdale Bicentennial Park from the northeast Corner, view southwest

Plate 5 Rockdale Bicentennial Park from along West Botany Street, view southwest

Plate 6 View along the wetland (left of photograph) at Rockdale Bicentennial Park , view south.

The wetland is located within Rockdale Bicentennial Park. The ground level between the walking track and the river is level and runs directly to the bank of the wetlands (see **Plate 7** to **Plate 10**). Again, this area has been heavily landscaped through what appears to be the filling of land to create the grassed playing area.

Plate 7 View of the track between Rockdale Bicentennial Park linking to Bicentennial Park East via the bridge across the wetland. View to east

Plate 8 View of the walking track within Bicentennial Park East, view to south

Plate 9 Bridge crossing the wetland between Rockdale Bicentennial Park linking to Bicentennial Park East

Plate 10 Existing culverts present along the wetland at Rockdale Bicentennial Park, view to west.

A bridge connecting a walking track between Rockdale Bicentennial Park and Bicentennial Park East extends off of the eastern side of the carpark area from Bicentennial Park. The bridge is believed to have been installed in 1988 when the landscaping works were completed and the Rockdale Bicentennial Park was opened.

Immediately across the bridge that connects Rockdale Bicentennial Park with the playing fields, a series of earthen walking tracks extend north and south along the western side of the wetlands. The southern walking track extends all the way to President Avenue. The walking track is built up above the wetland area, and includes extensive landscaping along both sides. The path opens up to a cleared grassed area where the path links up with the existing footpaths along President Avenue (see **Plate 11**).

Plate 11 View of the Southern portion of Kings Wetland. View to north.

4.3.2 431 to 439 West Botany Street

This portion of the project area is located immediately to the west of Rockdale Bicentennial Park and would form part of the ventilation outlet and operational facilities as well as cut and cover construction associated with the tunnelling works. The buildings present at 433 to 439 West Botany Street comprise of similar single and two storey brick façades with besser block side and back walls (see **Plate 12** to **Plate 14**). The buildings appear to be slab on ground constructions, likely built with strip footings. The rear yard areas consist of concrete driveways and hardstand storage areas. Access to these areas was not possible at the time of the survey.

Number 431 West Botany Street is a vacant block. The site previously consisted of a warehouse that occupied the entire block. Access to this block was not possible at the time of survey, however, views through the boundary fence show that the site has been highly disturbed from the construction of the previous warehouse and from its demolition in c2016.

Plate 12 View of the buildings present at 431 to 439 West Botany Street. View to east

Plate 13 View of the buildings present at 431 to 439 West Botany Street. View to northeast

Plate 14 Vacant property at 431 West Botany Street. View to southwest.

4.4 Summary of Archaeological Potential

Based on the site inspection and an understanding of the historical land use of the area, predictions about the archaeological potential can be made. Rockdale Bicentennial Park, including Bicentennial Park East and Patmore Swamp were largely left undeveloped swamp lands until the depression era reclamation works between 1932 and 1934. There were market gardens present along and within the western boundary of Rockdale Bicentennial Park, including the gardens and potential for light weigh shed structures. These were located in the vicinity of the present day skate ramp and car parking area. Archaeological remains associated with the former market gardens in this area are likely be limited to remnants of the former garden beds and or material that was brought in with the night soil used. Nineteenth and 20th century artefact material may have also been included in the might soil deposits that were used on the market gardens. Relic material that may be included in the night soil deposits, however, would be considered to be out of context as they have been transported to site as part of the night soil material, and not associated with the market garden land use itself. As such, this material, if present, would not have archaeological research value.

The level of impact that appears to have occurred from the landscaping in 1932-34 and associated with the creation of Rockdale Bicentennial Park in 1988 is likely to have disturbed this area and removed the archaeological potential from the site.

There are expected to be active drains installed as part of the modification and reclamation works in 1932-34. These items, however, are not likely to have any archaeological significance or research potential. Also, former or active drains are not considered to be 'relics' but are 'works' defined by the *Heritage Act 1977*, and therefore no permit is required to impact on these items.

Within Patmore Swamp, there is not expected to be any areas of historical archaeological potential. The swamp remain undeveloped, particularly the area that is to the south of President Avenue. A section of Moore's Racecourse track was built in this area, but has likely been disturbed by subsequent landscaping works post 1943. There are not expected to be any archaeological remains associated with the track within the Project area.

Based on the level of reclamation and modification works, including along the sites of 431 to 439 West Botany Street where a former market garden was present, any archaeological potential associated with former farming practices in this area is likely to be highly disturbed.

It has been assessed that there are no areas of archaeological potential within Rockdale Bicentennial Park, including Rockdale Bicentennial Park East, or Patmore Swamp.

5 Significance Assessment

Based on the historical research, site inspection and assessment of the archaeological potential that exists within the project area, a significance assessment would be prepared for those items that would potentially be effected directly and indirectly by the project.

In order to understand how a development would effected on a heritage item, it is essential to understand why an item is significant. An assessment of significance is undertaken to explain why a particular item is important and to enable the appropriate site management and curtilage to be determined. Cultural significance is defined in *The Australia ICOMOS Charter for Places of Cultural Significance 2013* (ICOMOS (Australia), 2013) as meaning "aesthetic, historic, scientific, social or spiritual value for past, present or future generations" (Article 1.2). Cultural significance may be derived from a place's fabric, association with a person or event, or for its research potential. The significance of a place is not fixed for all time, and what is of significance to us now may change as similar items are located, more historical research is undertaken and the tastes of the community change.

The process of linking this assessment with an item's historical context has been developed through the NSW Heritage Management System and is outlined in the guideline *Assessing Heritage Significance* (NSW Heritage Office, 2001), part of the *NSW Heritage Manual* (NSW Heritage Office & NSW Department of Urban Affairs and Planning, 1996). The *Assessing Heritage Significance* guidelines establish seven evaluation criteria (which reflect four categories of significance and whether a place is rare or representative) under which a place can be evaluated in the context of State or local historical themes. Similarly, a heritage item can be significant at a local level (i.e. to the people living in the vicinity of the site), at a State level (i.e. to all people living within NSW) or be significant to the country as a whole and be of National or Commonwealth significance.

In accordance with the guideline *Assessing Heritage Significance*, together with Section 33(3) of the Heritage Act, an item would be considered to be of State significance if it meets two or more criteria at a State level, or of local heritage significance if it meets one or more of the criteria outlined in **Table** 3. The Heritage Council require the summation of the significance assessment into a succinct paragraph, known as a Statement of Significance. The Statement of Significance is the foundation for future management and impact assessment.

As previously identified, there are not likely to be any previously unknown historical archaeological sites present within the project area around the southern portal. This area was a swamp up until the 1930s and the existing buildings on the site are likely to have further disturbed the historical archaeological potential that may exist in the area. The significance assessments associated with the existing heritage listed items, being Kings Wetland and Patmore Swamp, are presented below.

Significance assessments previously prepare for the 17 identified heritage items that are located above the tunnel route are also presented below.

Table 3 Significance assessment criteria

Criterion	Inclusions/Exclusions
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The site must show evidence of significant human activity or maintains or shows the continuity of historical process or activity. An item is excluded if it has been so altered that it can no longer provide evidence of association.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	The site must show evidence of significant human occupation. An item is excluded if it has been so altered that it can no longer provide evidence of association.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	An item can be excluded on the grounds that it has lost its design or technical integrity or its landmark qualities have been more than temporarily degraded.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	This criterion does not cover importance for reasons of amenity or retention in preference to proposed alternative.

Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Under the guideline, an item can be excluded if the information would be irrelevant or only contains information available in other sources.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	An item is excluded if it is not rare or if it is numerous, but under threat. The item must demonstrate a process, custom or other human activity that is in danger of being lost, is the only example of its type or demonstrates designs or techniques of interest.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	An item is excluded under this criterion if it is a poor example or has lost the range of characteristics of a type.

5.1 Kings Wetland Statement of Significance

A Statement of Significance has previously been prepared for the Kings Wetland heritage listing and is presented below unabridged.[18]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The Kings Wetland is of historical significance as a remnant of a natural wetland habitat dating from the time prior to white settlement of Australia.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	[The Kings Wetland site does not meet the State of local heritage listing under this criterion]
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The Kings Wetland is of aesthetic significance as a remnant wetland habitat containing a number of significant species of water plants. The site demonstrates the geography and vegetation of the area prior to white settlement. The site has further value as natural open space within a highly urbanised environment.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The Kings Wetland may have some social significance to the Aboriginal community but this cannot be ascertained from current available information.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	The Kings Wetland has some research significance associated with remnant indigenous plantings and the use of the area by native wildlife.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Regional
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Regional

Statement of Significance

"The Kings Wetland is an area of regionally significant aquatic plants and demonstrates the geography and vegetation of the area prior to white settlement. The destruction of wetland habitats in the Sydney Metropolitan Region, for the purposes of urban expansion, are of considerable concern and any surviving wetland habitats are considered to be of high significance" (Source: http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=3490033) (NSW Office of Environment & Heritage, 2018).

[18] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=3490033

5.2 Patmore Swamp Statement of Significance

A Statement of Significance has previously been prepared for the Patmore Swamp listing and is presented below unabridged.[19]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Historically significant as part of a depression public works programme.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	The Patmore Swamp is historically associated with Patrick Moore was granted 60 acres (240,000 m^2) of land in 1812.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Aesthetically significant as a landscape of high visual amenity contrasting with surrounding suburbs.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Technically significant for its contribution to the Central Scarborough wetland area which is an integral part of the wetlands corridor.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The swamp is representative of a man-made landscape.

Statement of Significance

"Technically significant for its contribution to the Central Scarborough wetland area which is an integral part of the wetlands corridor. The place also has historical value for its role in the depression era program of public works. The wetland reserve contributes to amenity and character of the area" (http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330166) (NSW Office of Environment & Heritage, 2018).

[19] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330166

5.3 School Building (1916) - Brighton-Le-Sands Public School Statement of Significance

This item is located at 35 Crawford Road, Brighton-Le-Sands. Below is the Statement of Significance previously been prepared for the School Building (1916) - Brighton-Le-Sands Public School listing and is presented in below unabridged.[20]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The school is historically significant as one of the earliest remaining buildings in Brighton Le Sands.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The school has aesthetic significance contributing to the streetscape of Crawford Street.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The school is socially significant as representative of new initiatives in education at the beginning of the twentieth century.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The school is representative of early twentieth century school buildings in NSW.

Statement of Significance

A distinctive Federation style building representative of education in Brighton Le Sands from the early twentieth century and contributing to the history and streetscape of the area.

[20] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330150

5.4 Arncliffe Market Gardens Statement of Significance

This item is located at 212 West Botany Street, Banksia. Below is the Statement of Significance previously been prepared for the Arncliffe Market Gardens listing and is presented below unabridged.[21]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The Arncliffe Market Gardens are of historical significance for their demonstration of a continuous pattern of land use since the late nineteenth century. They are also of significance for their association with the development of local industry and for their association with early Chinese immigration and the influence of ethnic communities on local industry.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The Arncliffe Market gardens are of aesthetic significance as an important area of productive open space, providing visual variety from the other types of open space in the area.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The Arncliffe Market Gardens are of high social significance for their association with early ethnic communities, especially Chinese, and for the role they have played in helping to feed the local and regional population, particularly during the Inter-War, Depression and Post-War periods.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	The Arncliffe Market Gardens have some technical/research significance for demonstrating early market gardening practices, particularly through the extant structure on the site relating to previous uses and remnant gardening equipment.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Market gardens such as this are becoming increasingly rare and the Arncliffe Market Gardens are of particular importance for their demonstration of a continuing pattern of usage from the late nineteenth century through to the 1930s.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Whilst there are market gardens elsewhere in the metropolitan region, there are few that have been used continually as these have.

Statement of Significance

The Arncliffe Chinese Market Gardens are of high significance for their association with the Chinese community and their demonstration of a continuous pattern of land usage since the late nineteenth century. They are one of only three such surviving market gardens in the Inner Sydney region and one of few similar surviving examples in the Sydney Metropolitan Region.

[21] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5045744

5.5 Wilsons Farm House Statement of Significance

This item is located at 310 West Botany Street, Rockdale. No Statement of Significance has been prepared for the Wilsons Farm House listed on the SHR. The listing includes a Statement of Significance only and is presented below unabridged. [22]

Statement of Significance

Wilsons Farm House is the last surviving example of the modest pioneer homes built along the banks of Muddy Creek. It demonstrates the early rural and more recent market garden development of Rockdale. It is an extant example of a simple nineteenth-century colonial farmhouse. It is associated with an early small holding settler family, the Wilson's (Design 5 1997).

[22] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=5044983

5.6 Southern and Western Suburbs Ocean Outfall Sewer Statement of Significance

Below is the Statement of Significance previously been prepared for the Southern and Western Suburbs Ocean Outfall Sewer listing and is presented below unabridged.[23]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	This section of the Western Outfall Main Sewer is of historical significance, being one of Sydney's earliest main sewers, built in the 1890's to end the discharge sewage into Sydney Harbour. It is also significant for its association with the former Botany Sewage Farm, which it served until 1916, when the farm was superseded by the SWSOOS No1
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The aqueduct is aesthetically sinificant as a finely detailed structure spanning Wolli Creek. The structure is technically significant exhibiting fine brickwork details and an early use of reinforced concrete formed by the brickwork.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	The sewer has potential to reveal further information about this type of construction method.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	The aqueduct and sewer is a rare and unusual example of late 19th century sewer construction and is part of the highly significant SWSOOS sewer system which is the largest in the SWC system and likely NSW.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The aqueduct is a representative example of late 19th century sewage construction.

Statement of Significance

The Arncliffe and Wolli Creek part of the original Southern and Western Ocean Outfall Sewer is of historical and technical significance. Historically, it is an original section of one of Sydney's oldest main sewers, built in the 1890s to end the discharge of sewage into Sydney Harbour. Its flow originally terminated at the former Botany Sewage Farm (which was one of only two known large scale sewage farms built in Australia during the 19th century), with which it has close temporal and locational associations. Technically the structure is significant as it demonstrates the brick aqueduct construction method of the time, which have provided continuous service for over 100 years.

[23] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330256

5.7 Sandstone Victorian Cottage Statement of Significance

This item is located at 15 Kyle Street, Arncliffe. Below is the Statement of Significance previously been prepared for the Sandstone Victorian Cottage listing and is presented below unabridged.[24]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The sandstone Victorian cottage at 105 Farr Street, Rockdale is historically significant as physical evidence of the development of Rockdale at the end of the 19th century.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The Victorian cottage makes an aesthetically positive contribution to the historic streetscape of Farr Street.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Dwelling is a rare stone cottage in the Rockdale area.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The building is a good representative example of a small sandstone Victorian cottage in the Rockdale area.

Statement of Significance

The sandstone Victorian cottage at 105 Farr Street, Rockdale is historically significant as physical evidence of the development of Rockdale at the end of the 19th century. The Victorian cottage makes an aesthetically positive contribution to the historic streetscape of Farr Street. The building is a good representative example of a small sandstone Victorian cottage in the Rockdale area.

[24] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330034

5.8 Arncliffe Public School and 'Teluba' Statement of Significance

This item is located at 168–170 Princes Highway, Arncliffe. Below is the Statement of Significance previously been prepared for the Arncliffe Public School and 'Teluba' listing and is presented below unabridged.[25]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Teluba is historically significant as a the grandest and earliest house in Segenhoe Street. It has important associations with the people responsible for developing the sewerage works and the Illawarra railway.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Teluba is historically significant for its association with prominent land owner, Samuel Terry, and the Arncliffe Public School.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Teluba is aesthetically significant as part of a group of dwellings from the late nineteenth century on the Segenhoe Street hill.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The school site including Teluba may have social significance for its value to past students and staff. This is as yet unsubstantiated.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Teluba is representative of Victorian villas in the Rockdale area.

Statement of Significance

A large villa in a prominent location as part of a streetscape of late Victorian buildings and representative of the early development of the Rockdale area. Teluba is historically significant as a the grandest and earliest house in Segenhoe Street. It has important associations with the people responsible for developing the sewerage works and the Illawarra railway. Teluba is historically significant for its association with prominent land owner, Samuel Terry, and the Arncliffe Public School.

[25] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330020

5.9 House (73 West Botany Street) Statement of Significance

This item is located at 73 West Botany Street, Arncliffe. Below is the Statement of Significance previously been prepared for this House listing and is presented below unabridged.[26]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house once known as "The Grange" is historically significant as one of the remaining house of the Innesdale Estate Arncliffe which formed the village of West Botany.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	The house is associated with W E Grainger postmaster of Arncliffe for 20 years and later alderman and mayor of Ashfield.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	This highly intact building at 73 West Botany Street has aesthetic value due to its integrity as a Victorian house. Its location in the context of other Victorian houses in Kyle Street add to its value both aesthetically and historically.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The dwelling is an excellent representative of Victorian dwellings in Rockdale.

Statement of Significance

This highly intact building at 73 West Botany Street has aesthetic value due to its integrity as a Victorian house. Its location in the context of other Victorian houses in Kyle Street add to its value both aesthetically and historically. The house is historically significant as one of the remaining houses which formed the village of West Botany.

[26] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330057

5.10 House (31 Kyle Street) Statement of Significance

This item is located at 31 Kyle Street, Arncliffe. Below is the Statement of Significance previously been prepared for this House listing and is presented below unabridged.[27]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house at 31 Kyle Street and originally known as "Hazeldene", is historically significant as one of the first houses to be built on the Innesdale Estate.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	The house has association with George W Beehag who was the son of James Beehag, market gardener and mayor of Rockdale 1872-1874.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The dwelling is aesthetically significant as a highly intact Victorian house.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The building is a good representative example of a single storey Victorian house in Rockdale.

Statement of Significance

The house at 31 Kyle Street and originally known as "Hazeldene", is historically significant as one of the first houses to be built on the Innesdale Estate. The house has association with George W Beehag who was the son of James Beehag, market gardener and mayor of Rockdale 1872-1874.The building is a good representative example of a single storey Victorian house in Rockdale.

[27] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330051

5.11 Footings of 1933 Pedestrian Bridge at Arncliffe School (Archaeological) Statement of Significance

Below is the Statement of Significance previously been prepared for this archaeological site and is presented below unabridged.[28]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The footbridge crossing on the Princes Highway linking Arncliffe Public School with residential housing opposite has historic significance at a local level, because it is the site of one of the earliest applications of road safety awareness within the Rockdale municipality, and also in the State. The first footbridge at this crossing was constructed in 1933, probably at the urging of the school and the local community, in order for students to be safely conveyed across the busy Pacific Highway to school. Prior to its demolition, this steel truss structure was the oldest extant footbridge in the Sydney metropolitan area. The footings of this original footbridge can be seen to the south of the existing structure, in the form of a concrete ledge on the western side of the cutting and two concrete stub columns on the eastern side. The current footbridge, constructed in 2003, continues the important function of its predecessor in conveying children safely to and from the school.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Does not meet this criterion.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	The continued retention of the footings of the 1933 bridge, and their interpretation to the public, has the potential to enhance awareness of the history and importance of road safety.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Does not meet this criterion.

[28] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=4305029

Statement of Significance

The footbridge crossing on the Princes Highway linking Arncliffe Public School with residential housing opposite has local historic significance because it is the site of one of the earliest applications of road safety awareness within the Rockdale municipality, and also in the State. The first footbridge at this crossing was constructed in 1933, probably at the urging of the school and the local community, in order for students to be safely conveyed across the busy Pacific Highway to school. Prior to its demolition, this steel truss structure was the oldest extant footbridge in the Sydney metropolitan area. The current footbridge at the crossing, a steel arch built by the RTA in 2003, continues the locally important function of carrying pedestrians safely across the Princes Highway. The footings of the original footbridge can be seen viewed from the deck of the current structure, and could be interpreted from the current footbridge.

5.12 Victorian house (23 Segenhoe Street, Arncliffe) Statement of Significance

This item is located at 23 Segenhoe Street, Arncliffe. Below is the Statement of Significance previously been prepared for this Victorian House and is presented below unabridged.[29]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house, originally named house Terravalley, is historically significant as being part of the early development the Avenal Estate. It represents the late 19th century development of this part of Arncliffe and provides physical evidence of its early development for housing.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	The building has minor historical value for its association with the Reverend Joseph Monahan a Methodist minister and his son William Willis Monahan, who was the mayor of Rockdale from 1914 to 1917.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The dwelling is aesthetically significant as part of a group of houses from the same period located on a prominent hilltop in Arncliffe.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The building is a good representative example of a Victorian two storey villa house in Rockdale.

[29] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330047

Statement of Significance

The house, originally named house Terravalley, is historically significant as being part of the early development the Avenal Estate. It represents the late 19th century development of this part of Arncliffe and provides physical evidence of its early development for housing. The dwelling is aesthetically significant as part of a group of houses from the same period located on a prominent hilltop in Arncliffe. The building is a good representative example of a Victorian two storey villa house in Rockdale. The building has minor historical value for its association with the Reverend Joseph Monahan a Methodist minister and his son William Willis Monahan, who was the mayor of Rockdale from 1914 to 1917.

5.13 Victorian house (25 Segenhoe Street, Arncliffe) Statement of Significance

This item is located at 25 Segenhoe Street, Arncliffe. Below is the Statement of Significance previously been prepared for this Victorian House and is presented below unabridged.[30]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house, which was once named house Porbury, is historically significant as being part of the early development the Avenal Estate. It represents the late 19th century development of this part of Arncliffe and provides physical evidence of its early development for housing.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The house is aesthetically significant as part of a group of houses from the same period located on a prominent hilltop in Arncliffe.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The building is a good representative example of a Victorian two storey villa house in Rockdale.

[30] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330048

Statement of Significance

The house, which was once named house Porbury, is historically significant as being part of the early development the Avenal Estate. It represents the late 19th century development of this part of Arncliffe and provides physical evidence of its early development for housing. The house is aesthetically significant as part of a group of houses from the same period located on a prominent hilltop in Arncliffe. The building is a good representative example of a Victorian house in Rockdale.

5.14 House (15 Cameron Street, Banksia) Statement of Significance

This item is located at 15 Cameron Street, Banksia. Below is the Statement of Significance previously been prepared for this House and is presented below unabridged.[31]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house once known as "Ballamona" is historically significant as one of the earliest houses constructed on the 1880s Rockdale Estate.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The two storey Victorian house is located on a hill with sweeping views to the east would have been a quite dominant building when it was built. It still commands attention today and makes an aesthetic contribution to the character of Banksia.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	The two storey Victorian house is an excellent representative example of its type which is uncommon in Rockdale.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Does not meet this criterion.

Statement of Significance

The house once known as "Ballamona" is historically significant as one of the earliest houses constructed on the 1880s Rockdale Estate. The two storey Victorian house is located on a hill with sweeping views to the east would have been a quite dominant building when it was built. It still commands attention today and makes an aesthetic contribution to the character of Banksia. The two storey Victorian house is an excellent representative example of its type which is uncommon in Rockdale.

[31] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330049

5.15 House (11 Gibbes Street, Banksia) Statement of Significance

This item is located at 11 Gibbes Street, Banksia. Below is the Statement of Significance previously been prepared for this House and is presented below unabridged.[32]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Jacksons Row is historically significant as a large speculative housing development built in 1885. The house is historically significant as one of a part of an early group of workers housing in Rockdale.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Jacksons Row is associated with Mercantile Building Land & Investment Company a speculative building company in the late 19th century.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Jacksons Row is significant as a large highly intact grouping of single storey Victorian terrace housing on two sides of a street.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house at 11 Gibbes Street is one of a long intact row of terraces which faces a row opposite, this housing type is rare in the City of Rockdale.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The house is representative of a single storey Victorian terrace house.

Statement of Significance

Jacksons Row is historically significant as a large speculative housing development built in 1885. The house is historically significant as one of a part of an early group of workers housing in Rockdale. Jacksons Row is associated with Mercantile Building Land & Investment Company, a speculative building company in the late 19th century. The house at 11 Gibbs Street is one of a long intact row of terraces which faces a row opposite, this housing type is rare in the City of Rockdale. The house is representative of a single storey Victorian terrace house.

[32] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330072

5.16 House (18 Gibbes Street, Banksia) Statement of Significance

This item is located at 18 Gibbes Street, Banksia. Below is the Statement of Significance previously been prepared for this House and is presented below unabridged.[33]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Jacksons Row is historically significant as a large speculative housing development built in 1885. The house is historically significant as one of a part of an early group of workers housing in Rockdale.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Jacksons Row is associated with Mercantile Building Land & Investment Company a speculative building company in the late 19th century.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Jacksons Row is significant as a large highly intact grouping of single storey Victorian terrace housing on two sides of a street.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	The house at 18 Gibbes Street is one of a long intact row of terraces which faces a row opposite, this housing type is rare in the City of Rockdale.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	The house is representative of a single storey Victorian terrace house.

Statement of Significance

Jacksons Row is historically significant as a large speculative housing development built in 1885. The house is historically significant as one of a part of an early group of workers housing in Rockdale. Jacksons Row is associated with Mercantile Building Land & Investment Company, a speculative building company in the late 19th century. The house at 18 Gibbs Street is one of a long intact row of terraces which faces a row opposite, this housing type is rare in the City of Rockdale. The house is representative of a single storey Victorian terrace house.

[33] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330073

5.17 Rock Lynn Statement of Significance

This item is located at 58 Bestic Street, Rockdale. Below is the Statement of Significance previously been prepared for Rock Lynn and is presented below unabridged.[34]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Rock Lynn is historically significant as part of land subdivided and auctioned in 1884 as the " Rockdale Township".
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Rock Lynn is aesthetically significant as a modified Federation rusticated sandstone house sitting in a prominent location on a rocky sandstone outcrop overlooking Botany Bay.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	The original part of the building is significant because it has the potential yield information about early building materials and techniques in the Rockdale area, as the sandstone building material for the house was most likely quarried on site.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Rock Lynn is a representative example of a modified Federation rusticated sandstone house.

Statement of Significance

Rock Lynn is a modified Federation rusticated sandstone house in the Rockdale area and sits in a prominent scenic location on a rocky outcrop overlooking Botany Bay. It has the potential to yield information about early building materials and techniques and also forms part of the 1884 " Rockdale Township" subdivision.

[34] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2330081

5.18 Toomevara Lane Chinese Market Gardens Statement of Significance

This item is located at 29A Toomevara Street, Kogarah. Below is the Statement of Significance previously been prepared for the Toomevara Lane Chinese Market Gardens and is presented below unabridged.

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	The Toomevara Lane Market Gardens are of historical significance for their demonstration of a continuous pattern of land usage since the late nineteenth century. They are also of significance for their association with the development of local industry and for their association with early Chinese immigration and the influence of ethnic communities on local industry.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The Toomevara Lane Market Gardens are of aesthetic significance as an important area of productive open space, providing visual variety from the other types of open space in the area.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The Toomevara Lane Market Gardens are of high social significance for their association with early ethnic communities, especially the Chinese Community, and for the role they have played in helping to feed the local and regional population, particularly during the Inter-War, Depression and Post-War periods.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	The Toomevara Lane Market Gardens have some technical/research significance for their demonstration of early market gardening practices, particularly through the extant structures on the site relating to previous uses.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Market gardens such as this are becoming increasingly rare and the Arncliffe Market Gardens are of particular importance for their demonstration of a continuing pattern of usage from the late nineteenth century through to the 1930s.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Whilst there are market gardens elsewhere in the metropolitan region, there are few that have been used continuously as these.

Statement of Significance

The Toomevara Lane Chinese Market Gardens are of high significance for their association with the Chinese community and their demonstration of a continuous pattern of land usage since the late nineteenth century. They are one of only three such surviving market gardens in the Inner Sydney region and one of few similar surviving examples in the Sydney Metropolitan Region.

5.19 House and Garden (177 Rocky Point Road) Statement of Significance

This item is located at 177 Rocky Point Road, Beverley Park. Below is the Statement of Significance previously been prepared for this House and Garden and is presented below unabridged.[35]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	As an exemplar of other contemporary dwellings in the locality, 177 Rocky Point Road provides noteworthy Inter-War stylistic evidence of the historical evolution of residential development in the Targo Estate in the 1920s.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	A large Inter-War Period dwelling which is notable for its simple Modernist stylistic influence evidenced by Roman brickwork detailing, accentuated wide eaves, articulated façade and recessed brick-quions. Located on a prominent corner block, the dwelling and original brick boundary fence make a worthy historical contribution to the streetscape of Rocky Point Road.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	Does not meet this criterion.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Does not meet this criterion.

Statement of Significance

177 Rocky Point Road, Beverley Park is significant at a Local level for its representative aesthetic qualities, streetscape contribution and historic value. The place is a substantially intact single storey brick and tile Inter-War Period bungalow located on a corner block with Modern stylistic influences. Notable for its extant original fabric, its good period detailing including Roman brickwork, accentuated wide eaves, articulated façade, and substantially intact front brick boundary fence. 177 Rocky Point Road makes a worthy historical contribution to the streetscape. The place provides evidence of the historical evolution of Inter-War residential development within the Targo Estate.

[35] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1870113

5.20 (Former) Ramsgate Methodist Church - Ramsgate Community Church Statement of Significance

This item is located at 181 Rocky Point Road, Beverley Park. Below is the Statement of Significance previously been prepared for the (Former) Ramsgate Methodist Church - Ramsgate Community Church and is presented below unabridged.[36]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Ramsgate Church, and former Ramsgate Methodist Church, have been a focal point for the community from the early twentieth century. The building provides tangible evidence of the establishment of religious institutions in the Kogarah LGA.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	This modest church is a good example of an Inter-War Period ecclesiastical brick and tile building displaying Romanesque and Gothic stylistic influence.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The church has special meaning for a recognisable religious group in the Kogarah community.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Does not meet this criterion.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Does not meet this criterion.

Statement of Significance

Ramsgate Community Church is of historic, social and aesthetic value at a Local level. The place has been a focus for a recognisable religious community group within the locality, and integral to its historical development as part of the growth of the Kogarah LGA. This brick and tile church is notable for its Inter-War Romanesque and Gothic stylistic influence. The place displays excellent brick detailing which contributes to its overall aesthetic value. Setting somewhat compromised by late twentieth century development adjacent and adaptation of front garden and brick fence to car parking.

[36] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1870114

5.21 Residential Flat Building, Roma Statement of Significance

This item is located at 70 Ramsgate Road, Sans Souci. Below is the Statement of Significance previously been prepared for the Residential Flat Building, Roma and is presented below unabridged.[37]

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	70 Ramsgate Road, Sans Souci provides evidence of the evolution of residential development within the Targo Estate in the Inter-War Period.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	The place has historic associations with the locally well-known Pittorino Brothers, who developed the site, and were instrumental in establishing the Ramsgate shopping precinct.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	The place is notable for its very good, substantially intact Inter-War Art Deco stylistic qualities. The place is stylistically very similar to adjacent shops located around the corner at 211-219 Rocky Point Road and as a group they have considerable streetscape significance.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The church has special meaning for a recognisable religious group in the Kogarah community.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Does not meet this criterion.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	70 Ramsgate Road, Sans Souci, is a relatively rare Inter-War Art Deco style residential flat building in the Kogarah LGA.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	An excellent representative example of an Inter-War residential flat building displaying Art Deco stylistic influence in the Kogarah LGA.

Statement of Significance

70 Ramsgate Road is significant at a Local level for its aesthetic and streetscape contribution and historic value. Prominently located in Ramsgate Road, the place is a relatively rare representative example of a two-storey Inter-War Art Deco style residential flat building within the Kogarah LGA. The place is stylistically similar to adjacent shops located around the corner at 211-219 Rocky Point Road and as a group they have considerable and comparatively rare aesthetic and streetscape significance in the LGA. Integrity is somewhat compromised by alterations and additions including in-filled balconies, replacement of leadlight windows and new front door. Together with contemporary buildings in the locality, 70 Ramsgate Road, Sans Souci provides evidence of the evolution of residential development within the Targo Estate in the Inter-War Period. The place has historic associations with the locally well-known Pittorino Brothers, who developed the site, and were instrumental in establishing the Ramsgate shopping precinct.

[37] http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1870169

5.22 Bardwell Park Railway Station Group Statement of Significance

This item is located on Hartill-Law Avenue, Bardwell Park. Below is the unabridged Statement of Significance, as previously prepared for the register listing.

Criterion	Statement
Criterion (a) – an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area).	Bardwell Park Railway Station is of historical significance as part of the East Hills line, a major depression-era public work undertaken under the controversial Premiership of Jack Lang and through its relationship to the development of the suburb of Bardwell Park and the broader East Hills region. The austere design of the platform building is reflective of the completion of the East Hills line as a Depression period unemployment relief works project.
Criterion (b) – an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local to area).	Does not meet this criterion.
Criterion (c) – an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).	Bardwell Park Railway Station is of aesthetic significance as an example of a small Inter-War period suburban railway building matching other East Hills line railway station buildings in design and style. The building is very austere in style, with Inter War Art Deco style touches (for example decorative brick strapwork detail to parapets) and is competently executed, exhibiting fine workmanship in its brickwork. The building is noted for its use of monochromatic brickwork, stepped parapets, irregular fenestration and engaged piers.
Criterion (d) – an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.	The place has the potential to contribute to the local community's sense of place, and can provide a connection to the local community's past.
Criterion (e) – an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). Significance under this criterion must have the potential to yield new or further substantial information.	Bardwell Park Railway Station is of technical significance for its ability to demonstrate design and construction techniques of the inter-war period. The building provides insights into NSW Railways experimentation with styles of architecture and their adaptation to depression period economic conditions.
Criterion (f) – an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).	Bardwell Park Railway Station platform building is not rare, as it is part of a cohesive group of 10 similar to identical Inter-War suburban railway buildings completed in 1931 between Turrella and East Hills.
Criterion (g) – an item is important in demonstrating the principal characteristics of a class of NSW's (or local area's): – cultural or natural places cultural; or – natural environments.	Bardwell Park Railway Station is a good representative example of a small, Inter-War East Hills line suburban railway station, with the platform and platform building and stair structure generally intact, and demonstrates the effects of the economic Depression of 1929-1930s on railway station construction. It is representative of the cohesive collection of 1931 East Hills line railway stations from Turrella to East Hills, including Padstow and Bexley North.

Statement of Significance

Bardwell Park Railway Station - including the 1931 platform, platform building, entry steps structure and overbridge - is of local heritage significance. Bardwell Park Railway Station has historical significance as a major public work completed as an unemployment relief project during the Great Depression, and as a major transport hub for Bardwell Park since 1931. Bardwell Park Railway Station is of aesthetic significance as an austere 1930s railway building with simple Art Deco detailing and fine brick workmanship that is evocative of the effects of the Depression on building programs for the NSW railways. Bardwell Park Railway Station is representative of the cohesive collection of 10 East Hills line railway stations from Turrella to East Hills.

6 Potential impacts

6.1 Construction

The project would result in potential impacts to both heritage listed items, Kings Wetland and Patmore Swamp.

Impacts to the Kings Wetland site would include clearing of trees located along the eastern boundary of the wetlands adjacent to the Brighton-Le-Sands school. These trees would be removed to allow for the construction of a haul road. The existing trees present along the bank of the wetland are proposed to be retained and would not be disturbed. At the conclusion of construction works, the area would be rehabilitated back to the original state of the wetlands prior to construction. The shared pedestrian and cycle pathway would also cause impacts to the Kings Wetland site.

Impacts to Patmore Swamp include the acquisition of a 30 metre strip along the frontage of President Avenue for the upgrade of President Avenue . A shared pedestrian and cyclist bridge would also be constructed over President Avenue. The shared pedestrian and cycle pathway would continue south through Patmore Swamp and would link up with Annette Avenue. This section of the shared pathway would be required to be raised above the current ground level of Patmore Swamp. The shared pathway will be approximately 150 metres long and up to six metres at its widest point through the swamp. The construction of the shared pathway would include the removal of the existing vegetation for the network to link President Avenue with Civic Avenue in the vicinity of Annette Avenue.

The proposed powerline connection route passes through the curtilage of one S170 listed item (Bardwell Park Railway Station Group) and five conservation areas. The proposed works will cause a temporary visual impact to the conservation areas which will be revered once works are completed. As the identified heritage values of these conservation areas are vested in the houses and streetscape no permanent heritage impacts are likely to occur from the powerline. As Bardwell Park Railway Station Group has the potential for direct impacts avoidance should be sought as a first preference, with mitigation measures required should the works require egress through the listed curtilage.

6.1.1 Operational impacts

Potential impacts to non-Aboriginal heritage (either direct or indirect) during the operation of the project largely relate to the associated impacts as urban design landscape character and visual amenity. Operational impacts such as increased noise or air quality are not considered likely to affect any of the known heritage-listed sites, including Kings Wetland or Patmore Swamp.

The design of the project, including post construction landscaping works, will rehabilitate the portion of the Kings Wetland area that would be impacted during construction works. Additionally, through design of the works along the boundary of Patmore Swamp with President Avenue, including the shared pathway through Patmore Swamp, the project has minimised total ground disturbance required for the project.

6.1.2 Vibration impacts

As per the separate noise and vibration assessment, impacts should be assessed for heritage structures on a case by case basis. The safe working distance identified in that assessment was 25 metres to avoid cosmetic damage to structures, assessed against the maximum rating for such plant operations as vibratory roller, hydraulic hammer, vibratory pile driver, pile boring and jack hammer. Analysis of mapped heritage items has identified that the only known heritage item within 25 metres of the proposed surface works with a potential for vibration impacts is the Shop and Residence listed on the Kogarah LEP 2012 as I97 with local significance. No direct impacts are proposed for this item which is located at 111 Princes Highway, adjacent to proposed surface works in that area (approximately seven metres from the closest work area location).

To avoid indirect impacts to this item use of machinery should be limited to a maximum plant use of vibratory roller < 100 kN (Typically 2-4 T), the medium hydraulic hammer (900 kg – 12-18 T excavator) and the hand-held jack hammer, which the noise and vibration assessment has identified as safe plant to use within a seven metre distance and avoid cosmetic damage to existing structures.

As heritage structures also need to be considered on a case by case basis, a visual inspection and assessment should be undertaken of the Shop and Residence (I97) by a heritage specialist before works commence in this area to confirm that no additional protectionary measures need to be undertaken to mitigate against the risk of vibration damage.

6.2 Heritage Impact Assessment

There would be the potential for direct impacts to both Patmore Swamp and Kings Wetland from the works associated with this Project. These impacts would be assessed against the significance criterion (as detailed in **Chapter 1** above).

The Proposed Works would have an impact to the current heritage listings associated with Patmore Swamp and Kings Wetland only. There are no other historical archaeological or potential built heritage sites that would be affected by the proposed works.

6.2.1 Kings Wetland heritage impact assessment

Criterion	Impact Assessment
Criterion (a) – The Kings Wetland is of historical significance as a remnant of a natural wetland habitat dating from the time prior to white settlement of Australia.	The potential removal of trees along the eastern side of the Kings Wetland to form a haul road would have a moderate impact to the site's historical significance. The removal of trees would directly affect the remnant wetland vegetation. The northern section of this heritage listing, from Kings Road looking north, is remnant vegetation, while the southern portion forms part of the post 1940s revegetation of the swamp land.
Criterion (c) – The Kings Wetland is of aesthetic significance as a remnant wetland habitat containing a number of significant species of water plants. The site demonstrates the geography and vegetation of the area prior to white settlement. The site has further value as natural open space within a highly urbanised environment.	The impact from the removal of trees along the eastern side of the Kings Wetlands heritage listing would have a minor impact to the heritage significance under this criterion. The listing specifically relates to the vegetation and geography "prior to white settlement", which is true for the section of Kings Wetland north of Kings Road. The section south of Kings Road forms part of the post 1940s reclamation works within the swamp and does not reflect the natural topography prior to European settlement. There is no proposed impact to the section of the watercourse within the Kings Wetland listing.
Criterion (d) – The Kings Wetland may have some social significance to the Aboriginal community but this cannot be ascertained from current available information.	The Metropolitan Local Aboriginal Land Council (MLALC) report states that the area was "a significant spiritual and social area" based on the past water resources that would have been at the original pre-disturbance swamp location likely being "very suitable as hunting and breeding grounds for Aboriginal people due to the abundance of bird and fish life, native food, fresh drinking water and swimming areas".
Criterion (e) – The Kings Wetland has some research significance associated with remnant indigenous plantings and the use of the area by native wildlife.	Due to past impacts in the area research potential is limited. Although the area was a resource location in the Aboriginal past its current condition does not reflect the natural landscape as it was at that time. Some research in the least disturbed sections may be possible.
Criterion (f) – Regional	The removal and rehabilitation of the Kings Wetland along the eastern side of the heritage listing boundary would have a moderate impact to the natural environment that is associated with the wetland. The southern section of the wetland represents post 1940s reclamation and landscaping of the swamp and can only be considered to be contributory to the remnant vegetation that is present to the north of Kings Road. Rehabilitation of the vegetation to the same state after construction works finishes will minimise the overall impact.

Criterion	Impact Assessment
Criterion (g) – Regional	The remnant section of Kings Wetland, specifically relating to the section of the heritage listing to the north of Kings Road is considered to be demonstrative of a native wetland in the previously prepared significance assessment. Removal of vegetation in this area would result in a moderate impact to the heritage significance associated with Kings Wetland under this criterion. Impacts to the southern portion of this heritage listing would only result in a minor impact to the significance under this criterion as the landscape reflects the post 1940s reclamation works and is not an example of the native vegetation prior to 1788.

6.2.2 Patmore Swamp heritage impact assessment

Criterion	Statement
Criterion (a) – Historically significant as part of a depression public works programme	The removal of approximately 30 metres of frontage along the President Avenue portion of Patmore Swamp, and the section to be used for the shared cycle and pedestrian pathway through the swamp, would only have a minor impact to the heritage significance under this criterion. Only approximately 4% of the current listed area would be removed for the proposed works. This impact would not have an impact to the overall form and character of the landscape.
Criterion (b) – The Patmore Swamp is historically associated with Patrick Moore was granted 60 acres (240,000 m^2) of land in 1812	The removal of the 30 metres of frontage and the area required for the shared pedestrian and cycle pathway would not have an impact to the historical association of the remaining section of Patmore Swamp as the site would be kept relatively intact.
Criterion (c) – Aesthetically significant as a landscape of high visual amenity contrasting with surrounding suburbs.	The removal of up to 4% of the current heritage listing of Patmore Swamp is unlikely to have a negative impact to the swamp's aesthetic significance. Creating a formal access into the swamp via the inclusion of an shared pedestrian and cycle pathway would also have a positive heritage outcome as it would highlight the aesthetic significance of the swamp under this criterion.
Criterion (e) – Technically significant for its contribution to the Central Scarborough wetland area which is an integral part of the wetlands corridor.	The technical significance of Patmore Swamp is associated with the modification and creation of the swamp during the depression era. The removal of up to 4% of the current heritage listing of Patmore Swamp is likely to have a negligible impact to the swamp's contribution to the Central Scarborough wetlands corridor. There is not expected to be any areas containing historical archaeological potential within the impact area of Patmore Swamp area.
Criterion (g) – The swamp is representative of a man-made landscape.	The removal of up to 4% of the current heritage listing of Patmore Swamp is likely to have a minor impact to the representation of a human made landscape.

6.2.3 Summary Of Heritage Impacts

The project works are likely to have a moderate impact to the Kings Wetland heritage listing and a minor impact to Patmore Swamp. Existing heritage items are predominantly avoided from direct or indirect impacts. **Table 4** summarises the impacts to heritage items.

Table 4 Summary of heritage impacts

Heritage Item	Impacts	Impact on Significance
Kings Wetland	Removal of vegetation along the eastern boundary that is associated with the Heritage Listing	Moderate impact to the aesthetic and historical significance. Vegetation that would be cleared will be rehabilitated at the conclusion of construction works to a state that is similar to how it is currently
Patmore Swamp	Removal of a 30 metres wide frontage along the southern side of President Avenue. Additional impact from the construction of an shared pedestrian and cycle pathway through Patmore Swamp,	This would have a minor impact to the heritage significance of Patmore Swamp. The removal of the portion of the swamp along President Avenue is considered to be a negative impact, however, the construction of the shared pedestrian and cycle pathway through the swamp would promote the aesthetic significances of the swamp and would have a positive heritage outcome.
Brighton Le Sands School Building (1916)	There would be no direct impact to the school or heritage listed 1916 building. The heritage listing is specific to the building and does not include any views and or vistas to or from the school buildings.	There would be no direct impact to the school or to the identified heritage building. The heritage listing for the Brighton-Le-Sands is specific to the school buildings and the aesthetics the school brings to Crawford Street, and does not include any views or vistas to or from the building. There would be no indirect impacts to the heritage significants associated with the Brighton-Le-Sands school.
Arncliffe Market Gardens	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this SHR listed item.
Wilsons Farm House	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this SHR listed item.
Sandstone Victorian Cottage	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this SHR listed item.
Arncliffe Public School and 'Teluba'	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
House (73 West Botany Street)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
House (31 Kyle Street)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
Footings of 1933 Pedestrian Bridge at Arncliffe School (Archaeological)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
Victorian house (23 Segenhoe Street, Arncliffe)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.

Heritage Item	Impacts	Impact on Significance
Victorian house (25 Segenhoe Street, Arncliffe)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
House (15 Cameron Street, Banksia)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
House (11 Gibbs Street, Banksia)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
House (18 Gibbs Street, Banksia)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
Rock Lynn	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
Toomevara Lane Chinese Market Gardens	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
House and Garden (177 Rocky Point Road, Beverley Park)	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
(Former) Ramsgate Methodist Church - Ramsgate Community Church	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
Residential Flat Building, Roma	Above the route of the tunnels	There would not be any vibration or subsidence impacts to this locally listed item.
Shop and Residence (I97) (111 Princes Highway, Kogarah)	Adjacent to surface works at 111 Princes Highway. No direct impacts.	There would not be any vibration or subsidence impacts to this locally listed item if use of machinery is limited to a maximum plant use of vibratory roller < 100 kN (Typically 2-4 T), the medium hydraulic hammer (900 kg – 12-18 T excavator) and the hand-held jack hammer, which the noise and vibration assessment has identified as safe plant to use within seven metres distance and avoid cosmetic damage to existing structures. A visual inspection and assessment should be undertaken by a heritage specialist before works commence to ensure no additional mitigation measures are required.

6.3 Comparative Analysis

In consideration of the potential impacts of the project, a comparative analysis of other heritage wetlands and swamps in the Sydney region is presented in **Table 5**.

Table 5 Comparative analysis on other heritage wetlands and swamps in the Sydney region

Item	Heritage Listing	Significance	Comparison to Kings Wetland and Patmore Swamp
Kings Wetland	S170	Criterion A, C, D, E, F & G	N/A
Patmore Swamp	LEP	Criterion A, B, C, E & G	N/A
Botany Water Reserves	SHR, S170, LEP	Criterion A, C, D, E, F & G	Botany Water Reserve is associated with Sydney's water source from 1850 through to 1870s. The listing is 58 ha of wetlands that includes smaller wetland and ponds. The larger ponds are similar in size to the natural ponds (known as Lachlan Swap) prior to their modification into the current ponds. This listing also includes non-Indigenous heritage items and historical plantings. There are also considered remnant sections of Eastern Suburbs Banksia Scrub present. The Botany Bay Water Reserves are considered to be of higher significance for both its natural and historical cultural values, being associated with Sydney's Water supply than that associated with the Kings Wetland and Patmore Swamp.
Centennial Park, Moore Park, Queens Park	SHR, S170, LEP Nominated to the National heritage list	Criterion A, C, D & E	Centennial Park is historically significant as part of the site of the second Sydney Common and public open (1811); Sydney's second and third water supply, Busby Bore and the Lachlan Water Reserve; and use as a major public event space. The most significant periods in the history of the park are: pre-European, natural environment pre-1788; Lachlan Water Reserve 1811-1887; Centennial Park 1888-1930, 1984-present [1990]. The natural and cultural significance of the site, including both indigenous and non-indigenous heritage, is considered to be a unique and exceptional at a State and National level. The natural and cultural significance of the Centennial parklands is considered to be greater than that attributed to Kings Wetland and Patmore Swamp.
Lower Duck River Wetlands	LEP	Criterion C & E	The Lower Duck River Wetlands is located along the foreshore of Duck River and is a representative indigenous vegetation, fauna and fauna habitat and an aesthetic element on the Parramatta River. This heritage listed wetland is listed for its natural heritage values, similar to both Kings Wetland and Patmore Swamp. Both Kings Wetland and Patmore Swamp have been extensively modified culturally, including landscaping and plantings.
Wolli Creek Wetlands	LEP	Criterion A, B & F	Wolli Creek Wetlands is considered to be an intact mangrove and salt marsh habitat in the Sydney region. The Salt marsh community is rare and poorly conserved in N.S.W. This area also acts as an important wildlife corridor for migratory Wading Bird Treaty, have been sighted in the area. Compared to both Kings Wetland and Patmore Swamp, this wetland is considered to be of a similar heritage value, however, the Wolli Creek Wetland is listed specifically only solely for its natural indigenous heritage values and no cultural heritage values. Both Kings Wetland and Patmore Swamp are both heavily impacted and highly landscaped sites that do not reflect much on their indigenous natural heritage values.

6.4 Cumulative Impacts

The future stages of the F6 Extension propose an additional motorway connection from President Avenue south towards Loftus. No detailed design is available at this stage, meaning that any understanding of the cumulative impacts of proposed future works can only be considered in a broader context. As these future works would combine controlled surface infrastructure with underground tunnels, and listed heritage items to the south of President Avenue are known, it should be possible to complete a design that is sensitive to these items and avoids any major impacts to heritage. Cumulative impacts can be avoided primarily through avoidance, with underground tunnels an effective method of retaining surface heritage features. Any mitigation measures that are needed would have to be considered when a detailed design is available, should total avoidance of all heritage prove unworkable.

The project would be a new link between the New M5 Motorway at Arncliffe and President Avenue at Kogarah. This project extends off of the other major link road projects in NSW including sections of the WestConnex program. These previous and currently being constructed projects have had impacts on heritage items and areas of heritage significance. A review of these previous projects and their impacts to heritage items has been carried out to determine the overall impacts these projects have had to date with an assessment of the impact the F6 Extension Stage 1 project would add to the cumulative impact of all of these projects to non-Aboriginal heritage.

6.4.1 New M5 Motorway

The New M5 Motorway comprises a new, multi-lane road link between the existing M5 East motorway east of King Georges Road and St Peters. The project also includes an interchange at St Peters and connections to the existing road network.

The New M5 Motorway was assessed for State and local non-Aboriginal landscape and built heritage as well as historic archaeology. The project directly and/or indirectly impacted 58 heritage items, with major adverse impacts brought about by the demolition of three heritage items, being the Rudders Bond Store, the terrace group at 28-44 Campbell Street and a house at 82 Campbell Street. Extensive mitigation measures were identified including the development of heritage interpretation plans, monitoring, archival recording, a well as salvage and reuse of architectural elements and original features where possible. Minimal impacts to historic archaeology were recorded.

Overall, the heritage impact of the New M5 Motorway project was found to be moderate.

6.4.2 King Georges Road Interchange Upgrade

Construction was completed on the WestConnex King George Road Interchange Upgrade in December 2016. The upgrade included the installation of a new interchange at ground level in preparation for the New M5 Motorway and resulted in significant alteration to this area/streetscape. The EIS for the King Georges Road Interchange Upgrade found that there would be no direct heritage impacts as a result of the project.

6.4.3 M4-M5 Link

The WestConnex M4-M5 Link comprises a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters, including an interchange at Lilyfield and Rozelle and a tunnel connection between Anzac Bridge and Victoria Road. In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

The EIS for the M4-M5 Link found that 17 identified items of potential heritage value that could be affected by the project. These items have been assessed as having potential local significance, with impacts on these items summarised as follows:

- Nine potential local heritage items would be subject to direct impacts through full demolition
- One potential local heritage item would be subject to direct impacts through partial demolition
- One structure assessed as being of potential state significance would be indirectly impacted through vibration
- Six potential local heritage items and one potential state item would be subject to indirect impacts through setting, vibration and/or settlement.

Overall, the heritage impact of the M4-M5 Link project was found to be moderate.

6.4.4 Summary

Table 6 presents and summary of assessed overall heritage impacts of relevant stages of the WestConnex program of works compared to the project.

Table 6 Summary of heritage impacts for the project and relevant WestConnex program of works

Project	Overall heritage impact ranking
F6 Extension Stage 1 (the project)	Minor adverse
WestConnex projects	
New M5 Motorway	Moderate adverse
King Georges Road Interchange Upgrade	Nil
M4-M5 Link	Moderate adverse

6.4.5 Conclusion

The project has been assessed as having an overall minor heritage impact. This has been due to the decision to design this extension as a tunnel, and thereby removing the impact to heritage items present along the proposed route. The above ground motorway infrastructure, including ventilation facilities and outlets, substations, water treatment plants, have been placed in areas where there are no heritage items, or are utilising existing road project infrastructure areas, such as the New M5 project compound sites. This has led to a reduction in impacts to existing heritage items and sites.

Additional impacts to heritage items have been avoided through:

- Design of the extension works to be a tunnel route rather than a surface road route
- Design and refinement of the intersection at President Avenue
- Location of ventilation shaft outlets and co-location of infrastructure with existing compounds and facilities.

The heritage impacts from the project are being addressed and managed through the implementation of the environmental mitigation measures presented in **section 7.1**.

7 Management of impacts

7.1 Management of construction impacts

Based on the historical research, site inspection and understanding of the project construction works, the following management and mitigation measures have been prepared and are presented in **Table** 7.

A Construction Heritage Management Plan will be prepared for the project. The plan will detail measures to minimise impacts on identified heritage features within the project boundary and will also detail procedures to manage unexpected heritage finds.

Impacts to non-Aboriginal heritage items will, to the greatest extent practicable, be avoided and minimised. Where impacts are unavoidable, works will be undertaken in accordance with the relevant management strategy as defined for the non-Aboriginal heritage item.

Table 7 Heritage environmental management measures

Impact	Environmental management measure	Timing
Kings Wetland	Consultation will be undertaken with Bayside Council regarding the impacts that would occur to the Kings Wetland (heritage item listed on the Rockdale LEP 2011). Roads and Maritime will provide a copy of the proposed landscape rehabilitation plan to Council to facilitate comment on the proposed impacts and mitigation measures.	Pre-Construction
Patmore Swamp	Notification and consultation will be undertaken with Bayside Council outlining the impacts that would occur to the Patmore Swamp (heritage items listed on the Rockdale LEP 2011).	Pre-Construction
Kings Wetland	A protection area will be established either side of the proposed haul road to reduce impacts within the boundaries of the heritage listing. The delineation of the protection area will be maintained throughout the construction period. As part of the detailed design phase, the haul road through the boundaries of the heritage listing will be further optimised with a view to reducing the requirement for the removal of vegetation, as far as is practical. At the conclusion of construction, parts of the area within the boundaries of the heritage listing will be rehabilitated.	Construction
Patmore Swamp	A protection area will be established as a no-go area during construction along either side of the proposed shared cycle and pedestrian pathways and along the new boundary of President Avenue and Patmore Swamp, to preserve as much of the existing vegetation as is practical within the boundaries of the heritage listing. The delineation of the protection area will be maintained throughout the construction period. A heritage interpretation strategy will be prepared to outline opportunities for heritage interpretation being integrated into the design of the shared cycle and pedestrian pathway through Patmore Swamp.	Construction
Shop and Residence (I97) (111 Princes Highway, Kogarah)	Use of machinery should be limited to a maximum plant use of vibratory roller < 100 kN (Typically 2-4 T), the medium hydraulic hammer (900 kg – 12-18 T excavator) and the hand-held jack hammer, which the noise and vibration assessment has identified as safe plant to use within a seven metre distance and avoid cosmetic damage to existing structures. A visual inspection and assessment should be undertaken by a heritage specialist before works commence to ensure no additional mitigation measures are required.	Pre-Construction and Construction

Unexpected Historic Finds

In the event that unexpected historic finds are identified during construction, all works should immediately cease. The following procedure guides the management of unexpected and previously unidentified finds during the course of operations. Finds includes artefact scatters (glass, animal bone, ceramic, brick, metal, etc), building foundations and earthworks of unknown origin. The procedures are:

- All work in the area is to cease immediately;
- Alert the Environmental Specialist to the find;
- If necessary, protect the area with fencing;
- Engage a suitably qualified archaeologist to undertake an assessment of the find/s;
- The assessment should be undertaken using the guidelines Assessing Significance for Historical Archaeological Sites and 'Relics' (NSW Heritage Branch, 2009);
- On the advice of the archaeologist, if necessary, prepare an Impact Assessment and Research design and methodology to submit to the Heritage Branch for a Section 140 excavation permit or exception;
- Undertake the archaeological mitigation in accordance with the prepared documents and the permit/exception issued by the Heritage Branch; and
- Once the site has been mitigated to the satisfaction of the archaeologist and the Heritage Branch, works may resume in the area.

Discovery of Human Remains

In the event that operations reveal possible human skeletal material (remains), the following procedure is to be followed:

- When suspected human remains are exposed, all construction work is to cease immediately in the near vicinity of the find location and the General Manager on site is to be immediately notified. The General Manager will contact the Police at the earliest reasonable time;
- An area of a five metre radius is to be cordoned off by temporary fencing around the exposed human remains site - work can continue outside of this area as long as there is no risk of interference to the human remains or the assessment of human remains. Assessment of risk may utilise the risk matrix provided within the NSW Health Policy directive on the exhumation of human burials;
- Contact the OEH Environment line on 131 555 and the Heritage Branch on 02 9873 8500; and
- A physical or forensic anthropologist should be commissioned by Rix's Creek Coal Mine to inspect the remains in situ (unless otherwise directed by the police), and make a determination of ancestry (Aboriginal or non-Aboriginal) and antiquity (pre-contact, historic or modern), then:
- if the remains are identified as modern the area is deemed as crime scene; or
- if the remains are identified as Aboriginal, the Environmental Specialist will notify OEH and representatives of the local Aboriginal community and appropriate management measures will be determined through consultation with them. Representatives of the Aboriginal community will be present during all investigations of Aboriginal remains; or
- if the remains are as non-Aboriginal (historical) remains, the site is to be secured and the Heritage Branch is to be contacted.
- The above process functions only to appropriately identify the remains and secure the site. From this time, the management of the area and remains is to be determined through one of the following means:
- If the remains are identified as a modern matter, liaise with the police and/or the Coroner's Office and/or NSW Health with respect to the exhumation of the remains;
- If the remains are identified as Aboriginal, liaise with OEH and Aboriginal stakeholders;
- If the remains are identified as non-Aboriginal (historical), liaise with the Heritage Branch; and
- If the remains are identified as not being human then work can recommence without delay.

The procedures take into account the following documents:

- Burials - Exhumation of Human Remains NSW Health Policy Directive PD2008_022 (NSW Health, 2013) available at : http://www.health.nsw.gov.au/policies/pd/2008/pdf/PD2008_022.pdf
- Manual for the Identification of Aboriginal Remains (NSW Department of Environment & Conservation, 2006);
- Skeletal Remains – Guidelines for the management of human skeletal remains under the Heritage Act 1977 (NSW Heritage Office, 1998); and
- The Aboriginal Cultural Heritage Standards and Guidelines Kit (NSW National Parks and Wildlife Service, 1997).

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Annexure A – Aboriginal Stakeholder Cultural Heritage Survey Report

F6 STAGE 1 – ARNCLIFFE TO PRESIDENT AVENUE, KOGARAH

Aboriginal stakeholder cultural heritage survey report

STAGE 2 – ROADS AND MARITIME SERVICES PROCEDURE FOR ABORIGINAL CULTURAL HERITAGE CONSULTATION AND INVESTIGATION

JANUARY 2018

Aboriginal stakeholder cultural heritage survey report

1. Purpose of this assessment

This assessment forms part of the Stage 2 assessment of the Roads and Maritime Services (RMS) *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*. Its purpose is to determine whether any features of Aboriginal cultural significance occur within the study area for this project, and whether they would be affected by the project. This assessment will be used to assist the RMS in determining whether further assessment and consultation is required for this project.

2. Project details: (provide the following information)

a) Project title: F6 Stage 1 – Arncliffe to President Avenue, Kogarah

b) Location of study area: Scarborough Park North

c) Name of Aboriginal site officer(s) completing this assessment: Selina Timothy

d) Name of Aboriginal organisation(s) represented by this survey: Metropolitan Local Aboriginal Land Council

e) Name of site officer(s) who undertook site survey: Darran Jordan

f) Date of survey: Thursday 25th January 2018

3. Methodology:

a) Approximately how much of the total project area was surveyed (eg 10%-100%) and why? (E.g. Certain areas were heavily disturbed, properties were inaccessible, ground visibility was poor, difficult weather conditions, etc.)

About 80% of the location had been surveyed with Darran Jordan, we both walked the entire area of Scarborough Park Kogarah Reserve.

Darran took photos as we walked and had discussions about Cultural Heritage and the many disturbances within the study area that has occurred over the years.

We then drove to Arncliffe and proceeded to do the same taking photos of the study area and discussing possibilities of evident of Cultural Heritage.

Looking at the study area of the proposed project these areas would have been marked sites that had been utilised in the past by Aboriginal people.

b) How was the survey undertaken? (E.g. On foot, by car, individually, in groups, other? If other people were involved in the survey, please provide their names and name of their organisation, if relevant)

Darran Jordan and I drove to the sites and surveyed by foot walking the entire area. We drove on to the second proposed project site and did the same walking and studying the proposed sites and taking photos.

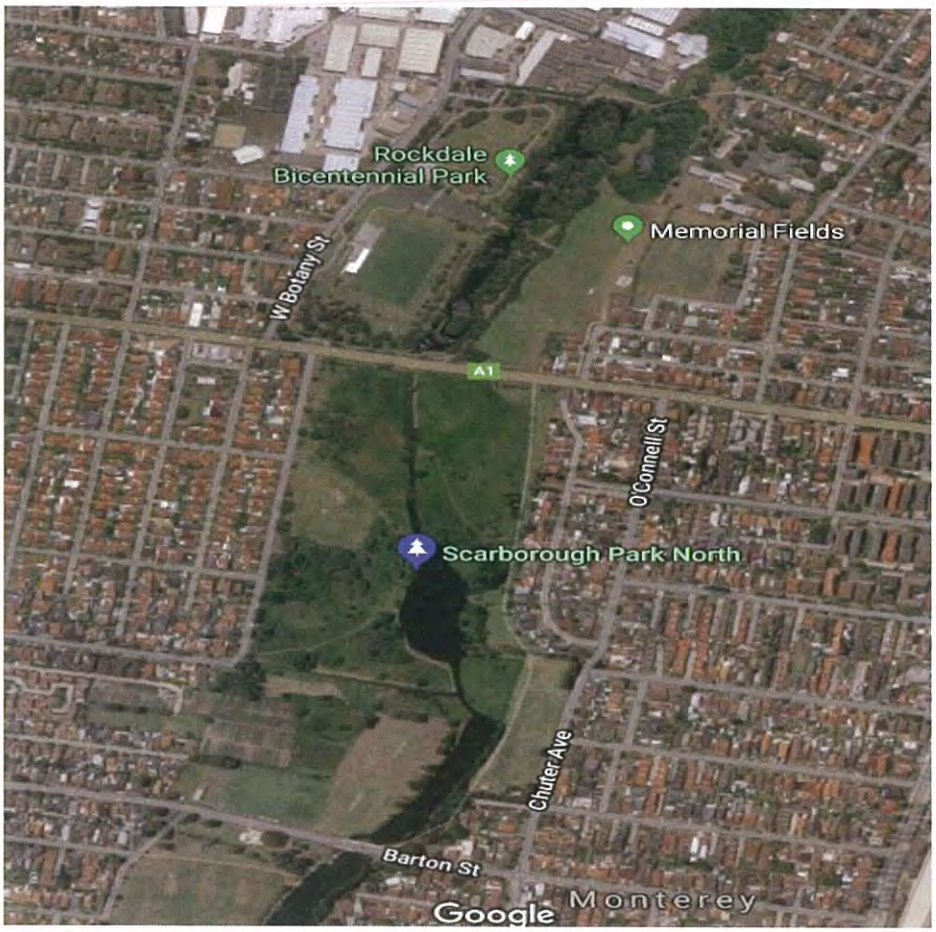
4. Results:

a) Please provide a description of the area surveyed. Include a description of the total area covered, landforms, built areas, etc. Where appropriate, survey areas should be identified on a map/plan.

(If additional space is required, please attach sheets)

The areas contained swamps and small creeks with overgrowth of vegetation and with an abundance of bird and fish life.

The site inspection and this report was to determine whether features of cultural heritage significance occurred and or were visible within the areas of the proposed project site. This survey site inspection was carried out by Selina Timothy Culture and Heritage Officer as a representative for Metropolitan Local Aboriginal Land Council and Darran Jordan Archaeologists for AECOM and for Roads and Maritime Services to see whether these areas would be affected by the proposed project.



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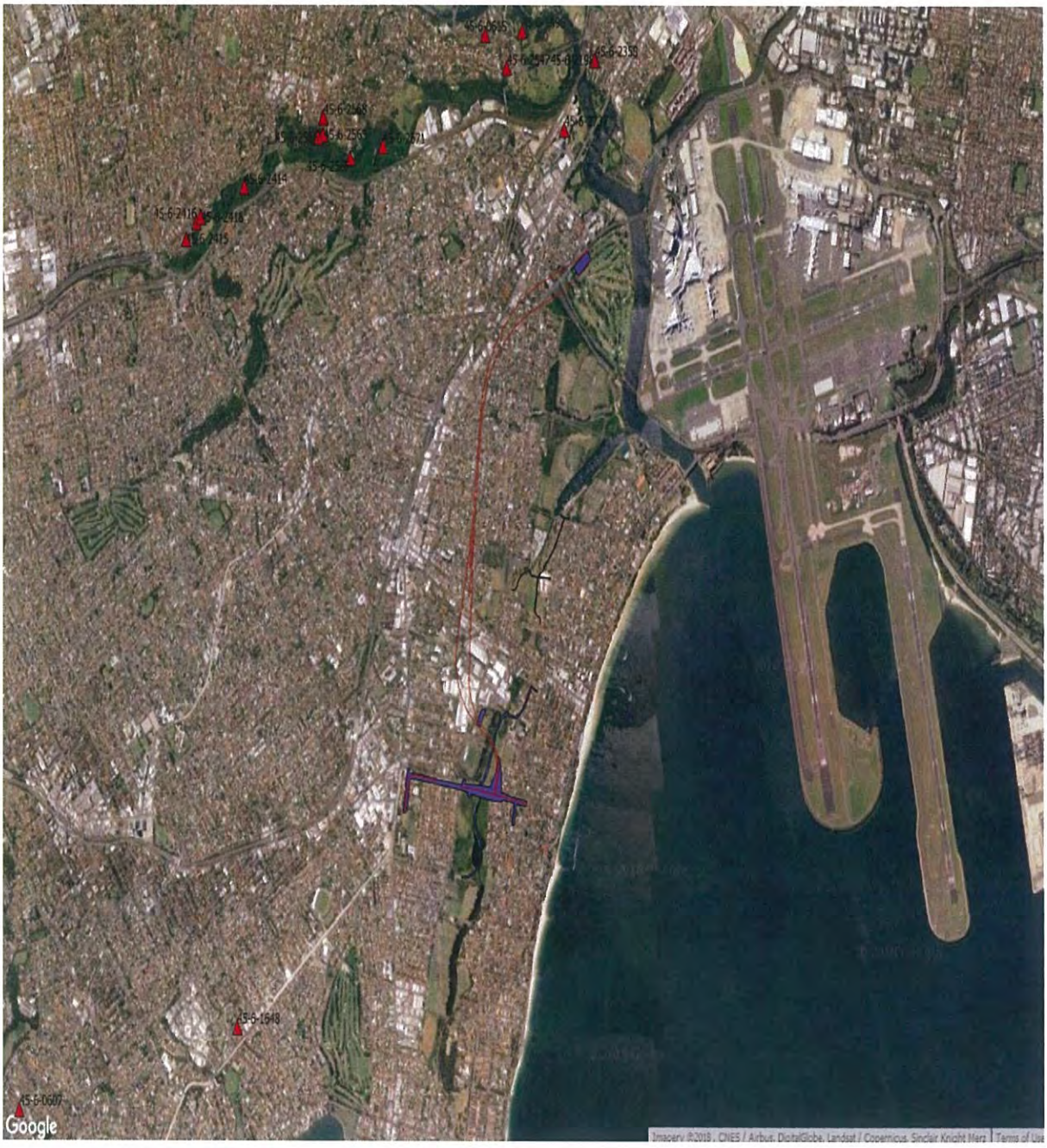

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b) Were any of the following features identified during the survey? (Please tick as required)

☐ stone tools or flakes	☐ hearths	☐ shell middens
☐ scarred trees	☐ shelters	☐ art sites
☐ bora circles	■ significant spiritual or social areas	
☐ totems	■ significant cultural landscape features	
☐ other – please state:		

If any of the above items were ticked, please provide a description including the location, quantity, size, condition and significance of the feature, if known. Where considered appropriate, this information should be identified on a map/plan).

None of the un-highlighted such as stone tools, scarred trees and or cultural and Heritage significant items were observed.

The swamp area and channels (creeks) would have been very suitable as hunting and breeding grounds for Aboriginal people due to the abundance of bird and fish life, native food, fresh drinking water and swimming areas. This indicates a high likelihood that the area was a significant spiritual and social area.

(If additional space is required, please attach sheets)

c) Is it likely that any of the above features may be present in the study area, despite not being positively identified during the survey?
No. Yes. (If yes, where are they considered likely to occur?)

Yes, the site has many introduced weeds and wild native plants that have grown upon the studied area over time. This leads me to assume that it is highly likely that there are features of cultural significance that are currently not apparent and visible.

d) If known, please provide a description of the natural resources used by Aboriginal people that are, or would have been, available within the study area. Please describe the significance of these resources to past and present Aboriginal communities.

(If additional space is required, please attach sheets)

This area would have been a gathering site because it is a suitable location for hunting due to the abundance of natural food sources such as water fowl and fish. The area is known to be a breeding ground for different species of frogs. The area would have been a suitable location for wallabies and other mammals due to the large fresh water source. The land would also have produced yams and berries and lilies. There would have been shell fish brought in from the coast, which leads me to believe that there are yet to be discovered middens in the area. This area was quite lush and sustainable for the Ancestors who lived off this land.

(If additional space is required, please attach sheets)

e) Please provide a description of past disturbances to the study area, if known, and how this may have affected Aboriginal cultural heritage features.

It is evident by the overgrowth of weedy plants such as lantana on the outer area of the swamp area, that the study area has been developed previously and cleared. This is comparable to the large native plant life such as Melaleuca trees are present and are growing near the water, showing that they have not been disturbed.

(If additional space is required, please attach sheets)

5. **Conclusion:**

Is the project likely to affect any significant known or potential Aboriginal cultural heritage features as identified by the survey?

- [x] No.
- [ ] Yes. (If yes, please describe the features and how they would be affected).

As there were no objects of Aboriginal cultural significance identified during the assessment, the Metropolitan Local Aboriginal Land Council have no objection to the proposed development of this site. But if any earth works minor or major or disturbing of the natural earth level than myself and an Archaeologist should be notified before the work has begun to be present on the site to protect any cultural items that may be present.

I am confident if the works is to proceed that any Aboriginal Heritage items will be protected and cared for in the correct way and Metropolitan Aboriginal Land Council would be notified.

(If additional space is required, please attach sheets)

This assessment has been completed by:

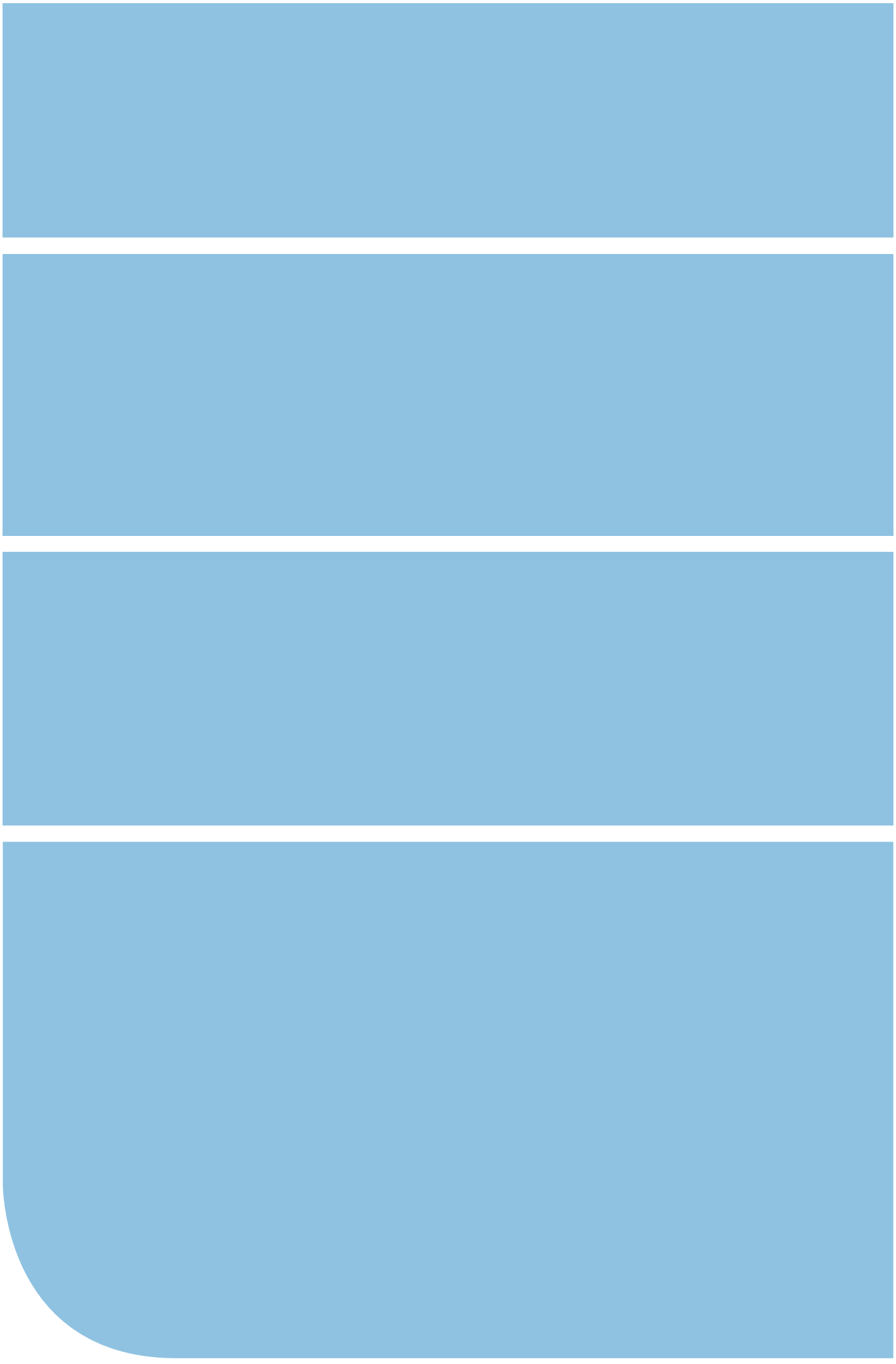
Name: **Selina Timothy** Selina Timothy

Position title: **Culture and Heritage Officer**

Organisation name: **Metropolitan Local Aboriginal Land Council**

On the following date: **15th February 2018**

(If additional space is required, please attach sheets)



Roads and Maritime Services

F6 Extension Stage 1

New M5 Motorway at Arncliffe to President Avenue at Kogarah

Environmental Impact Statement

Appendix O
Methodologies

Volume 7

O

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Glossary of terms and abbreviations

Term	Definition
Adaptation	The process of adjustment to actual or expected climate and its effects. Adaptation can be autonomous or planned (CSIRO and BoM 2015a).
AR5	IPCC Fifth Assessment Report
BoM	Bureau of Meteorology
Bushfire	Bushfires in Australia occur as grass fires or forest fires.
Climate change	A change in the state of the climate that can be identified (e.g. by statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period of time, typically decades or longer (CSIRO and BoM 2015a).
Climate projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which in turn is based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realised (CSIRO and BoM 2015a).
CO_2	Carbon dioxide. A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning biomass, of land use changes and of industrial processes (e.g. cement production). It is the principle anthropogenic greenhouse gas that affects the Earth's radiative balance (CSIRO and BoM 2015a).
CSIRO	Commonwealth Scientific and Industrial Research Organisation.
Emissions scenario	A plausible representation of the future development of emissions of substances that are potentially radiatively active (e.g. greenhouse gases, aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships (CSIRO and BoM 2015a).
ENSO	El Nino-Southern Oscillation. A fluctuation in global scale tropical and subtropical surface pressure, wind, sea surface temperature, and rainfall, and an exchange of air between the south-east Pacific subtropical high and the Indonesian equatorial low (CSIRO and BoM 2015a).
Extreme temperature	Definitions vary, however this Chapter refers to extreme temperature as hot days (days above 35˚C) and very hot days (days above 40˚C).
Extreme rainfall	There is no consistent global definition for extreme rainfall. It can be defined by either relative rainfall at a location (amount relative to averages), or absolute rainfall amounts (e.g. over 100 millimetres in a single day). In this Chapter, an extreme rainfall event is defined as the wettest day in 20 years.
FFDI	Forest fire danger index.
Fire weather	Weather conditions conducive to triggering and sustaining wild fires, usually based on a set of indicators and combinations of indicators including temperature, soil moisture, humidity, and wind. Fire weather does not include the presence or absence of fuel load (CSIRO and BoM 2015a).
Greenhouse gas	Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere (CSIRO and BoM 2015a).
IPCC	Intergovernmental Panel on Climate Change
Mean rainfall	The arithmetically averaged total amount of precipitation recorded during a calendar month or year (BoM 2007).
NARCliM	NSW/ACT Regional Climate Modelling
O/C	Overall construction cost
RCP	Representative concentration pathway. Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/cover (CSIRO and BoM 2015a).

1.0 Overview

This technical report provides the methodologies used to assess the climate change risks, greenhouse gas emissions, environmental risk and cumulative impacts associated with the project and has been prepared to support the EIS. The assessment of each of these factors have been assessed using applicable guidelines. A summary of each method is provided below.

2.0 Climate change risk assessment

The climate change risk assessment (**section 2.0**) follows the approach outlined in the draft *Technical Guide for Climate Change Adaptation for the Road Network*. The approach is focused on risk management and is closely aligned with AS/NZS 31000:2009 Risk Management and complements Roads and Maritime's *Guidelines for Risk Management*. The approach comprises the following steps:

- Pre-screening
- Screening
- Detailed risk assessment
- Risk evaluation
- Adaptation (risk treatment).

3.0 Greenhouse gas assessment

The greenhouse gas (GHG) emissions associated with the construction and operation of the project was identified in accordance with the *Transport Authorities Greenhouse Group (TAGG) Workbook1 2013.* **Section 3.0** proves the methodology used for calculating GDG emissions from fuel use, electricity consumption, vegetation removal, the embodied energy of materials used and the decomposition of waste generated during the project.

4.0 Environmental risk analysis

Section 4.0 outlines the environmental risk analysis process carried out for the project which included:

- A preliminary environmental assessment, that was carried out as part of the SSI application report[1] to allow early identification of the key environmental issues and to inform the SSI application
- An assessment of the key issues identified in the SEARs for the project
- An environmental risk review undertaken to confirm the impacts based on the results of the detailed investigations presented in this EIS.

Through the environmental risk analysis process, issues that may be associated with the project were identified and categorised as a 'key issue' or 'other' allowing for the identification matters that might be considered as additional key issues to the project.

5.0 Cumulative impacts

The cumulative impact assessment in this EIS is based on the broad requirements set out in the SEARs for the project (**section 5.0**). This section includes a description of how projects were initially identified for consideration and includes an overview of the type of assessment undertaken for the relevant cumulative impacts.

[1] Roads and Maritime (2017). F6 Extension – Stage 1 SSI application

2.0 Climate Change Risk Assessment

The climate change risk assessment follows the approach outlined in the draft *Technical Guide for Climate Change Adaptation for the Road Network*[2]. The approach is focused on risk management and is closely aligned with AS/NZS 31000:2009 Risk Management and complements Roads and Maritime's *Guidelines for Risk Management*. The approach comprises the following steps:

- Pre-screening
- Screening
- Detailed risk assessment
- Risk evaluation
- Adaptation (risk treatment).

Each of these steps is described in the following sections.

2.1 Pre-screening

A pre-screening exercise was undertaken to determine whether the project was likely to be impacted by climate change. As part of the exercise, key issues were considered to determine whether the project warrants consideration of climate change. These key issues included:

- Site location and project objectives
- Climate variables of relevance to the project
- Existing climate exposure of the local surroundings
- Likely capacity of project components to withstand changes in climate
- Significance of the project infrastructure and willingness to accept risk
- Desired level or service
- Design life.

It was determined that an assessment of the impact of climate change on the project is warranted due to the significant investment required, the long design life of the project, and its exposure to potential sea level rise and flooding impacts.

2.2 Screening

Screening aims to identify potential exposure to relevant climate change impacts. Each road infrastructure project has a range of engineering components and service provisions and is subject to different climate change impacts and risks. It is therefore not appropriate to consider a generic list of climate change risks. Current climate change science and projections were used to inform the climate change risk assessment.

2.2.1 Selection of climate change projections

Climate change projections selected to inform this risk assessment are based on information published by CSIRO and BoM in 2015. The design life of the project's key infrastructure components is 100 years. As such, projections modelled for 2030 (an average of the period 2020–2039) and 2090 (an average of the period 2080–2100) have been selected for the assessment. These are the available projections for the time horizon closest to project opening and the end of the project design life, respectively.

Projections for southeast Australia have also been published by the NSW and the Australian Capital Territory (ACT) Regional Climate Modelling (NARCliM) project (2014) in collaboration with OEH. These projections are based on the earlier climate models used for the IPCC's Fourth Assessment

[2] Roads and Maritime (unpublished 2015). Draft Technical Guide: Climate Change Adaptation for the Road Network

Report (AR4) and provide downscaled climate change data for a 10 kilometre resolution specific to NSW and the ACT.

While both sets of projections provide robust information on possible changes to the NSW climate, NARCliM projections are not yet available for a number of key climate variables (extreme rainfall, sea level rise, storm surge, wind speed) and the 'far future' projections are limited to projections from 2060 to 2079. This presents limitations when considering climate change impacts on road planning.

For the purposes of this climate change risk assessment, it is considered prudent to consider the potential impact of sea level rise on the project, given the project's proximity to the coastline, particularly at Rozelle Bay, and the sensitivity of road infrastructure to inundation impacts. Therefore, projections provided by CSIRO and BoM are considered most appropriate for this project and are recommended in the draft *Technical Guide: Climate Change Adaptation for the Road Network*.

It is important that a single source of projections is used as this ensures an 'internally consistent climate future' is presented, with a consistent set of assumptions, scenarios and modelling methods applied to each projection to represent the complex interactions that occur between climate variables within the climate system. As such, only the CSIRO and BoM projections have been used. Regardless, the purpose of the climate change chapter is to inform a climate change risk assessment and the difference between the sources of projections is not considered to impact on the development of risk scenarios for the project, except where data is unavailable for particular climate variables, such as sea level rise.

2.2.2 Climate change projections

Projections are presented for two emission scenarios or possible pathways, referred to as 'representative concentration pathways' (RCPs), each reflecting a different concentration of global greenhouse gas emissions. The two RCPs reported here are Intermediate emissions (RCP4.5) and High emissions (RCP8.5). Intermediate emissions projections are only provided in this report for context. The assessment is based on 'High' emissions projections, to account for a worst case scenario based on the precautionary principle.

The projections published by CSIRO and BoM[3] are spatially divided into eight natural resource management 'clusters', which largely correspond to broad-scale climate and biophysical regions of Australia. The project falls within the East Coast cluster. Due to the large north–south extent of the East Coast cluster and the diversity of the region, climate change projections are presented for the East Coast South sub-cluster where available. The sub-cluster extends from the south of Sydney to the Queensland border. Projections at this scale are considered appropriate for the consideration of future climate for road projects, in line the draft *Technical Guide: Climate Change Adaptation for the Road Network*.

2.2.3 Climate change risk screening

For the project, specific risks were identified using a screening matrix, which plots relevant elements of the project on one axis and key climate change variables relevant to the region on the other axis. By identifying the intersection between the climate change variables and the elements of the project, relationships can be identified and used to form the basis of potential risk scenarios for further analysis. This step forms part of the 'risk identification' stage of a typical risk management process as described in Roads and Maritime's *Guidelines for Risk Management*.

Table 2-1 provides the risk screening matrix developed for the project. On one axis are the key project components; the other axis presents the key climate variables relevant to the project. Where there is a relationship between a climate variable and a project element, this has been indicated in the matrix with an '✓'. Identified relationships form the basis of the development of risk scenarios in the following section, noting that one relationship might result in multiple risks and multiple relationships may combine to result in a single risk.

[3] CSIRO and BoM (2015). Climate Change in Australia – East Coast Cluster Report: Projections

Table 2-1 Risk screening matrix

	Project components											
Climate variable	Tunnel drainage	Tunnel ventilation (including outlets)	Surface road upgrades	Surface drainage	Pavement and base layers	Elevated structures (bridges, flyovers)	Shared cycle and pedestrian pathways	Water treatment facilities	Power supply	Ancillary infrastructure (signage, traffic signals, etc.)	Landscaping	F6 road users
Extreme rainfall	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mean rainfall		✓									✓	
Extreme temperature		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Mean surface temperature		✓									✓	
Mean annual wind speed		✓				✓				✓		
Atmospheric carbon dioxide (CO_2)	✓		✓	✓		✓				✓		
Bushfire weather		✓					✓		✓			✓
Sea level rise	✓		✓	✓			✓	✓	✓	✓	✓	
Extreme sea level	✓		✓	✓			✓	✓	✓	✓	✓	✓

As part of the screening process, a multidisciplinary workshop was held on 21 December 2017 with key members of the project design and planning team to identify and validate climate change risks specific to the project, as discussed in section **22.3** and section **22.4** of the EIS.

2.3 Detailed risk assessment

The first step of the detailed risk assessment was the formulation of risk scenarios for each of the relationships identified in the screening stage. Each risk scenario was then analysed in detail by assigning a likelihood and consequence rating. The criteria used for likelihood and consequence (following the *Guidelines for Risk Management*[4]) are shown in Table 2-2 and **Table 2-3** of this appendix. The consequence rating considers the potential consequences for the physical asset (damages), service provision (loss), safety, the environment and the community.

By combining the likelihood and consequence rating for each risk scenario, using the risk ranking matrix in **Table 2-4**, a level of risk can be determined. These levels represent that risk that exists before any mitigation or adaptation treatments are applied. For example, a risk with medium likelihood and low consequence results in a risk level of low.

The detailed risk assessment for the project is provided in section **22.3** and section **22.4** of the EIS.

[4] Roads and Maritime (2014). Guidelines for Risk Management

Table 2-2 Likelihood Criteria

Likelihood rating	Description		Probability parameters	
Extreme	Almost Certain	The event is expected to occur in most circumstances	>90% probability	> 1 in one year
High	Likely	The event will probably occur in most circumstances	51% to 90% probability	1 in 10 years
Medium	Moderate	The event should occur at some time	21% to 50% probability	1 in 50 years
Low	Unlikely	The event could occur at some time	10% to 20%	1 in 100 years
Negligible	Rare	The event might occur in exceptional circumstances	<10% probability	1 in 1000 years

Source: Guidelines for Risk Management (Roads and Maritime 2014)

Table 2-3 Consequence criteria – impacts on the project objectives

Consequence rating	Development Time	Delivery Time	Development Cost	Delivery Cost	Delivery Safety	Operation Safety	Environment Delivery Operation	Traffic flow peak hour	Local traffic	Community attitude	Fit for purpose Defects Accidents Maintenance costs
Extreme	Years	Months	$(25% overall construction cost)	$(10% overall construction cost)	Worker's Compensation Liability > $250,000 Death, permanent loss of physical or mental amenity	Multiple Worker's Compensation Liability > $250,000 Death, permanent loss of physical or mental amenity	Major environmental damage and/or delay due to legal finding in Land and Environment	No improvement	Severe disruption	Severe community protests	Functional failure
High	Months	Months	$(15% overall construction cost)	$(7% overall construction cost)	Worker's Compensation Liability $10,001 – $250,000 Lost time >= 5 days	Worker's Compensation Liability >$250,000 Death, permanent loss of physical or mental amenity	Serious environmental damage and/or delay due to public inquiry or EPA major notice	Marginal improvement	Disruption	Community protests	Serious functional failure
Medium	Months	Months	$(7.5% overall construction cost)	$(4% overall construction cost)	Worker's Compensation Liability $1,001 – $10,000 Lost time 1-4 days	Worker's Compensation Liability $10,001-$250,000 Lost time >= 5 days	Environmental damage and/or EPA infringement notice	-	-	Daily complaints	Minor functional failure

Consequence rating	Development Time	Delivery Time	Development Cost	Delivery Cost	Delivery Safety	Operation Safety	Environment Delivery Operation	Traffic flow peak hour	Local traffic	Community attitude	Fit for purpose Defects Accidents Maintenance costs
Low	Months	Weeks	$(1% overall construction cost)	$(1% overall construction cost)	Worker's Compensation Liability $251 – $1000 Lost time >= 1 day	Worker's Compensation Liability $1001 – $10,000 Lost time 1-4 days	Minor environmental damage and/or minor EPA infringement notices, written community complaints	km/hr	-	Complaints	-
Negligible	Weeks	Nil	$(0.1% overall construction cost)	$(0.1% overall construction cost)	Worker's Compensation Liability $1 – $250 First aid treatment (no lost time)	Worker's Compensation Liability $252 – $1000 Lost time >= 1 day	Minor repairable environmental damage Verbal community comment	km/hr	-	Negligible complaints	-

Source: Guidelines for Risk Management (Roads and Maritime 2014)

Table 2-4 Risk level matrix

Likelihood	Consequence					
		Negligible	Low	Medium	High	Extreme
	Extreme	Medium	High	Extreme	Extreme	Extreme
	High	Low	Medium	High	Extreme	Extreme
	Medium	Negligible	Low	Medium	High	Extreme
	Low	Negligible	Negligible	Low	Medium	High
	Negligible	Negligible	Negligible	Negligible	Low	Medium

2.4 Risk evaluation

The purpose of risk evaluation was to identify which risks require treatment, through either mitigation or adaptation. Treatments should be applied to those risks evaluated as extreme or high. Risks evaluated as negligible or low do not require any further consideration.

As this is a preliminary climate change risk assessment, based on design information available at the time of preparation of the EIS, and given that a subsequent detailed risk assessment would be undertaken during detailed design, any risks rated medium or higher have been retained for further consideration. The risk evaluation for the project is provided in **section 22.3** and **22.4** of the EIS.

2.5 Adaptation (risk treatment)

This step involves the development of risk treatments that can reduce the original unmitigated risk rating. Adaptation measures incorporated in the project design at this stage are associated with broader design refinements and opportunities for optimisation, as discussed in **section 22.5.1** of the EIS. Additional options for further consideration during the detailed design of the project are provided in **section 22.5.2** of the EIS.

3.0 Greenhouse Gas Assessment

This section provides a detailed description of the GHG assessment methodology, including the emissions factors used for all emission sources, and detailed calculation methods used to estimate the GHG emissions from fuel combustion, electricity consumption, vegetation removed, materials use and waste.

3.1 Assessment methodology

The following has been undertaken in estimating the greenhouse gas (GHG) emissions associated with the construction and operation of the project in accordance with the Transport Authorities Greenhouse Group (TAGG) Workbook1 2013:

- GHG emissions relevant to the stages of project construction and operation have been identified
- The GHG inventory boundary has been determined, which defined the emissions sources to be considered in the assessment and those to be excluded (refer to Chapter 22 (Climate Change Risk Assessment and Greenhouse gas) of this EIS for further details)
- The emissions sources have been quantified (see **Table 2-1** and **Table 4-1**)
- For the different emissions sources, emissions factors have been established and the emissions calculated.

The following sections provide the methodology used for calculating GHG emissions from fuel use, electricity consumption, vegetation removal, the embodied energy of materials used and the decomposition of waste generated during the project.

3.1.1 Guiding principles

The assessment has been conducted in accordance with the following GHG guiding principles:

- Relevance – select and use GHG sources, sinks, data and methodologies appropriate for the project/organisation and intended use of GHG inventory results
- Completeness – include all relevant GHG emissions and information which support methodology and criteria used
- Consistency – use consistent data, calculation/modelling methods, criteria and assumptions to enable valid comparisons
- Transparency – include clear, sufficient and appropriate information to enable others to understand the basis for results and make decisions regarding use of GHG inventory results with reasonable confidence
- Accuracy – reduce bias and uncertainties, as much as practical.

In addition to the accounting and reporting principles presented above, the issue of materiality has also been assessed in the GHG assessment. This is a core accounting and auditing principle which ensures that sources, assumptions, values and procedures included in the GHG assessment are material to the project. As materiality is valued within the context of the project being assessed, this can vary significantly between projects.

The materiality checklist provided in the TAGG Workbook has been used to identify potential sources of emissions to be included or excluded in the assessment. Based on this guidance the use of inert materials such as imported fill, sand and fly ash are considered to be insignificant to the assessment and have therefore been excluded from the assessment boundary.

Vegetation clearance has been included within the assessment boundary as more than 0.5 hectares of vegetation would be required to be removed as part of the project.

3.1.2 Fuel

The following method was used to calculate the Scope 1 GHG emissions from the combustion of liquid fuels (for the purposes of transport) is given by the formula below, as sourced from the National Greenhouse Accounts (NGA Factors 2017):

*Greenhouse gas emissions (t CO_{2-e}) = ((Q x ECF)/1000) x (EF_{CO2} + EF_{CH4} + EF_{N2O}); w*here:

- Q is the quantity of fuel (in kL)
- ECF is the relevant energy content factor (in GJ/kL)
- EF_{CO2} is the relevant Carbon dioxide (CO_2) emission factor (in kg CO_2-e/GJ)
- EF_{CH4} is the relevant Methane (CH_4) emission factor (in kg CO_2-e/GJ)
- EF_{N2O} is the relevant Nitrous oxide (N_2O) emission factor (in kg CO_2-e/GJ)

The method used for calculating the Scope 3 GHG emissions from the combustion of liquid fuels, for transport energy purposes is given by the formula below, as given by the NGA Factors 2017:

Greenhouse gas emissions (t CO_2-e) = (Q x ECF x $EF_{Scope\ 3}$)/1000; where:

- Q is the quantity of fuel (in kL)
- ECF is the relevant energy content factor (in GJ/kL)
- EFScope 3 is the relevant emission factor (in kg CO_2-e/GJ)

The Scope 1 and Scope 3 emission factors for the use of fuels (post 2004) are given in **Table 3-1**.

Table 3-1 - Scope 1 and Scope 3 emission factors for the use of fuels (post 2004 vehicles)

Fuel	Energy content factor (GJ per kL)	Scope 1 emission factor (kg CO_2-e/GJ)			Scope 3 emission factor (kg CO_2-e/GJ)	Emissions per unit quantity (t CO_2-e per kL)	
		CO2	CH4	N2O		Scope 1	Scope 3
Diesel - transport - post 2004 vehicles	38.6	69.9	0.01	0.6	3.6	2.7217	0.1390
Petrol (gasoline) - Light vehicle transport - post 2004 vehicles	34.2	67.4	0.02	0.2	3.6	2.3126	0.1231

3.1.3 Electricity

The method used to calculate the Scope 2 and Scope 3 GHG emissions from the consumption of purchased electricity is given by the formula below, as given by the NGA Factors 2017:

*Greenhouse gas emissions (t CO_2-e) = Q x ($EF_{for\ scope}$/1000); w*here:

- Q is the quantity of purchased electricity (in kWh)
- EFfor scope is the Scope 2 or Scope 3 emissions factor for NSW (in kg CO_2-e/kWh).

The emission factors for the consumption of purchased electricity are given in **Table 3-2**.

Table 3-2 Scope 2 and Scope 3 emission factors for the use of purchased electricity

Fuel	Emissions per unit quantity t CO_2-e per kWh	
	Scope 2	Scope 3
Electricity	0.00083	0.00012

3.1.4 Vegetation removal

The TAGG Workbook (2013) provides a methodology for estimating the loss of carbon sequestration potential associated with the removal of vegetation that would be required as part of land clearing activities during the project. The methodology provided in Appendix E of the TAGG Workbook was developed by GHD (2012) and is in line with the methodology used by the Australian Government Department of the Environment to estimate Australia's national GHG emissions for reporting under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

The methodology is based on a conservative approach, in line with relevant GHG guiding and reporting principles, and the following assumptions:

- All carbon pools are removed as part of the clearance of vegetation (eg debris and soil)
- All carbon removed is converted to CO_2 and released to the atmosphere
- Sequestration as a result of any revegetation works carried out as part of the project has not been included in the assessment.

The methodology estimates the GHG emissions associated with the loss of carbon sequestration that exists in vegetation at the time of clearing and the potential carbon that could have been sequestered in the future if the vegetation was not cleared. The GHG emissions associated with the loss of CO_2 sequestration potential through the removal of vegetation have been calculated using the following steps:

- The potential maximum biomass class ('Maxbio' class) has been determined for the project location using vegetation maps provided in Appendix E of the TAGG Workbook
- The class of vegetation (Table 1 of the TAGG Workbook Appendix E) and the area in hectares for each vegetation type to be cleared as part of the project has been identified
- The vegetation clearance emissions factors have been identified for each vegetation class for the selected 'Maxbio' class from Table 2 of the TAGG Workbook Appendix E
- The GHG emissions associated with the loss of CO_2 sequestration potential have been estimated by multiplying the area of vegetation to be cleared (in hectares) by the corresponding emissions factor (t CO_2-e per hectare) for each vegetation type
- The total estimate of GHG emissions associated with the loss of CO_2 sequestration potential for the project has been obtained by adding the results for each vegetation type.

Vegetation clearance emissions factors for the project are identified in **Table 3-3**.

Table 3-3 Scope 1 emission factors for vegetation clearance by type of vegetation

Vegetation type	Vegetation class	Emissions factor ($t CO_2$-e per hectare)
Open Woodlands - Casuarina Forest and Woodlands	D	307
Open Woodlands - Eucalypt Woodland	D	307
Grassland	I	110

* Note: the 'Maxbio' class is derived from the Australian Greenhouse Office and estimates the maximum tonnes of dry vegetation matter per hectare for a specific location.

3.1.5 Construction materials and waste

Indirect Scope 3 GHG emissions form the embodied energy of materials used in the project and the decomposition of waste generated by the project have been calculated according to the formula below:

Greenhouse gas emissions ($t CO_2$-e) = Q (t) x EF ($t CO_2$-e/t); where:

- Q is the quantity of material or waste (in tonnes).
- EF is the relevant Emission Factor (in t CO_2-e per tonne of material/waste).

Emission factors have been sourced from the TAGG Workbook (2013) and the NGA Factors 2017, as given in Table 3-4.

Table 3-4 Scope 3 embodied energy of construction materials

Material	Emissions per unit quantity ($t CO_2$-e/t)	Source	Assumptions & comments
Concrete (40MPa)	0.155	TAGG Workbook Appendix D	Concrete 40MPa (1:1.5:3) (conservative)
Concrete (30MPa)	0.127	TAGG Workbook Appendix D	Concrete 30MPa (1:2:4) (conservative)
Concrete (20MPa)	0.096	TAGG Workbook Appendix D	Concrete 20MPa (1:3:6) (conservative)
Steel reinforcement	1.05	TAGG Workbook Appendix D	Structural steel
Aggregate	0.005	TAGG Workbook Appendix D	e.g. crushed rock
Asphalt	0.058	TAGG Workbook Appendix D	Hot Mix Asphalt (400MJ/t)
Copper	5.15	TAGG Workbook Appendix D	
Plastic - PVC	2.41	TAGG Workbook Appendix D	PVC assumed as no split of plastics provided
Waste			
Municipal solid waste	1.4	NGA Factors July 2017, Table 44	
Construction and demolition waste	0.2	NGA Factors July 2017, Table 44	

3.2 Construction greenhouse gas assessment activity data

This section details the quantification of the GHG emission source data used to estimate emissions associated with construction of the project, including the sources of information used and assumptions made.

In addition to the mainline tunnel and portals, six construction ancillary facilities are described in this EIS. **Table 3-5** details the GHG emission source data and emissions factors used in the GHG assessment.

The layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval.

Table 3-5 F6 Ext (Stage 1) emissions source activity data and emissions factors

Emissions source	Emissions source	Quantity	Unit	Emissions per unit quantity			
				Scope 1	Scope 2	Scope 3	Units
Fuel use - diesel	Construction plant, equipment and heavy vehicle movements onsite	21,000	kL	2.721686		0.13896	t CO_2-e per kL
	Transport of construction materials, spoil and waste to/from site	9,060	kL	2.721686		0.13896	t CO_2-e per kL
Fuel use - petrol (gasoline)	Project vehicle movements onsite (light vehicles)	1,345	kL	2.312604		0.12312	t CO_2-e per kL
Electricity purchased from the grid	Electricity consumption to power roadheaders, ventilation, site offices and other associated plant and equipment onsite	75,377,590	kWh		0.00083	0.00012	t CO_2-e per kWh

Emissions source	Emissions source	Quantity	Unit	Emissions per unit quantity			
				Scope 1	Scope 2	Scope 3	Units
Construction materials	Concrete (cast insitu total)	477,100	t			-	t CO_2-e per t
	20MPa	8,000	t			0.096	t CO_2-e per t
	25MPa	100	t			0.127	t CO_2-e per t
	32MPa	118,000	t			0.127	t CO_2-e per t
	40MPa	61,000	t			0.155	t CO_2-e per t
	50MPa	290,000	t			0.155	t CO_2-e per t
	Concrete (precast)	230	t			0.155	t CO_2-e per t
	Steel (total)	100,210	t			1.05	t CO_2-e per t
	Aggregate	77,000	t			0.005	t CO_2-e per t
	Asphalt	15,000	t			0.058	t CO_2-e per t
	Copper	300	t			5.15	t CO_2-e per t
	Plastic (PVC)	60	t			2.41	t CO_2-e per t
Vegetation clearance	Removal of vegetation	1.54	ha	**			t CO_2-e per ha
Decomposition of waste	General Solid Waste	139,100	t			1.4	t CO_2-e per t
	Construction and demolition waste	2,900	t			0.2	t CO_2-e per t

**for vegetation clearance emissions factors refer to section 3.1.4

3.3 Detailed calculation methods

Table 3-6 provides the GHG assessment results for the emissions estimated to occur during construction of the project, reported according to Scope 1, Scope 2, Scope 3 and total emissions. GHG emissions are reported in this assessment as tonnes of carbon dioxide equivalent (t CO_2-e).

Table 3-6 F6 Ext (Stage 1) emissions results

Emissions source	Emissions source	Quantity	Unit	Emissions per unit quantity				
				Scope 1	Scope 2	Scope 3	Total	% total
Fuel use - diesel	Construction plant, equipment and heavy vehicle movements onsite	21,000	kL	57,155.41		2,918.16	60,073.57	11.23%
	Transport of construction materials, spoil and waste to/from site	9,060	kL	24,659.65		1,259.04	25,918.69	4.85%
Fuel use - petrol (gasoline)	Project vehicle movements onsite (light vehicles)	1,345	kL	3,111.19		165.64	3,276.83	0.61%
Electricity purchased from the grid	Electricity consumption to power roadheaders, ventilation, site offices and other associated plant and equipment onsite	75,377,590	kWh		62,563.40	9,045.31	71,608.71	13.39%
Construction materials	Concrete (cast insitu - total)	-	t			-	0.00	0.00%
	20MPa	8,000	t			768.00	768.00	0.14%
	25MPa	100	t			12.70	12.70	0.00%
	32MPa	118,000	t			14,986.00	14,986.00	2.80%
	40MPa	61,000	t			9,455.00	9,455.00	1.77%
	50MPa	290,000	t			44,950.00	44,950.00	8.40%
	Concrete (precast)	230	t			35.65	35.65	0.01%
	Steel (total)	100,210	t			105,220.50	105,220.50	19.67%
	Aggregate	77,000	t			385.00	385.00	0.07%
	Asphalt	15,000	t			870.00	870.00	0.16%
	Copper	300	t			1,545.00	1,545.00	0.29%
	Plastic (PVC)	60	t			144.60	144.60	0.03%
Vegetation clearance	Removal of vegetation	1.54	ha	321.09			321.09	0.06%
Decomposition of waste	General solid waste	139,100	t			194,740.00	194,740.00	36.41%
	Construction and demolition waste	2,900	t			580.00	580.00	0.11%
Totals				85,247.3	62,563.4	387,080.6	534,891.3	100.00%
% Total				15.94%	11.69%	72.37%	100.0%	

3.4 Emissions from operational road use

Improvements to traffic flow and congestion through increased speeds, reduced travel distances and reduced frequency of stopping results in improved fuel efficiency and a subsequent reduction in GHG emissions associated with road use. As a result, it is anticipated that the project would result in GHG emissions savings when compared to the base case 'do minimum' scenario (without the project).

To assess the indirect Scope 3 GHG emissions associated with fuel combustion of vehicle traffic using the project, and to evaluate any potential GHG emissions savings as a result of the project, the following road use scenarios were considered:

- At opening (2026): it is proposed that the project would be constructed and fully operational by 2026. The following scenarios were considered:
  - 'Do something' (2026)
  - 'With the project' (2026)
- Future (2036): 10 years in the future was assessed as well as other transport network elements. The following scenarios were considered:
  - 'Do something' (2036)
  - 'With the project' (2036)
  - 'Cumulative (2036).

These scenarios are summarised in **Chapter 8** (Traffic and Transport) of the EIS. While traffic volumes were modelled for both of these years as detailed in **Appendix D** (Traffic and Transport: Technical Work Paper).

The GHG assessment for operational road use involved calculation of the following inputs:

- Average speed for each road link
- Vehicle Kilometres Travelled (VKT) for both light and heavy vehicles
- Rate of fuel consumption
- Total fuel quantity
- Fuel quantity by fuel type
- Calculation of GHG emissions.

3.4.1 Average speed by road type

For each scenario, the average weekday speeds on links within the study area were sourced from the SMPM, for each direction of traffic in the AM peak, inter-peak, PM peak and evening periods. Average speed is influenced by the level of congestion experienced for each link, as well as factors such as the number of traffic lights, road or tunnel gradient and ramp curvature.

3.4.2 Vehicle kilometres travelled

For each scenario, VKT for light and heavy vehicles on each link within the study area was sourced from the SMPM, for each direction of traffic in the AM peak, inter-peak, PM peak and evening periods. The average VKT for each daily time period was multiplied to give the average volume of traffic for each time period over 365 days per year. The VKT assessed is based on model outputs of average weekday traffic (AWT) projections. This provides a conservative assessment for annual VKT based on higher weekday traffic volumes, rather than average daily traffic (ADT), as generally ADT volumes are lower than AWT on most roads and similar on a few roads.

3.4.3 Rate of fuel consumption

The rate of fuel consumption was calculated for each vehicle type within the traffic impact footprint, using the basic fuel-speed formula given below (Equation 1 in Austroads Guide to Project Evaluation Part 4: Project Evaluation Data, Part 6 (2008)):

Fuel Consumption (L/100km) = A+ (B/V) + (CxV) + (DxV^2)

Where: A, B, C, D are the fuel consumption parameter values given in **Table 3-7**.

V is the all day average link speed in km/h

Table 3-7 Fuel consumption parameter values on freeways – litres/100 km

Vehicle type	A	B	C	D
Cars	-18.433	1306.02	0.15477	0.0003203
Light commercial vehicle (LCV)	-27.456	2060.50	0.1911	0.000851
Rigid trucks	-65.056	4156.75	0.49681	0.0006798
Articulated vehicles	-80	6342.80	0.48496	0.0020895
Buses	-80	5131.63	0.60539	0.0015775

3.4.4 Total fuel quantity combusted

For each scenario, VKT was factored by the rate of fuel consumption for each road type to determine the total quantity of fuel consumed in each scenario.

3.4.5 Fuel quantity combusted by fuel type

The analysis considered three fuel types: petrol, diesel and LPG. The total quantity of fuel combusted in each scenario, for 2026 and 2036, was apportioned according to fuel type, based on Australian Bureau of Statistics Survey of Motor Vehicle Census at the Census date 31 January 2017 (released 28 July 2017). Estimates of the proportional makeup of light and heavy vehicles by fuel type are given in **Table 3-8**.

Table 3-8 Fuel proportions for light and heavy vehicles

Vehicle category	Fuel Type	Estimated Proportion
Light vehicles	Petrol	0.785
	Diesel	0.194
	LPG/CNG/dual fuel / hybrid	0.021
Heavy vehicles	Petrol	0.057
	Diesel	0.932
	LPG/CNG/dual fuel / hybrid	0.011

3.4.6 GHG emissions calculations

The Scope 3 GHG emissions associated with the use of petrol, diesel and LPG in each scenario for 2026 and 2036 were calculated according to the formula below, as given by the NGA Factors 2017:

Greenhouse gas emissions (t CO_2-e) = (*Q x EFfull fuel cycle*)/1000

Where: Q is the quantity of fuel (in kL).

$EF_{\text{full fuel cycle}}$ is the relevant emission factor (in kg CO_2-e/kL).

The emission factor applied represents the full fuel cycle, which is the sum of Scope 1 and Scope 3 emissions. The emission factors for petrol, diesel and LPG, for general transport as a conservative assumption, are given in **Table 3-9**.

Table 3-9 - Scope 1 and Scope 3 emission factors for general transport

Fuel	Energy content factor (GJ per kL)	Scope 1 emission factor (kg CO_2-e/GJ)			Scope 3 emission factor (kg CO_2-e/GJ)	Emissions per unit quantity (t CO_2-e per kL)			Full fuel cycle (t CO_2-e per kL)
		CO_2	CH_4	N_2O		Scope 1	Scope 2	Scope 3	
Petrol (gasoline)	34.2	67.4	0.5	1.8	3.6	2.38374	N/A	0.12312	2.50686
Diesel oil	38.6	69.9	0.1	0.5	3.6	2.7213	N/A	0.13896	2.86026
Liquid petroleum gas (LPG)	26.2	60.2	0.6	0.7	3.6	1.6113	N/A	0.09432	1.70562

4.0 Environmental risk analysis

An environmental risk analysis for the project was carried out as part of this EIS. This section outlines the environmental risk analysis process. Identification of the key environmental issues as determined by the analysis can be found within each specialist chapter.

4.1 Environmental risk analysis process

The environmental risk analysis process carried out for the project included:

- A preliminary environmental assessment, that was carried out as part of the SSI application report[5] to allow early identification of the key environmental issues and to inform the SSI application
- An assessment of the key issues identified in the SEARs for the project (refer to the SEARs in **Appendix A** (Secretary's Environmental Assessment Requirements checklist))
- An environmental risk review undertaken to confirm the impacts based on the results of the detailed investigations presented in this EIS.

Through the environmental risk analysis process, issues that may be associated with the project were identified and categorised as a 'key issue' or 'other' (see **Table 4-1**). This enabled the identification of any matters that might be considered as additional key issues, and provided a basis for an appropriately detailed assessment of these additional key issues in this environmental assessment.

Table 4-1: Environmental risk categories

Risk category	Description
Key issue	Potential for high or moderate impacts (actual or perceived) requiring further investigation to identify specific management and mitigation measures
Other	Potential for low impacts that can be managed effectively with standard and/or best practice management and mitigation measures

As required by the SEARs, this process of key issue identification and analysis continued during the course of preparing the EIS. Emphasis was placed on using the detailed information gathered for the project to identify and review potential environmental issues. More specifically, the analysis:

- Identified environmental issues, including key issues in the SEARs, and any other issues
- Examined potential impacts and proposed management and mitigation measures in relation to the identified issues
- Identified the impacts likely to remain after management and mitigation measures are applied (e.g. the residual impacts).

The identified environmental issues are described and assessed in **Chapter 8** (Traffic and transport) to **Chapter 24** (Project synthesis) and **Appendix D** to **Appendix N**. As required by the SEARs, a risk analysis, including a likelihood and consequence analysis, has been undertaken and is included within each respective environmental chapter. An assessment of cumulative impacts is presented in **Chapter 24** (Project synthesis).

As part of the environmental risk analysis for the project, a residual impact assessment was also undertaken and provided in each respective environmental chapter. This assessment provides an analysis of project impacts post-mitigation (e.g. after management and mitigation measures are applied to manage the impact) based on the risk assessment approach described in **section 4-3**.

Likelihood consequence analysis

To determine the residual impacts for each potential key issue, the following risk assessment approach has been undertaken. The likelihood of an impact occurring following the implementation of management and mitigation measures is assessed using the categories provided in **Table 4-2**.

[5] Roads and Maritime (2017). F6 Extension – Stage 1 SSI application

Table 4-2: Likelihood categories

Likelihood	Description
Certain	Expected to happen routinely during the project life.
Likely	Could easily happen and has occurred on a previous similar project.
Unlikely	Possible, but not anticipated.

The consequence of the impact occurring following the implementation of management and mitigation measures was assessed using the categories provided in **Table 4-3**.

Table 4-3: Consequence categories

Consequence	Description
Certain	Minor effects on biological, social, economic or physical environment, both built and natural. Minor short to medium term damage to small area of limited significance, easily rectified.
Likely	Moderate effects on biological, social, economic or physical environment, both built and natural. Moderate short to medium term widespread impacts. More difficult to rectify.
Unlikely	Serious effects on biological, social, economic or environment, both built and natural. Relatively widespread medium to long term impacts. Rectification difficult or impossible

Based on the assessment of the likelihood and consequence of a given impact occurring with the proposed management and mitigation measures in place, a residual risk rating was derived from the risk matrix as presented in **Table 4-4**.

Table 4-4: Risk Matrix – Residual Risk Rating

	Consequence		
Likelihood	**Minor**	**Moderate**	**Major**
Certain	Medium	High	High
Likely	Low	Medium	High
Unlikely	Low	Low	Medium

If an identified residual risk is not lowered or remains high, consideration of additional management and mitigation measures will be identified and implemented, or justification provided for the risk.

4.2 Identification of key issues and risk

The environmental risk analysis has been undertaken following the assessment of likely impacts for each of the key issues identified by the SEARs as well as other environmental matters that have been identified as potentially being impacted by the project. The environmental issues are described and assessed in detail in **Chapter 8** (Traffic and transport) to **Chapter 24** (Project synthesis) and **Appendix D** to **Appendix N**.

4.3 Risk analysis approach

For each of the identified issues, a level of assessment was undertaken commensurate with the potential degree of impact the project may have on that issue. This included an assessment of whether the identified impacts could be avoided or minimised (for example, through design amendments). Where impacts could not be avoided, environmental management measures were recommended to manage impacts to acceptable levels. These are detailed in full in **Chapter 29** (Summary of environmental management measures).

Environmental management measures will be implemented through the management frameworks put in place by the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP), and relevant sub-plans. In addition to incorporating management measures, these plans will include details of how the measures will be implemented, monitored and audited for compliance.

The assessment of key issues has been undertaken based on a concept design, as identified in **Chapter 1** (Introduction). The identified management measures will be reassessed during the detailed design for their appropriateness. In relation to managing impacts, the following hierarchy has been implemented during the concept design and will also be implemented during the detailed design. The hierarchy will avoid environmental impacts where possible through design. Where impacts cannot be avoided, feasible and reasonable measures are recommended to minimise these impacts to the greatest extent practicable. As a result, the following assessment does not detail residual risks that are considered low, or the beneficial impacts of the project.

Chapter 8 (Traffic and transport) to **Chapter 24** (Project synthesis) and **Appendix D** to **Appendix N** of the EIS provide a description of the potential unmitigated impacts of the project. The environmental risk analysis process detailed in **section 4.1** was then applied to the key project impacts as assessed in **Chapter 8** to **Chapter 24** and **Appendix D** to **Appendix N** to provide a post-mitigation residual risk rating for each identified key risk.

4.4 Risk analysis outcomes

Medium residual risks

For medium level residual risks identified in the residual risk assessment, opportunity exists through the detailed design process to:

- Resolve impacts through detailed design refinement
- Develop effective construction methodologies and planning with the construction contractor to ensure that management and mitigation measures are effectively implemented
- Implement a process of review, correction and audit for the CEMP and OEMP as detailed in Chapter 29 (Summary of environmental management measures). This is a process of continuous improvement that will form part of the CEMP and OEMP and allow for management measures to be updated or improved during construction and operational phases where practical.

Following the implementation of the above, medium residual risk level items would be further reviewed during the detailed design development and where necessary additional measures implemented to ensure these risks are suitably mitigated.

Low residual risks

Other impacts identified as having a low residual risk are considered to have already been managed to a reasonable and feasible level. Regardless of the low risk rating, the same level of review, correction and continual improvement would be applied to the measures identified to address these impacts as will be detailed in the CEMP and OEMP.

5.0 Cumulative impact assessment methodology

There are currently no NSW or Australian Government guidelines on undertaking cumulative impact assessments. Therefore, the cumulative impact assessment in this EIS is based on the broad requirements set out in the SEARs for the project.

This section includes a description of how projects were initially identified for consideration by explaining the screening criteria applied in determining whether the projects should be assessed for cumulative impacts. It also includes an overview of the type of assessment undertaken for the relevant cumulative impacts. Specific cumulative impacts are discussed within each respective environmental assessment chapter, while a summary of the assessment is provided in **Chapter 24** (Project synthesis) of the EIS.

5.1 Nature of cumulative impacts

Cumulative impacts are determined by an assessment of major developments that are proposed, have been approved (but not yet under construction) and/or those that would be constructed or operating at the same time as the planning, construction or operation of the project. Cumulative impacts are considered important to assess because in isolation, a particular impact from one project may be considered minor, but when the impact of multiple projects are considered, the impacts may be more substantial.

Impacts can be either adverse or beneficial. Where an adverse impact is considered likely, mitigation and/or management measures would be implemented to avoid or reduce those impacts. Assessment of cumulative impacts assumes that the specific mitigation and management measures outlined for the project in the various chapters of this EIS have been applied and therefore the summary focuses on the more strategic measures that may be implemented in coordination with other relevant projects.

5.2 Identification of other projects

The following sources were consulted to identify an initial list of projects for potential inclusion in the cumulative impact assessment:

- The WestConnex program of works (New M5 Motorway and M4-M5 Link)
- Other known NSW Roads and Maritime Services and other transport infrastructure projects in proximity to the project
- A review of the DP&E's Major Projects website
- Consultation with government agencies
- A review of Rockdale Council (now Botany Bay) development website.

Only projects considered to be of 'material' scale in the vicinity of the project were included on the list of projects to be screened. The materiality threshold for this cumulative impact assessment is defined as projects listed on the DP&E's Major Projects website as SSD, SSI and known project proposals of a relevant scale or resultant impact that involve activities that could result in a cumulative impact, including proposed projects that interface with the project.

Project classifications were undertaken by their status. This includes those that are:

- Recently completed
- Currently under construction and/or likely to be under construction
- Approved, but not yet under construction
- Under a statutory environmental impact assessment
- Considered future strategic government projects, but not yet subject to statutory environmental impact assessments.

Projects listed can broadly be defined under the following categories:

- **Related NSW Roads and Maritime Services projects:** Other Roads and Maritime projects that may interact with, be under construction at the same time as the project, or operate within the vicinity of the project include; WestConnex, Sydney Gateway, Western Harbour Tunnel and Beaches Link. As these projects are in varying stages of planning and construction, consistent and robust data are limited to inform the cumulative effects assessment
- **Sydney Motorway Corporation projects (WestConnex):** Program of works including the New M5 Motorway and M4-M5 Link projects (under construction and likely to be under construction)
- **Other projects or strategic development:** Other local projects under consideration by the local councils including urban development, smaller scale infrastructure development and active transport projects. Projects are in varying stages of development with limited detail available on specific impacts in most cases.

A brief description of these projects is provided in **Table 5-1**.

Table 5-1: Projects assessed as part of the cumulative effects assessment

Project Name	Brief project description	Status
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 Motorway project) and the Sydney Airport and Port Botany precinct.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval. For the purposes of this cumulative impact assessment, the Sydney Gateway project is conservatively assumed to be operational by 2023.
Western Harbour Tunnel and Beaches Link	Western Harbour Tunnel: Tunnels connecting to the M4-M5 Link at the Rozelle interchange, crossing underneath Sydney Harbour between the Birchgrove and Waverton areas, and connection with the Warringah Freeway at North Sydney. Beaches Link: Tunnels connecting to the Warringah Freeway, crossing underneath Middle Harbour and connecting with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval. For the purposes of this cumulative impact assessment, the Western Harbour Tunnel component is conservatively assumed to be operational by 2023, but construction may continue after the expected opening year of the M4-M5 Link project. For the purposes of this cumulative impact assessment, the Beaches Link component is conservatively assumed to be operational by 2033.
New M5 Motorway	Duplication of the M5 East from King Georges Road in Beverly Hills with tunnels from Kingsgrove to a new interchange at St Peters. The St Peters interchange allows for connections to the proposed future Sydney Gateway project and an underground connection to the M4-M5 Link. The New M5 Motorway tunnels also include provision for a future connection to the proposed future F6 Extension.	Planning approval under the EP&A Act granted on 20 April 2016. Commonwealth approval under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) granted on 11 July 2016. Under construction.
M4-M5 Link	Twin tunnels connecting the New M4 at Haberfield with the New M5 Motorway at St Peters, including an interchange at Rozelle. The M4-M5 Link also provides a future connection to the Western Harbour Tunnel and Beaches Link.	Preferred infrastructure report submitted, with planning approval under the EP&A Act anticipated in February 2018. Construction expected to begin mid-2018.
Cook Cove Precinct	Redevelopment of around 100ha existing open space to provide residential, civic and community facilities and environmental remediation works.	Development application has been submitted with environmental assessments. Currently split into two precincts. No timing currently for construction.

5.3 Screening criteria

The following criteria were applied to the list of relevant projects to determine whether each project or development should be included within the assessment.

- Spatial proximity (distance between projects) – projects were considered spatially proximate if they were located within approximately 10 kilometres of the project
- Temporal proximity (timeframe between projects) – projects were considered temporally proximate if the expected assessment, construction or operation of that project would overlap with the timing of the F6 Extension – Stage 1
- Publicly available information – projects must have an adequate level of detail available to allow either a quantitative or qualitative assessment to be prepared.

These criteria were used in determining the relative merit of each project for inclusion in the cumulative impact assessment.

5.4 Project screening

Based on the application of the criteria listed in **section 5.3**, a number of projects were considered, but then ultimately not included. These are detailed in **Table 5-2**.

It is noted that in searching the Rockdale Council development register, numerous developments on exhibition within the vicinity of the project were identified. These primarily involved alterations or additions to existing developments or new construction. It is noted that while spatially proximate, these are unlikely to be still under construction during the timing of the project, nor are they considered to be at a scale that would contribute towards cumulative impacts.

Table 5-2: Projects considered but not assessed

Project name	Brief project description	Potential interaction with the f6 extension – stage 1	Justification for exclusion
Powering Sydney's Future Cable	The project includes: • Two new 330 kV underground transmission cables between the existing Rookwood Road Substation and the existing Beaconsfield West Substation; • A new single 330 kV underground transmission cable from the existing Beaconsfield West Substation to the existing Sydney Park Adit and then to the Haymarket Substation via an existing cable in an existing tunnel; • Upgrade works within the Rookwood Road Substation and the Beaconsfield West Substation; • Connection to an existing joint bay located at surface level adjacent to the Sydney Park Adit; • Minor upgrade works at the Haymarket Substation; and • Ancillary infrastructure and works as required.	Spatially – within 4 kilometres of the project footprint.	Insufficient public information available Impacts are not yet known
Vopak Bulk Liquids Facility	The proposal is for works to facilitate the increase in throughput capacity of the terminal, and involves: • construction of a new access road and driveway • construction of four new road tanker bays, driver amenities building and extension to existing warehouse; • an upgrade to the vapour recovery unit; and • installation of additional transfer pumps and pipelines and associated infrastructure.	Spatially – within 5 kilometres of the project footprint	Impacts are not yet known
DA2017/2011	Integrated Development - Construction of a seven (7) storey mixed use development comprising 64 residential units (including 32 units as affordable housing), three (3) commercial units, basement car parking and demolition of existing structures.	Spatially – less than 1 kilometre from the project footprint	Impacts are not yet known
DA35/98 – New Packaging Facility	The proposal is to construct a packaging facility to enable the site to package selected chemicals into 200 litre drums, and 1,000 litre Intermediate Bulk Containers (IBCs).	Spatially – within 8 kilometres of the project footprint	Impacts are not yet known