

Referral of proposed action

Project title: The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park

1 Summary of proposed action

1.1 Short description

Roads and Maritime Services (Roads and Maritime) is seeking approval for The Northern Road Upgrade from Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park (hereafter known as 'the proposed action').

The upgrade of The Northern Road corridor is part of the Western Sydney Infrastructure Plan (WSIP), a package of major road infrastructure upgrades funded by the Australian and NSW governments to support the development of western Sydney airport at Badgerys Creek, employment zones such as Western Sydney Priority Growth Area (WSPGA) and growth centres such as South West Priority Land Release Area (SWPLRA).

The proposed action would include:

- From Mersey Road, Bringelly to Littlefields Road, Luddenham; a realignment of the current The Northern Road to by-pass Luddenham and to avoid the site of the planned western Sydney airport
- From Littlefields Road, Luddenham to about 100 m south of Glenmore Parkway, Glenmore Park; widening the existing two lane corridor to up to eight lanes.

The proposed action would include upgrading of some intersections, widening of the existing road and changed accesses to improve safety. The upgrade is expected to include a range of infrastructure such as retaining walls, drainage, safety barriers, bridges, underpasses, shared paths and lighting.

The proposed action may also require supporting facilities during construction, such as compounds, batching plant(s), stockpile sites, temporary accesses and sedimentation basins. The entire length of the upgrade will be designed for a speed limit of 90 kilometres per hour, but likely operated at 80 kilometres per hour.

The regional context of the proposed action is shown in **Figure 1-1**.

1.2	Latitude and Longitude		Latitude			Longitude		
		Location point	degrees	minutes	seconds	degrees	Minutes	seconds
	Mersey Road to Littlefields Road							
	Mersey Road	33	55	8.4	150	42	50.5	
	The Northern Road	33	54	51.3	150	42	20	
	Farm	33	54	32.4	150	41	58.9	
	Willowdene Avenue 1	33	54	9.4	150	41	6.3	
	Bend point 1	33	53	55.5	150	40	55.7	
	Willowdene Avenue 2	33	53	45.6	150	40	56.8	
	Eton Road	33	53	2.2	150	41	50.4	
	Adams Road	33	52	45	150	41	58.2	
	Bend point 2	33	52	15.6	150	41	45.7	
	Elizabeth Drive	33	51	50.8	150	41	53	
	Littlefields Road to Glenmore Parkway							
	Littlefields Road	33	50	46.4	150	41	16.4	
	Gates Road	33	50	27.7	150	41	5.8	
	Kings Hill Road	33	49	47.5	150	41	0.1	
	Chain-o-Ponds Road	33	49	15.9	150	41	7.1	
	Defence Establishment Orchard Hills	33	48	43.2	150	41	32.7	
	Bradley Street	33	48	18.8	150	41	46.1	
	Glenmore Parkway	33	47	37.4	150	41	56.8	

1.3 Locality and property description

The Northern Road is about 45 km west of the Sydney central business district and traverses the local government areas of Penrith in the north and Liverpool in the south.

The Northern Road is a key north–south road between Narellan and Richmond, connecting the North West and South West Priority Land Release Areas (see **Figure 1-1**). The corridor intersects with major roads such as (from south to north) Camden Valley Way, Bringelly Road, Elizabeth Drive, M4 Western Motorway, Great Western Highway and Richmond Road. The Northern Road runs adjacent to the Defence Establishment Orchard Hills site. A seven kilometre section of the existing The Northern Road alignment bisects the western Sydney airport site south-east of the Luddenham town centre.

The proposed action is for the 16 km section between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park and travels through the local government areas (LGAs) of Liverpool in the south and Penrith in the north.

The proposal corridor, as used in this Referral, is the area of the final operational footprint of the proposed action with an additional 10 m either side to allow for construction impacts. This corridor (also described as the construction footprint) has been selected to incorporate the widest possible extent of the proposed action at locations where batter slopes may be at their widest.

The proposal corridor generally consists of semi-rural properties located on both sides of the existing and proposed corridor to the north and south of Luddenham town centre and suburban areas near Glenmore Parkway to the north. The Defence Establishment Orchard Hills facility is also located along the eastern side of the proposed alignment. A section of The Northern Road (from south of Elizabeth Drive) would be relocated to allow construction of western Sydney airport and to bypass Luddenham. There are areas of Commonwealth land that would be affected by the proposal. Affected Commonwealth land includes part of the planned western Sydney airport site and along the western boundary of the Defence Establishment Orchard Hills.

The location and key elements of the proposed action are shown on **Figure 1-2** and **Figure 1-3**.

1.4 Size of the development footprint or work area (hectares)

The concept design has not yet been finalised and as such the area required for construction and operation of the proposed action has not yet been confirmed and would be identified as part of the environmental impact assessment process.

As described above, the proposal corridor is described as the area required for construction of the project between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park. The total construction footprint is estimated at 183 hectares. This is anticipated to include about 64 hectares of native vegetation (comprising 28 hectares of EPBC Act listed vegetation) and about 58 hectares of Commonwealth land.

The final operational footprint is estimated to be 194 hectares in total.

1.5 Street address of the site

The proposed action extends in a south to north direction from Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park.

1.6 Lot description

Roads and Maritime has and will continue to minimise the amount of land required to be purchased for the proposed action wherever possible through the options selection and design process and is engaged in an ongoing process of negotiation with affected landowners. All land acquisition will be in accordance with relevant Australian and NSW legislation. All parcels of land affected by the proposed action are listed below.

Lot2/DP623457	Private	Lot2/DP32026	Private
Lot21/DP614481	Private	Lot3/DP1067073	Private
Lot11/DP30775	Private	Lot23/DP207317	Private
Lot6/DP26658	Private	Lot3/DP911607	Private
Lot4/DP26658	Private	Lot1/DP851626	The Commonwealth of Australia
Lot93/DP654182	Private	Lot2/DP202647	Private
Lot25/DP700302	Private	Lot98/DP2234	Private
Lot28/DP259698	Private	Lot75/DP2234	Private
Lot1/DP795841	Private	Lot101/DP580082	Private
Lot10/DP26658	Private	Lot112/DP1030865	Private
Lot5/DP26658	Private	Lot71/DP668758	Private
Lot9/DP26658	Private	Lot82/DP1055149	Private
Lot4/DP232324	Private	Lot68/DP651114	Private
Lot27/DP259698	Private	Lot132/DP1002668	Private
Lot7/DP4832	Penrith City Council	Lot95/DP27550	Private
Lot37/DP959167	Private	Lot94/DP27550	Private
Lot12/DP30775	Sydney Water	Lot2/DP250030	Private
Lot1/DP90157	Private	Lot92/DP27550	Private
Lot32/DP259698	Commonwealth of Australia	Lot21/DP258581	Private
Lot16/DP30775	Private	Lot22/DP258581	The Commonwealth of Australia
LotA/DP341893	Private	Lot66/DP2234	Private
Lot3/DP26658	Private	Lot6/DP29081	Private
Lot7/DP26658	Private	Lot1/DP202647	Private
Lot111/DP1030865	Private	Lot101/DP2234	Private
Lot1/DP551558	Penrith City Council	Lot36/DP959167	Private
Lot22/DP700302	Private	Lot80/DP2120	Private
Lot33/DP259698	Commonwealth of Australia	Lot8723/DP1040626	Private
Lot1/DP1064093	Private	Lot3/DP32026	Private
Lot31/DP244610	Private	Lot73/DP2120	Private
Lot19/DP29081	Private	Lot81/DP1055149	Private
Lot62/DP2234	Private	Lot102/DP812653	Private
Lot502/DP580982	Private	Lot3/DP250030	Private
Lot506/DP587193	Private	Lot1/DP232996	Private
Lot1/DP250030	Private	Lot96/DP27550	Private
Lot101/DP597243	Penrith City Council	Lot15/DP658328	Private
Lot11/DP232322	Private	Lot97/DP2234	Private
Lot7/DP232322	Private	Lot69/DP2234	Private
Lot2/DP851626	Private	Lot1/DP232322	Private
Lot97/DP27550	Private	Lot84/DP2234	Private
Lot20/DP258581	Private	Lot10/DP29081	Private
Lot19/DP258581	Private	Lot72/DP2234	Private
Lot71/DP2234	Private	Lot501/DP580982	Private
Lot11/DP29081	Private	Lot13/DP29081	Private
Lot3/DP202647	Private	Lot14/DP30775	Private
Lot6/DP232322	Private	Lot10/DP232322	Private
Lot2/DP32053	Private	Lot9/DP232322	Private
Lot22/DP843123	Private	Lot70/DP1091926	Private
Lot102/DP846962	Private	Lot1/DP517853	Private
Lot1/DP109697	Private	Lot79/DP1085461	Private
LotA/DP160890	Private	Lot1/DP1088989	Private
Lot2/DP29081	Private	Lot1/DP1169433	Private
Lot61/DP2234	Private	Lot1/DP224861	Private
Lot73/DP2234	Private	Lot113/DP1015911	Private
Lot100/DP2234	Private	Lot1/DP838361	The Commonwealth of Australia
Lot5/DP599382	Private	Lot13/DP30775	Private
Lot7/DP249113	Private	Lot1/DP238092	The Commonwealth of Australia
Lot10/DP249113	Private	Lot14/DP655312	Private
Lot11/DP249113	Private	Lot9/DP249113	Private

Lot8/DP249113	Private	Lot22/DP29081	Private
Lot1/DP711076	Private	Lot42/DP878814	Private
Lot121/DP870188	Private	Lot6/DP250684	Private
Lot1/DP200435	Private	Lot77/DP659462	Private
Lot103/DP846962	Private	Lot68/DP2234	Private
Lot101/DP846962	Private	Lot20/DP29081	Private
Lot1/DP250684	Private	Lot41/DP878814	Private
Lot8/DP29081	Private	Lot3/DP29081	Private
Lot4/DP29081	Private	Lot17/DP29081	Private
Lot96/DP2234	Private	Lot8/DP232322	Private
Lot12/DP249113	Private	Lot3/DP238092	The Commonwealth of Australia

1.7 Local Government Area and Council contact (if known)

The proposal corridor covers two LGAs consisting of:

- Liverpool City Council (generally to the south of Elizabeth Drive and Park Road, Luddenham)
- Penrith City Council (generally to the north of Elizabeth Drive, Luddenham).

The proposed action is not subject to local government planning approval and is being assessed under Part 5.1 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act).

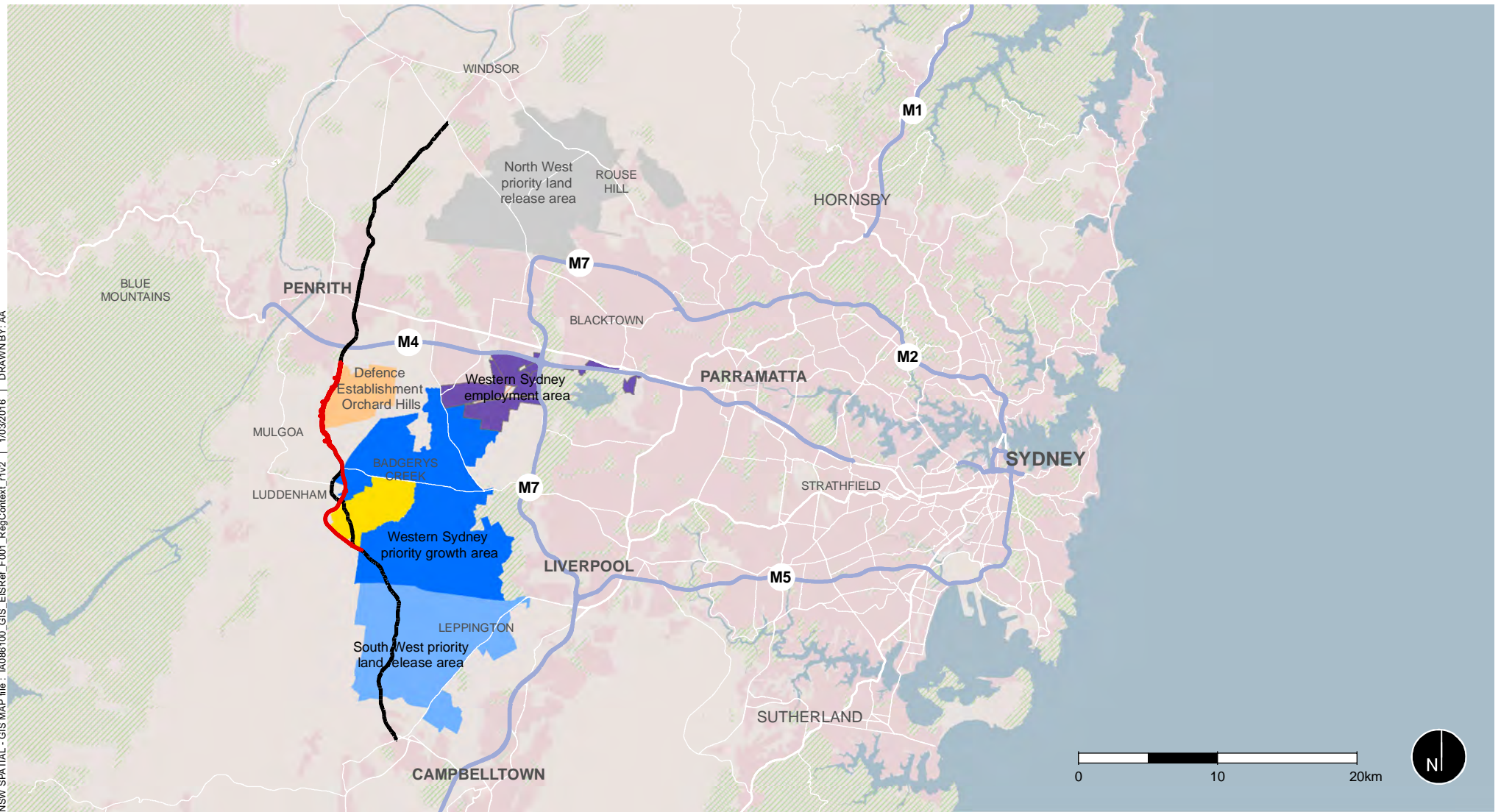
1.8 Time frame

The following are estimated project schedules and staging, subject to planning approval and when funding becomes available

Early / preliminary work – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park Mid 2017

Mersey Road to Littlefields Road	Littlefields Road to Glenmore Parkway
Main work – Late 2017	Main work – Mid 2018
Operation – End 2019	Operation – End 2020

1.9	Alternatives to proposed action		No
		X	Yes, see section 2.2
1.10	Alternative time frames etc	X	No
1.11	State assessment		No
		X	Yes, see Section 2.5
1.12	Component of larger action	X	No
1.13	Related actions/proposals		No
		X	Yes, see Section 2.7
1.14	Australian Government funding		No
		X	Yes. The proposed action would be 80 percent funded by the Australian government through the WSIP. The WSIP involves major road upgrades that will capitalise on the economic gains from developing an airport at Badgerys Creek whilst boosting the local economy and liveability of Western Sydney. The remainder of the funding for the proposed action would be from the NSW government.
1.15	Great Barrier Reef Marine Park	X	No

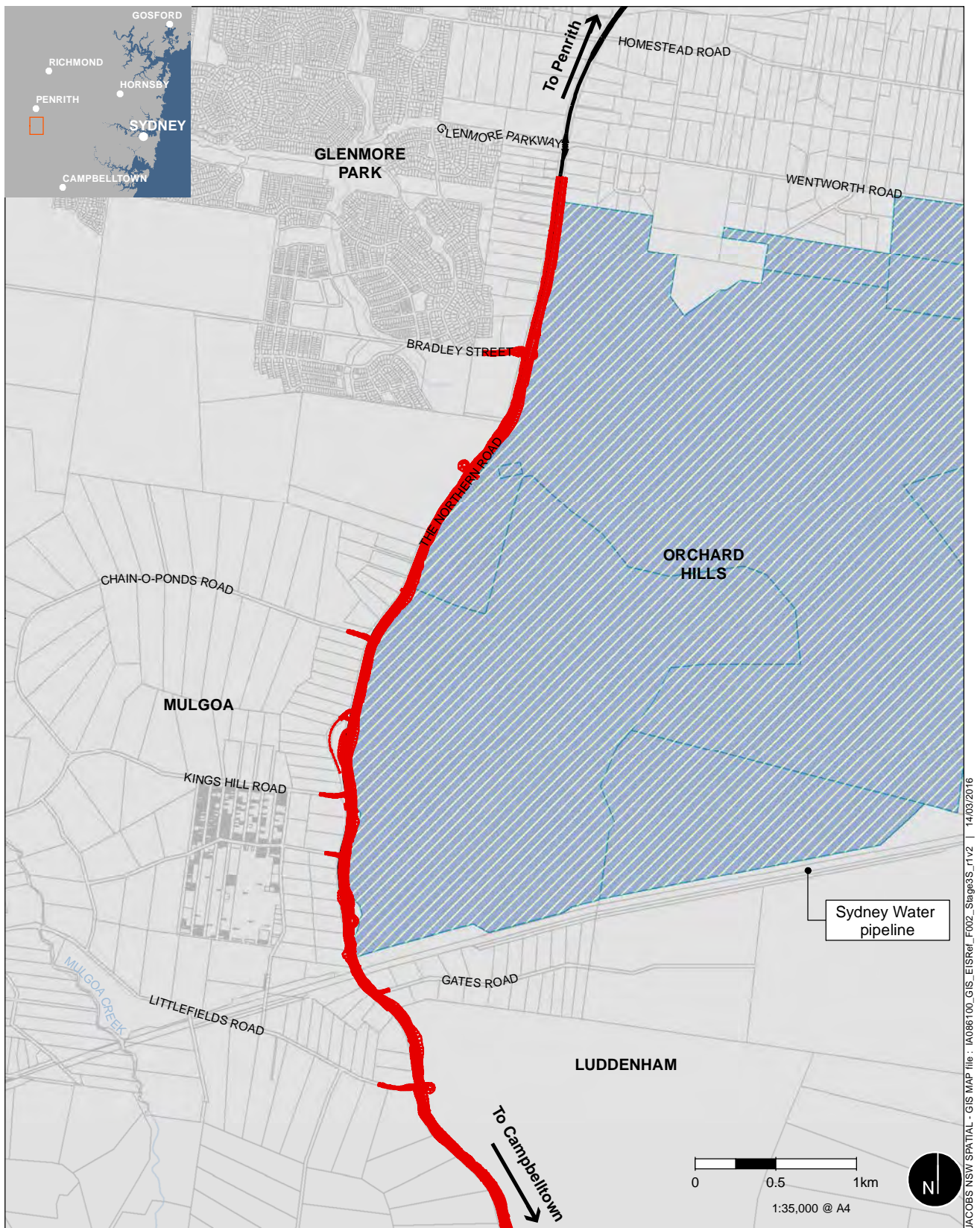


Legend

- The Northern Road
- The Northern Road upgrade - Mersey Road to Glenmore Parkway
- Proposed western Sydney airport
- Defence Establishment Orchard Hills
- Western Sydney employment area
- South West priority land release area
- Western Sydney priority growth area
- Reserves and parklands
- Growth centres
- Built areas

Figure 1-1 | Regional context of the project

The Northern Road upgrade - Mersey Road to Glenmore Parkway



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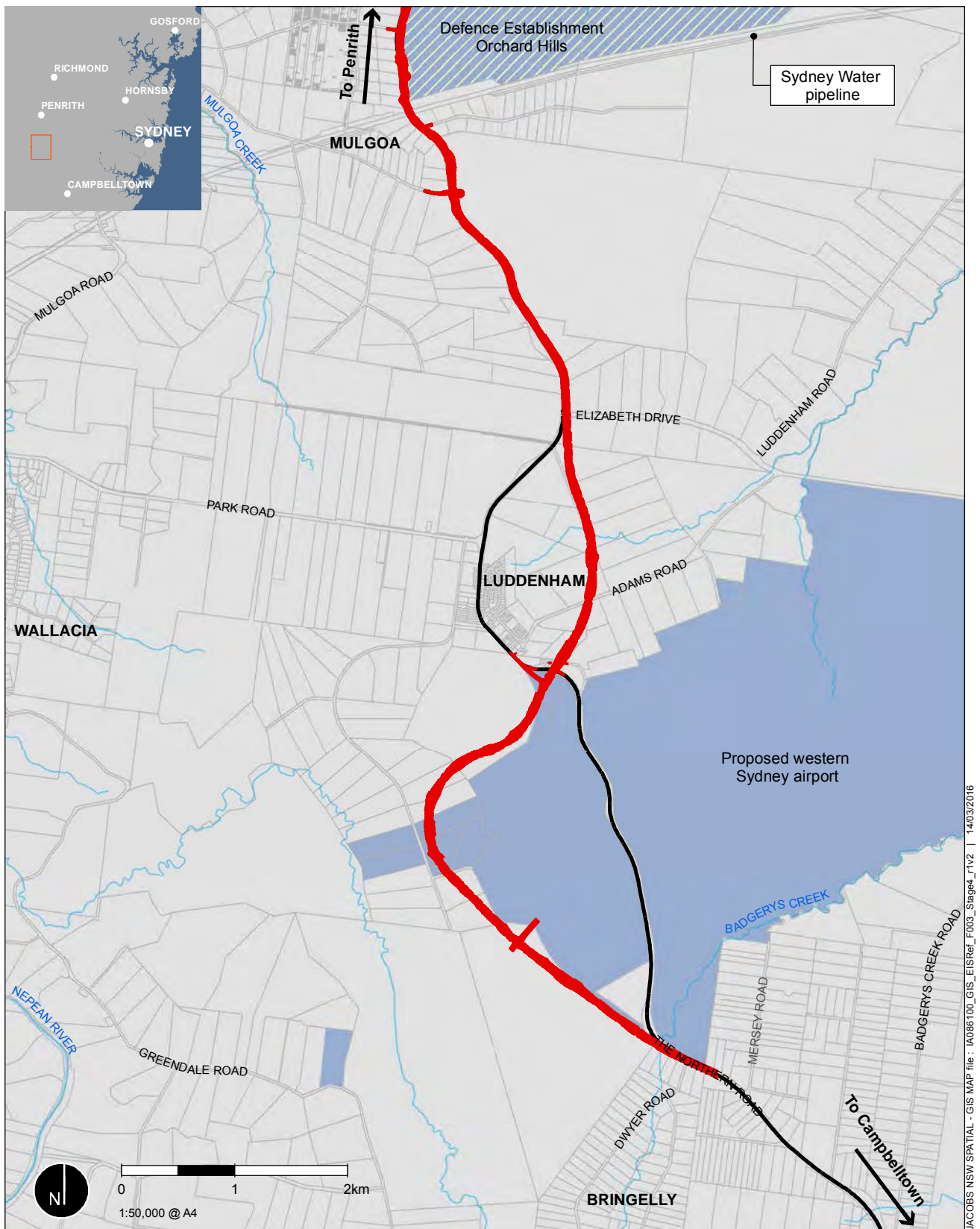
Legend

- The Northern Road upgrade
Glenmore Parkway to Mersey
Road (Proposal corridor)
- The Northern Road
- Defence Establishment Orchard
Hills
- Commonwealth lands

Data sources

Jacobs 2015
LPI 2015
RMS 2015

Figure 1-2 | The Northern Road upgrade Glenmore Parkway to Littlefields Road - Key features



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Legend

- The Northern Road upgrade
Glenmore Parkway to Mersey
Road (Proposal corridor)
- The Northern Road
- Commonwealth lands
- Defence Establishment Orchard
Hills

Figure 1-3 | The Northern Road upgrade Littlefields Road to Mersey Road – Key features

Data sources
Jacobs 2015
LPI 2015
RMS 2015

2 Detailed description of proposed action

2.1 Description of proposed action

The description of the proposed action is based on a concept design that incorporates flexibility for refinement during the environmental impact assessment process and to respond to any submissions made following public display of the environmental impact statement to minimise impacts. The incorporation of flexibility in the concept design also accounts for refinements that may occur during the detailed design stage.

The proposed action involves upgrading the 16 km section of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park. The proposed action comprises the following key features:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Orchard Hills (two general traffic lanes and a kerbside bus lane in each direction separated by a median)
- Provision for possible widening of the road (if required in the future) to eight lanes within the road corridor between Mersey Road and Bradley Street. Future widening would be allowed for into the median and would be subject to separate environmental planning approval
- An eight-lane divided road between Bradley Street, Orchard Hills to 100 m south of Glenmore Parkway (three general traffic lanes and a kerbside bus lane in each direction separated by a median)
- About eight kilometres of new road between Mersey Road and just south of Elizabeth Drive, Luddenham, to realign the section of The Northern Road that currently bisects the western Sydney airport site
- About eight kilometres of upgraded and widened road between Elizabeth Drive and 100 m south of Glenmore Parkway
- New intersections with traffic signals at:
 - The service vehicle access for the proposed western Sydney airport
 - The connection of the new The Northern Road with the existing The Northern Road south of Luddenham (west of the new alignment)
 - A new four way intersection formed from a realigned Elizabeth Drive and the existing The Northern Road north of Luddenham
 - The proposed M12 Motorway, Luddenham
- New traffic signals at existing intersections:
 - Littlefield Road, Luddenham
 - Kings Hill Road, Mulgoa
 - Chain-O-Ponds Road, Orchard Hills
 - Defence Establishment Orchard Hills
 - Bradley Street, Orchard Hills
- Modified intersection arrangements at
 - Dwyer Road, Bringelly (left in, left out only)
 - The connection of the new The Northern Road with the existing The Northern Road south of Luddenham (east of the new alignment, left in, left out only)
 - The connection of the new The Northern Road with the existing The Northern Road north of Luddenham
 - Gates Road, (left in, left out only)
 - Longview Road, Orchard Hills (left in, left out only)
 - Removal of Grover Crescent (south) intersection
 - Grover Crescent (north), Orchard Hills (right in, left in, left out)
- Dedicated U-turn facilities at:
 - On Mersey Road (provided as part of the Stage 2 upgrade project)
 - The service vehicle access for the proposed western Sydney airport
 - On the existing The Northern Road at Luddenham, south of Elizabeth Drive
 - Littlefields Road, Luddenham
 - The southbound heavy vehicle inspection bay (near Longview Road)
 - Grover Crescent (north), Orchard Hills
 - Defence Establishment Orchard Hills

- Bradley Street, Orchard Hills
- New bridges and underpasses at:
 - A bridge over the access road for the dairy farm north of Mersey Road, Bringelly
 - Duncans Creek, Bringelly
 - A bridge over Adams Road, Luddenham
- Local road changes and upgrades at:
 - Eaton Road, Luddenham (cul-de-sac east and west of The Northern Road.
 - New roundabout on Littlefields Road extension
 - Extension of Littlefield Road to Gates Road
 - Extension of Vineyard Road, Orchard Hills between Kings Hill Road and Longview Road
- A new shared-path on the western side of The Northern Road and a pedestrian path on the eastern side of The Northern Road
- Drainage infrastructure upgrades
- Operational ancillary facilities including
 - Heavy vehicle inspection bays for both northbound and southbound traffic, adjacent to Grover Crescent and Longview Road respectively
 - An incident response facility at the southbound heavy vehicle inspection bay
- New traffic control facilities including variable message signs (VMS)
- Roadside furniture and street lighting
- Utility services relocations
- Changes to property access along The Northern Road (generally left in, left out only)
- Establishment and use of temporary site compounds during construction.

2.2 Alternatives to taking the proposed action

Program objectives for the WSIP were developed in February 2015 by Roads and Maritime, Transport for NSW and the Australian Government. The four key focus areas for the WSIP and associated program objectives are as follows:

- Development and demand – support the proposed western Sydney airport, and land use change and residential growth; balancing functional, social, and environmental and value for money considerations
- Connectivity to airport – provide a resilient connection to the proposed western Sydney airport site for freight and people
- Integrated network – provide road improvements to support and integrate with the broader transport network
- Customer focus – provide meaningful engagement with customers and stakeholders throughout the program life.

Project specific objectives have been developed to complement the WSIP objectives. The objectives for the project were developed independently at workshops held by the project teams in February and May respectively and subsequently ratified by the Executive Steering Committee. The project specific objectives are:

- Improve road safety
- Improve transport connections from the south, including Campbelltown and the M31 Hume Motorway, to the proposed western Sydney airport and surrounding developments including the South West Priority Land Release Area and Western Sydney Priority Growth Area
- Improve the transport connections from the Penrith region and M4 Western Motorway to the proposed western Sydney airport and surrounding developments including the South West Priority Land Release Area and Western Sydney Priority Growth Area
- Improve the flow of traffic to provide reliable journeys
- Support public and active transport to promote sustainable and efficient journeys
- Support freight movement to efficiently address the growing freight task
- Realign The Northern Road around the proposed western Sydney airport site to allow building and facilitation of the proposed airport

The merits of the proposed action were considered in the context of a limited range of other potentially available alternatives. The alternatives considered are consistent with those considered for recent WSIP projects and broader Sydney region road projects. Alternatives to the proposed action were considered based on the extent to which they could meet the proposal objectives and criteria and how well they performed with reference to other transport, environmental, engineering, social and economic factors. The following alternatives to the proposed action were considered:

- Alternative 1 – the base case or do minimum (do minimum)
- Alternative 2 – the ‘full upgrade’ option
- Alternative 3 – investment only in public transport.

These alternatives to the proposed action are considered in the following sections.

Alternative 1 – the base case or do nothing / do minimum (do minimum)

The ‘do minimum’ alternative would only involve realigning the section of The Northern Road (one lane in each direction) that currently bisects the planned western Sydney airport site, and would not involve other work, such as widening the road corridor at any location between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park.

The ‘do minimum’ alternative would have the following disadvantages:

- It would not meet the WSIP project objectives. The project objectives set for WSIP are:
 - Development and demand – support the proposed western Sydney airport, and land use change and residential growth balancing functional, social, and environmental and value for money considerations
 - Connectivity to airport – provide a resilient connection to the western Sydney airport site for freight and people
 - Integrated network – provide road improvements to support and integrate with the broader transport network
 - Customer focus – provide meaningful engagement with customers and stakeholders throughout the program life.
- It would not meet The Northern Road Upgrade project objectives that complement the WSIP program objectives. These include:
 - Cater for future traffic demand to improve the flow of traffic to provide reliable journeys
 - Improve transport connections from the south, including Campbelltown and the M31 Hume Motorway, to the planned western Sydney airport and surrounding developments including the South West Priority Land Release Area and Western Sydney Priority Growth Area
 - Improve facilities for public and active transport to promote sustainable and efficient journeys.
- It would meet only some of The Northern Road Upgrade supporting project development criteria, including:
 - Minimise environmental impacts – it would have less environmental impacts than the preferred option, but the realignment of the section of The Northern Road that bisects the western Sydney airport site would result in some impacts on biodiversity, noise, Aboriginal heritage and other environmental aspects
 - Maintain arterial road function – it would maintain the arterial road function, but the current traffic performance of The Northern Road is poor, and would not be improved
 - Accommodate access to the south-western end of the airport – it would accommodate access to the south-western end of the planned western Sydney airport site
- It would not meet some of The Northern Road Upgrade supporting project development criteria including:
 - Deliver a cost-effective proposal – it would cost less than the preferred option but would not provide road capacity and safety benefits
 - Improve road safety – it would not improve road safety as the predicted increase in road users in the region would increase safety risks.

The 'do minimum' alternative would have the following advantages:

- It would be substantially cheaper than the preferred option
- It would avoid some of the impacts on biodiversity, noise, Aboriginal heritage, air quality, water quality and other environmental aspects

It would meet only some of The Northern Road Upgrade supporting project development criteria, including:

- Minimise environmental impacts – it would have less environmental impact, but realigning the section of The Northern Road that currently bisects the planned western Sydney airport site would result in some impacts on biodiversity, noise, Aboriginal heritage and other environmental aspects
- Maintain arterial road function – it would maintain the arterial road function, but the current traffic performance of The Northern Road is poor. Under forecast growth the traffic performance of The Northern Road will continue to degrade below acceptable levels for an arterial road
- Accommodate access to south-western end of the planned western Sydney airport – it would accommodate access to the south-western end of the airport site. However, the access capacity and use would be limited by the current poor traffic performance and capacity of The Northern Road.

In the context of the identified transport challenges facing Western Sydney, a 'do minimum' option is considered unrealistic and would not address key strategic goals for the WSIP and The Northern Road Corridor. The Do Minimum option would also fail to meet a number of WSIP and The Northern Road project objectives.

Alternative 2 – a full upgrade option

The 'full upgrade' of The Northern Road would include:

- Realigning the section of The Northern Road that bisects the planned western Sydney airport site to a location that allows for construction and operation of the planned western Sydney airport
- Providing an eight-lane divided road (three general traffic lanes and a kerbside bus lane in each direction) separated by a median (this would be a raised concrete median or a wide central grassed median subject to constraints) from Mersey Road, Bringelly to about 100 m south of Glenmore Parkway, Glenmore Park
- Upgrading intersections and associated traffic management infrastructure to improve safety and traffic performance
- Upgrading bus infrastructure including a bus lane in each direction and improved bus stops
- Providing new shared paths and footpaths to cater for pedestrians and cyclists
- Installing auxiliary infrastructure to support the operation of the project such as Intelligent Transport Systems (ITS) infrastructure, heavy vehicle inspection bays, incident response facilities, water quality control facilities and noise mitigation measures.

The full upgrade option is essentially the same as the proposed action, except that it would provide three general traffic lanes and a kerbside bus lane between Bradley Street and Mersey Road. The proposed action would transition from three general traffic lanes and a kerbside bus lane in each direction to two general traffic lanes and a kerbside bus lane per direction just south of Bradley Street.

The 'full upgrade' alternative would have the following disadvantages:

- It would be more expensive than the preferred option
- As it has a larger operational and construction footprint it would have marginally greater impacts on biodiversity, Aboriginal heritage, air quality and other environmental aspects than the preferred option
- It would have marginally greater construction amenity impacts including noise, air quality, traffic and visual impacts than the preferred option.

The 'full upgrade' alternative would have the following advantages:

- It would meet the WSIP project objectives, particularly to deliver new and upgraded roads to support integrated transport in the region and capitalise on the economic benefits from developing the planned western Sydney airport at Badgerys Creek.
- It would meet The Northern Road Upgrade project objectives that complement the WSIP program objectives.

It would meet some of The Northern Road Upgrade supporting project development criteria, including:

- Deliver a cost-effective proposal – it would cost more than the ‘do minimum’ alternative, but the investment would provide substantial road capacity and safety benefits
- Improve road safety – it would improve road safety because it would increase capacity and provide road safety measures such as separated carriageways, improved traffic control at intersections and ITS infrastructure to a similar extent to the proposal
- Maintain arterial road function – it would maintain and enhance the arterial road function
- Accommodate access to south-western end of the airport – it would accommodate high capacity access to the south-western end of the airport site.

Alternative 3 – Investment only in public transport

The Northern Road corridor is not served by rail-based public transport and bus services are currently limited with no dedicated bus facilities provided between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park.

As discussed in Chapter 3, the proposed action is consistent with a number of key NSW strategic planning policies including the Long Term Transport Master Plan (LTTMP) and the 2016 NSW State Priorities. As part of a broader integrated transport solution, the project supports a coordinated approach to the management of freight and passenger movements, as well as all modes of transport including road, rail, bus, cycling and walking. There is recognition that freight, commercial and services tasks require distribution of goods and services across Western Sydney, which relies on more diverse and dispersed point-to-point transport connections that can only be provided by the road network.

Investment in public transport options only would partially address customer demands. There are no feasible strategic transport alternatives such as heavy or light rail options or bus corridor enhancements that will meet the diverse range of customer needs for travel in this corridor and address the core proposal objectives as effectively as the proposed action. Notwithstanding, public transport alternatives and options would be complementary to the proposed action.

As part of the proposed action, dedicated bus lanes would be provided in each direction. This would allow high frequency and rapid bus services to be provided from Western Rail Line train stations such as Penrith. As a dedicated rail line to planned western Sydney airport is not proposed as part of the initial development of the airport, bus would be the primary mode of public transport to access the airport upon opening.

Investment in public transport infrastructure only would also not meet key WSIP and project objectives such as providing an integrated network of road improvements to support and integrate with the broader transport network, improving the flow of traffic to provide reliable journeys and improving road safety.

Route Options considered

The proposed action was divided into two key components to facilitate the development and assessment of route options. These components were:

- Widening of the existing The Northern Road between Glenmore Parkway, Glenmore Park and Littlefields Road, Orchard Hills - The road corridor in this section is limited by existing development and options considered for the upgrade were limited to widening the corridor either to the west or east
- Re-alignment of The Northern Road to bypass Luddenham and the planned western Sydney airport - as this section requires realigning to allow construction of the western Sydney airport, a comprehensive route development and assessment process was undertaken. Twelve potential route options were initially developed and these were shortlisted to four route options before selecting a preferred option.

Reference and concept design development has included the identification and evaluation of options for route alignment as summarised below.

Road widening – Glenmore Parkway, Glenmore Park to Littlefields Road, Orchard Hills

The proposed action between Glenmore Parkway and Littlefields Road, Orchard Hills would utilise the existing The Northern Road alignment, with widening generally to the east of the current road corridor. An options assessment was conducted through an Options and Scoping Value Management Workshop on 23 March 2015. The workshop, and subsequent investigations, determined the preference is to expand the road to the eastern side of the existing corridor for up to eight lanes.

Widening to the west was considered at the Scoping Value Management Workshop. Although widening to the west is feasible, it has a number of disadvantages when compared to the widening to the east. In particular, widening to the west would:

- Have a higher complexity, cost and construction impacts compared to widening to the east because most of the intersecting roads in this section of The Northern Road are from the west
- Involve substantially more private property acquisition than widening to the east. This would increase the cost of the proposal and may result in delays due to the need to acquire multiple properties
- Result in greater local community and stakeholder impacts because of the required acquisition of private property
- Have greater construction impacts on the local community, including traffic and access, noise and vibration, air and dust and other local amenity impacts
- Require more utility relocations than widening to the east because there are more utilities on the western side of the current alignment.

The main potential impact of widening to the east would be the need to acquire land from the Defence Establishment Orchard Hills. If this land were not made available, then widening to the west would be the only option. Discussions with the Commonwealth Department of Defence indicate that it is willing to provide the land for the project and the acquisition would not have an impact on the operations or security of the facility.

Realignment of The Northern Road to bypass Luddenham and the planned western Sydney airport

The existing alignment of the upgrade between Littlefields Road, Luddenham and Mersey Road, Bringelly crosses a substantial portion of the planned western Sydney airport site; therefore, Roads and Maritime have investigated alternative route options to bypass the planned western Sydney airport site and the township of Luddenham, while maintaining the north-south road corridor.

Key Roads and Maritime project team members developed a series of preliminary route options in workshops held in 2014 and early 2015. A further workshop was held in April 2015 to review environmental constraints and the preliminary route options identified in the previous workshops. Changes to the options were made with added options and/or sub-options, which led to a long-list of 12 options (see **Figure 2-1**).

The long-list options were shortlisted to four route alignment options during a strategic route options short-listing workshop in April 2015 (**Figure 2-2**). The four short-listed options were:

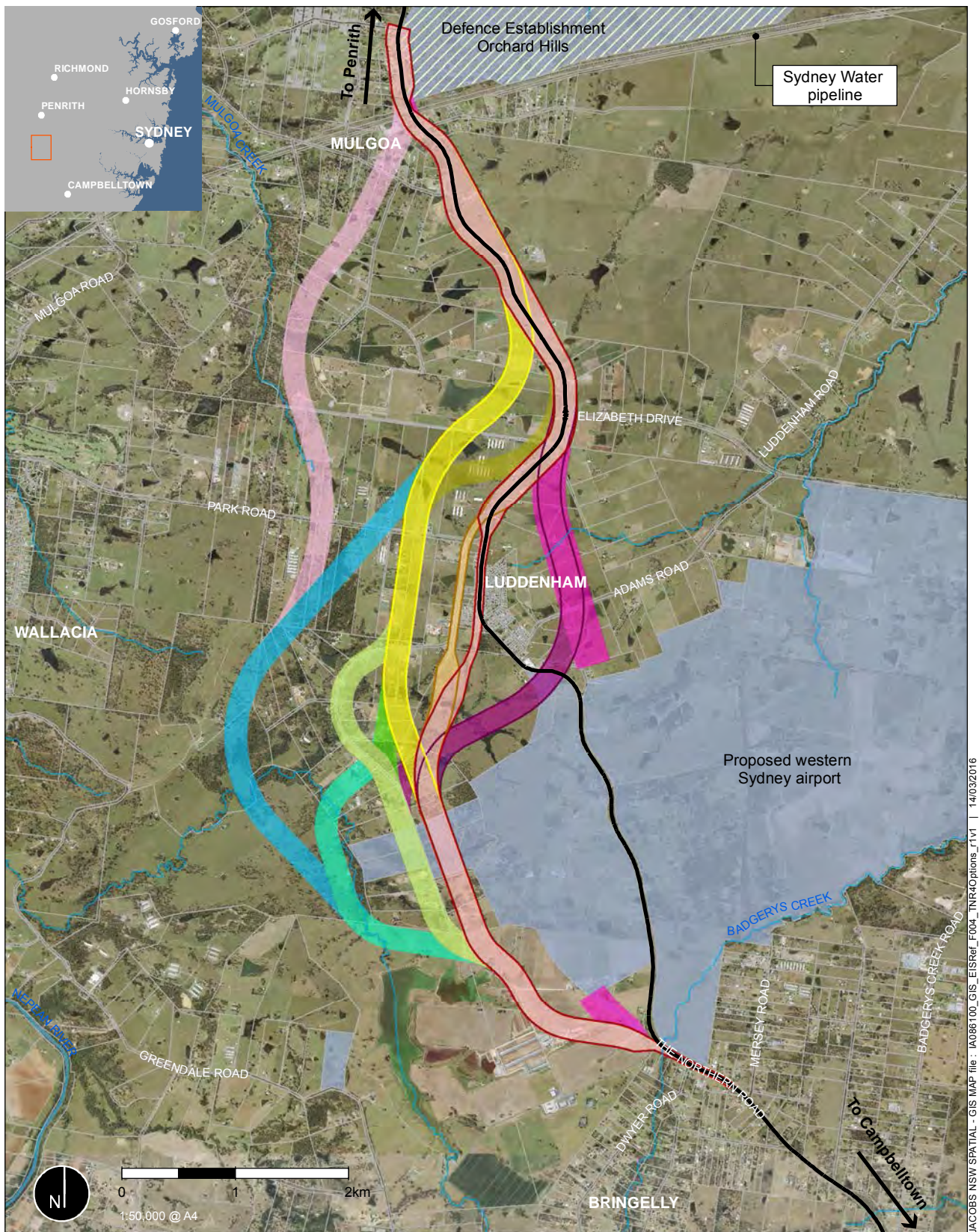
- **Town Centre** - This option follows the existing route of The Northern Road through part of Luddenham and would support a speed limit of 80 km/h with a reduction to 60 km/h through Luddenham. The central option would provide a connection with Elizabeth Drive and Park Road. A number of properties through the township would require complete or partial acquisition.
- **Campbell Street** - This option would adopt the Campbell Street corridor through Luddenham to the west of The Northern Road. This option generally supports a speed limit of 80 km/h with a reduction to 60 km/h through Luddenham and 40 km/h through a school zone for the Holy Family Catholic School at the corner of Campbell Street and Willowdene Avenue. This option retains the existing connection with Elizabeth Drive
- **West Luddenham** - Located approximately 600 m the west of the existing The Northern Road at Luddenham, this option provided a bypass of Luddenham and would support a speed limit of 80 km/h. This option impacts land that is currently used for rural residential or agricultural purposes. This option would require a new or altered connection to Elizabeth Drive
- **East Luddenham** - This option crosses The Northern Road close to the planned western Sydney airport boundary, south of Luddenham. The route passes about 300-600m from residents on the eastern side of Luddenham. This option would support a speed limit of 80 km/h. It has a connection with Elizabeth Drive.

These options were displayed to the community in July and August 2015 to:

- Raise awareness of the proposed action and invite comments on the options
- Engage with key stakeholders and affected local communities early in the planning process, so issues raised would help inform the concept design
- Allow face to face dialogue between community members and the proposal team
- Engage early with property owners about the potential need for property acquisition for the construction and operation of the bypass.

Field investigations were commenced in July 2015. Economic analysis, further design work and costing commenced in May 2015. A preferred option workshop was conducted in September 2015, which assessed the four options and the community feedback. The preferred options workshop involved a range of stakeholders from Roads and Maritime, as well as Australian and other NSW State government agencies, Penrith Council and Liverpool Council.

The eastern option was selected as the preferred option as it was deemed to best meet the WSIP and project objectives. The subsequent report provides details of the selection process for the preferred route – <http://www.rms.nsw.gov.au/documents/projects/sydney-west/infrastructure-plan/wsipcommunity-consultation-report-1510.pdf>.



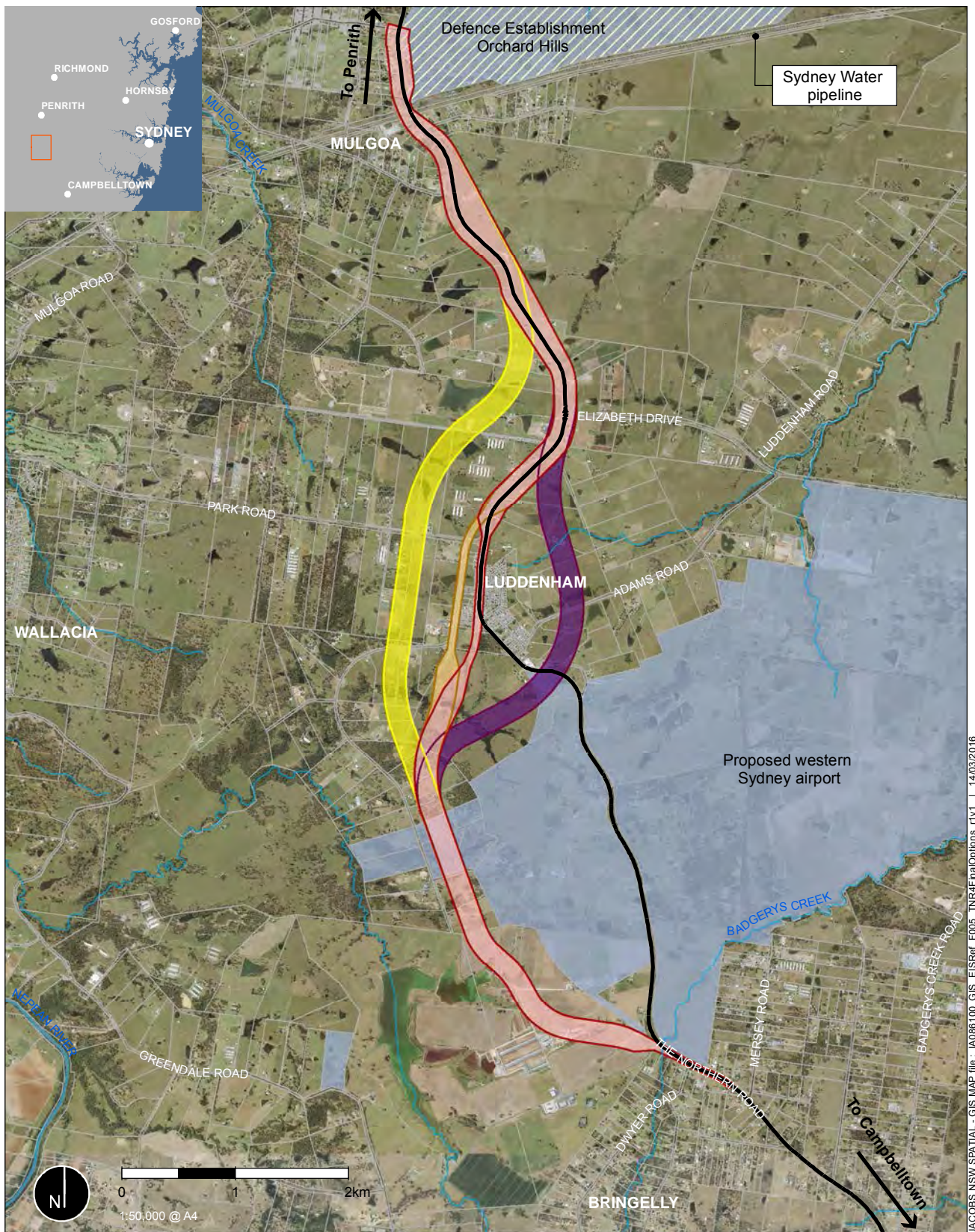
JACOBS NSW SPATIAL - GIS MAP file : JA086100_GIS_EISRef_F004_TNROptions_r1v1 | 14/03/2016

Legend

- | | | | |
|-------------------------------------|--------------------------------|-----------|----------------------------|
| The Northern Road | Option 1A (Central option) | Option 4A | Option 8A |
| Commonwealth lands | Option 2A (Campbell St option) | Option 4B | Option 9A |
| Defence Establishment Orchard Hills | Option 3A (Western option) | Option 5A | Option 9B (Eastern option) |
| | Option 3B | Option 6A | |
| | | Option 7A | |

Data sources
 Jacobs 2015
 LPI 2015
 RMS 2015

Figure 2-1 | The Northern Road upgrade Littlefields Road to Mersey Road – Long listed route options



JACOBS NSW SPATIAL - GIS MAP file: JA086100_GIS_EISRef_F005_TNR4FmaOptions_r1v1 | 14/03/2016

Legend

- The Northern Road
- Commonwealth lands
- Defence Establishment Orchard Hills
- Option 1A (Central option)
- Option 2A (Campbell St option)
- Option 3A (Western option)
- Option 9B (Eastern option)

Data sources
 Jacobs 2015
 LPI 2015
 RMS 2015

Figure 2-2 | The Northern Road upgrade Littlefields Road to Mersey Road – Short listed route options

2.3 Alternative locations, time frames or activities that form part of the referred action

No alternatives, timeframes or locations are proposed.

2.4 Context, planning framework and state/local government requirements

This proposed action is part of an overall initiative to upgrade The Northern Road in four stages, as described in **Table 2-1** Stages of The Northern Road upgrade.

On 30 June 2015, a State Significant Infrastructure Application (SSI) was lodged to the NSW Department of Planning and Environment (DPE) under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Roads and Maritime formed the opinion that approval under Part 5.1 of the EP&A Act was required due to the application of paragraph 1, Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011, as potential environmental impacts, particularly regarding biodiversity and heritage matters in the 'green-field' areas of the proposal, were considered to be likely to have a significant effect on the environment, thus requiring an environmental impact statement (EIS).

At the time, the SSI included a section of The Northern Road Corridor (Stage 3) between Glenmore Parkway, Glenmore Park and Jamison Road Penrith. On 28 July 2015, the NSW Department of Planning & Environment (DPE) issued Secretary's environmental assessment requirements (SEARs).

Since lodging the original SSI application, Roads and Maritime reviewed the delivery model and planning pathway for the proposal and have identified that The Northern Road upgrade between Glenmore Parkway, Glenmore Park and Jamison Road, Penrith can be assessed and delivered as a separate, stand-alone activity. This is because it is an operable project needed to relieve current traffic congestion, particularly at Glenmore Parkway and the M4 interchange. It would provide these benefits independent of the delivery of the rest of The Northern Road upgrade from Mersey Road to Glenmore Parkway (the proposed action). Furthermore, having regard to the environmental studies undertaken to date, Roads and Maritime is of the opinion that The Northern Road upgrade between Glenmore Parkway, Glenmore Park and Jamison Road, Penrith is not likely to have a significant impact on the environment and, therefore, can be assessed under Part 5 of the EP&A Act through preparation of a review of environmental factors.

As a result, on 22 February 2016 Roads and Maritime requested DP&E to amend the SSI application so that it applies to The Northern Road upgrade from Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park.

The NSW Assessment Bilateral Agreement with the Australian Government allows the Commonwealth Minister for the Environment to rely on specified State based environmental impact assessment processes in assessing actions under the EPBC Act. Discussions with the Commonwealth Department of Environment (DoE) in December 2015, indicated that if part of the project located on Commonwealth land (in this case, the Defence Establishment Orchard Hills) is likely to have a significant impact on matters of NES, and it is determined by the Commonwealth to be a controlled action, the NSW Assessment Bilateral Agreement would not apply.

Should the Commonwealth make the determination that the proposal is a controlled action but the NSW Assessment Bilateral Agreement does not apply, Roads and Maritime would seek that the action be assessed under a NSW assessment process (Part 5.1) as an accredited assessment (case by case). This would provide a single integrated environmental impact assessment document and contribute to strengthening intergovernmental cooperation on the environment and minimising costs, while maintaining high environmental standards.

Other legislation

A number of approvals are not required for a project approved under Part 5.1 of the EP&A Act (EP&A Act s.115ZG). Those approvals not required for the project are:

- Permits under sections 201, 205 and 219 of the *Fisheries Management Act 1994*
- Approvals under Part 4 and excavation permits under section 139 of the *Heritage Act 1977*
- Aboriginal heritage permits under section 90 of the *National Parks and Wildlife Act 1974*
- Authorisations under the *Native Vegetation Act 2003* to clear native vegetation or State protected land

- Various approvals under the *Water Management Act 2000*, including water use approvals under section 89, water management work approvals under section 90, and activity approvals (other than aquifer interference approvals) under section 91.

Approvals under other NSW legislation that may apply to the project include:

- An environmental protection licence for road construction under chapter 3 of the *Protection of the Environment Operations Act 1997*. In accordance with section 115ZH of the EP&A Act, such a licence cannot be refused for an approved project and is to be substantially consistent with the Part 5.1 approval
- An approval under the *Water Act 1912* should access to ground or surface water be required during construction
- An approval under the *Crown Lands Act 1989* to grant a relevant interest (ie licence, permit, easement or right of way) over a Crown Reserve.

Other legislation that may apply to the project includes:

- *Land Acquisition (Just Terms Compensation) Act 1991* – applies to the acquisition of any land required for the project
- *Contaminated Land Management Act 1997* – outlines the circumstances in which notification of the (NSW) Environmental Protection Authority (EPA) is required in relation to the contamination of land
- *Crown Lands Act 1989* – applies to the acquisition of land reserved under this Act.

The project may be declared as critical State significant infrastructure, therefore sections 115ZG(2) and 115ZG(3) of the EP&A Act may preclude the following directions, orders or notices being made to prevent or interfere with the carrying out of the project once approved:

- An order restricting harm to buildings, works, relics or places that are not the subject of an interim heritage order or listing in the State Heritage Register under Division 8 of Part 6 of the *Heritage Act 1977* (NSW)
- An interim protection order (within the meaning of the *National Parks and Wildlife Act 1974* (NSW) or the *Threatened Species Conservation Act 1995* (NSW))
- An order under Division 1 (Stop work orders) of Part 6A of the *National Parks and Wildlife Act 1974* (NSW), Division 1 (Stop work orders) of Part 7 of the *Threatened Species Conservation Act 1995* (NSW) or Division 7 (Stop work orders) of Part 7A of the *Fisheries Management Act 1994* (NSW)
- A remediation direction under Division 3 of Part 6A of the *National Parks and Wildlife Act 1974* (NSW)
- An environment protection notice under Chapter 4 of the *Protection of the Environment Operations Act 1997* (NSW)
- An order under section 124 of the *Local Government Act 1993* (NSW).

Certain third party appeal provisions are also precluded (refer to section 115ZK of the EP&A Act).

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

Roads and Maritime, has formed the opinion that the proposed action would require an EIS under Part 5.1 of the NSW EP&A Act (see Section 2.4).

An EIS and supporting specialist reports are currently being prepared in accordance with NSW SEARS (see **Attachment D**) for the proposed action. The EIS is expected to be on public exhibition in late-2016. Subject to the outcome of this referral it would also address any necessary requirements of the Commonwealth. Some of the specialist studies to support the EIS have commenced and where relevant information is available, these have been included.

In addition to the EIS, the proposed action has also been subject to the following investigations:

- *Western Sydney Infrastructure Plan – The Northern Road Upgrade Preliminary Environmental Investigation* (Roads and Maritime, 2015)
- *Western Sydney Infrastructure Plan - The Northern Road Upgrade Jamison Road, Penrith to Mersey Road, Bringelly (Stages 3 and 4) - State Significant Infrastructure Application report* (Roads and Maritime, 2015)

- *Western Sydney Infrastructure Plan - The Northern Road Upgrade Glenmore Parkway, Glenmore Park to Mersey Road, Bringelly – Amended State Significant Infrastructure Application report (Roads and Maritime, 2016)*
- The Northern Road Stage 3 and Stage 4 options assessment reports as identified in section 2.3 of this application.

2.6 Public consultation (including with Indigenous stakeholders)

Roads and Maritime undertook an extensive community consultation program for the proposed action and other WSIP proposals. The purpose of community consultation was to:

- Inform community members and stakeholders about the preliminary investigations that were carried out and how the options were developed to meet the proposal objectives
- Seek comments, feedback, ideas and suggestions from the community to be considered before developing a concept design of the preferred options
- Build a database of community members and stakeholders for Roads and Maritime to engage with during development of the proposed action.

In July and August 2015, Roads and Maritime carried out consultation for four WSIP projects, including the preliminary design and access strategy for The Northern Road Upgrade Stage 3 (which, at the time included a section of the proposed action between Glenmore Parkway and Littlefields Road) and route options for The Northern Road Upgrade Stage 4 (including the area of the proposed action bypassing Luddenham and the western Sydney airport).

Consultation activity was extensive and included a community update newsletter issued to all properties within the project areas, a postcard issued to 47,000 homes, door knocking all potentially directly impacted property owners, six community information sessions, a media release, newspaper advertisements, emails, SMS, establishing a project webpage, delivering an interactive online portal including videos and animations, electronic variable message signs, static poster displays, stakeholder meetings and one to one meetings. This consultation period allowed Roads and Maritime to build accurate stakeholder databases for the projects. As part of the consultation period, the WSIP team delivered a number of events to give the community a chance to hear more about the projects, meet the project team and have their say. Details of these information sessions are below:

- Wednesday 22 July, 4pm – 8pm, Penrith Anglican College Gymnasium, 338-356 Wentworth Road, Orchard Hills
- Saturday 25 July, 12pm – 3pm, Bringelly Community Centre, 5 Greendale Road, Bringelly
- Wednesday 29 July, 3pm – 7pm, Holy Family Primary School Hall, Lot 32 Willowdene Avenue, Luddenham
- Saturday 1 August, 11am – 2pm, Glenmore Park Youth and Community Centre, Luttrell Street (off Town Terrace), Glenmore Park
- Thursday 6 August, 3pm – 7pm, Kemps Creek Public School Hall, 100 Cross Street, Kemps Creek
- Saturday 8 August, 12pm – 3pm, Holy Family Primary School Hall, Lot 32 Willowdene Avenue, Luddenham.

As a result of the consultation process, a total of 296 submissions were received regarding the WSIP projects. About 140 submissions were received on the planned western Sydney airport bypass options relevant to the proposed action.

Key issues raised by the community during consultation included:

- Property (acquisition, value and access)
- Noise and air quality (impacts and mitigation)
- Traffic impacts and management (noise and congestion)
- Design recommendations (access and intersection locations)
- Proposed route options.

The community also provided feedback about environmental impacts and mitigation, access to the M4 Western Motorway, cycling access and facilities, construction impacts, consultation processes, economic impacts on local businesses, utilities, heritage, land use, pedestrian access and public transport.

The *Western Sydney Infrastructure Plan Community Consultation Report* (Roads and Maritime, October 2015) summarises the consultation undertaken to support development of several WSIP projects including The Northern Road Upgrade Stages 3 and 4. The Community Consultation Report is a publicly available document and can be found on the Roads and Maritime website at the following link <http://www.rms.nsw.gov.au/documents/projects/sydney-west/infrastructure-plan/wsip-community-consultation-report-1510.pdf>.

The consultation summary section of the report responds to the issues raised during the consultation period. Issues highlighted by stakeholders and the community will be appropriately considered throughout the planning and implementation of the proposed action.

Consultation activities have continued during preparation of the EIS, including but not limited to the following:

- Project information line (ongoing) - A 1800 number has been established to receive calls about the proposed action and respond to community questions and concerns about the proposed action
- Project website (ongoing) - Project information including a short animation is available on the project website www.rms.nsw.gov.au/wsip
- Information sessions – Further community information sessions are planned. The Roads and Maritime project team will be available to answer questions and receive feedback on the proposed action
- Meetings and briefings (October 2015 – August 2016) - Meetings and briefings will be held with key government agencies, local councils and industry stakeholders to explain specific details of the proposed action and gather feedback. Opportunities for meetings and briefings with stakeholders will continue throughout the life of the project.

As part of the initial investigations, Aboriginal heritage assessments have commenced. This has included consultation and field work with the relevant Local Aboriginal Land Councils (LALCs). Further consultation with Aboriginal stakeholders is planned based around Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) and the SEARs issued for the proposed action (**Attachment D**)

The Roads and Maritime PACHCI procedure outlines a four stage process for investigating potential impacts to Aboriginal cultural heritage as a result of road planning, development, construction and maintenance activities. It includes a process of community consultation that aims to ensure that the role, function and views of Aboriginal people are considered. The process for Aboriginal stakeholder consultation is further described in OEH's *Aboriginal cultural heritage consultation requirements for proponents 2010*.

2.7 A staged development or component of a larger project

The Australian and NSW governments are planning to upgrade The Northern Road as part of the WSIP to improve safety, reduce congestion and improve travel times now and into the future. The WSIP is a package of major road infrastructure upgrades funded by the Australian and NSW governments to enable the development of the planned western Sydney airport, employment zones such as WSPGA and growth centres such as SWPLRA. Also a 7 km section of The Northern Road currently bisects the planned western Sydney airport site and requires relocation around the airport site to allow the construction of the runways and other airport facilities.

The Northern Road Upgrade, about 35 km in length, from The Old Northern Road, Narellan to Jamison Road, Penrith, is being planned in four stages. It will cater for future traffic from planned residential and commercial developments in time for a western Sydney airport opening in the mid-2020s. Timing for exhibition, construction and opening of the four stages is outlined in **Table 2-1**.

Table 2-1 Stages of The Northern Road Upgrade

The Northern Road upgrade stage	Location/length	Project status
Stage 1	Camden Valley Way, Narellan, to Peter Brock Drive, Oran Park (3.3 km)	Construction commenced in January 2016
Stage 2 (2a, 2b and 2c)	Peter Brock Drive, Oran Park, to Mersey Road, Bringelly (10 km)	<p>The detailed design for stages 2a and 2c is progressing and is expected to be completed by early 2016</p> <p>The environmental assessment for stage 2b is expected to be finalised shortly. The detailed design is progressing and expected to be completed in mid-2016. Construction is expected to start in early 2017 and open to traffic in late 2019</p>
Stage 3	Jamison Road, Penrith to Glenmore Parkway, Orchard Hills (4 km)	The concept design and review of environmental factors will be displayed for public comment in mid-late 2016. Construction is expected to start in late 2017 and open to traffic in late 2019
Stages 4-6 (Mersey Road to Glenmore Parkway) (the proposed action)	Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park (16 km)	The proposed action – subject of this referral

The naming of these project stages may change as the delivery strategies are developed further.

The EIS for The Northern Road Upgrade - Mersey Road to Glenmore Parkway will be displayed for public comment in late 2016. Pending planning approval, it is planned to start construction in late 2017 and be open to traffic in late 2019.

The proposed action is a stand-alone project and is not dependent on the completion of the upgrade of other sections of The Northern Road or on other WSIP projects. It would be viable in its own right regardless of the completion of those other separate projects. The proposed action can be constructed independently of other The Northern Road upgrades and WSIP projects and is subject to a separate NSW assessment and approval process.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

Information provided in the following sections has generally been sourced from a search of the Protected Matters Search Tool (PMST), (Department of Environment, November 2015). A ten kilometre buffer was used along the centre of the proposed alignment.

3.1 (a) World Heritage Properties

Description

There is one World Heritage Property located within 10 km of the proposal (DoE 2015, **Attachment C**).

At its nearest point the Greater Blue Mountains Area is located about six kilometres west of the proposed action.

Nature and extent of likely impact

The proposed action will not result in any direct or indirect impacts on World Heritage Properties.

3.1 (b) National Heritage Places

Description

There is one World Heritage Property located within 10 km of the proposal (DoE 2015, **Attachment C**).

At its nearest point the Greater Blue Mountains Area is located about six kilometres west of the proposed action.

Nature and extent of likely impact

The proposed action will not result in any direct or indirect impacts on National Heritage Places.

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

Description

There are no Wetlands of International Importance (declared Ramsar wetlands) located within 10 km of the proposed action (DoE 2015, **Attachment C**).

Nature and extent of likely impact

The proposed action will not result in any direct or indirect impacts on Wetlands of International Importance (declared Ramsar wetlands).

3.1 (d) Listed threatened species and ecological communities

Description

A Biodiversity Assessment Report and Biodiversity Offset Strategy is being prepared for the proposed action in accordance with the NSW Offsets Policy for Major Projects (OEH 2014a) and *Framework for Biodiversity Assessment* (FBA) (OEH 2014b), the Commonwealth MNES Significant Impact Guidelines 1.1 EPBC Act (DoE 2013) and applicable Commonwealth threatened species survey guidelines. The methodology and results of the assessment as they relate to EPBC Act listed threatened species and ecological communities are provided here.

As part of the Biodiversity Assessment, a review of existing information and government maintained databases was undertaken as the first stage of the investigation. Where applicable, a 10 kilometre radius was used when searching databases. The following information was reviewed:

- The Protected Matters Search Tool (PMST) provided under the EPBC Act (Accessed November 2015)
- Atlas of NSW Wildlife, maintained by the NSW Office of Environment and Heritage
- BioBanking credit calculator and associated Threatened Species Profile Database
- NSW Vegetation Information System (VIS)
- Available vegetation mapping including the *Native Vegetation of Southeast NSW: A Revised Classification and Map for the Coast and Eastern Tablelands* (Tozer et al. 2006) and the *Native Vegetation of the Cumberland Plain, Western Sydney: systematic classification and field identification of communities* (Tozer 2003).

Field surveys were undertaken within the study area from 2 September 2015 to 4 February 2016. For the purposes of this referral, the study area used for calculating potential impacts to EPBC Act listed threatened species and ecological communities was defined as a 90 m buffer from the centre line of the road design (180 m corridor), and represents a worst case scenario that has scope to be reduced at the detailed design stage. The study area is a larger footprint than the proposal corridor used throughout this Referral. The Study area used for the ecological surveys is shown on **Figure 3-1a** and **Figure 3-1b**.

The field surveys involved detailed floristic surveys in accordance with the methodology outlined in Stage 1 of the FBA. Native vegetation extent within the study area was first mapped and verified in the field during the survey. Native vegetation was stratified into Plant Community Types (PCTs). A plot-based full floristic survey was undertaken (using 400 m² plots nested within a larger 1,000 m² plot with a central 50 m transect) that was stratified and targeted to assess the variation in the vegetation (variability assigned as vegetation zones). Any threatened ecological communities associated with a PCT were identified. Within each plot/transect the following information was recorded:

- native plant species richness (including cover and abundance)
- native over-storey cover %
- native mid-storey cover %
- native ground cover (grasses) %
- native ground cover (shrubs) %
- native ground cover (other) %
- exotic plant cover
- number of trees with hollows
- proportion of over-storey species occurring as regeneration
- total length of fallen logs.

Habitat assessments were undertaken for all identified candidate threatened species.

Targeted threatened flora surveys

Targeted surveys were completed for all identified candidate flora species with suitable habitat. The targeted flora surveys followed the methods described in the *Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft 2004* (Department of Environment and Conservation 2004). The survey timing adhered to the months detailed in the BioBanking Credit Calculator for each candidate flora species. For cryptic species with a potential habitat present (i.e. *Pimelea spicata*), the field survey included visiting reference populations to ensure visibility in the study area during the survey period. The targeted flora surveys were completed prior to the release of the NSW Guide to Surveying Threatened Plants (Office of Environment and Heritage 2016). However, a systematic approach was taken to the survey including targeting the species at the optimal time of year, identifying potential habitats, then undertaking a survey using parallel field traverses.

Targeted terrestrial fauna surveys

Targeted surveys were completed for all identified threatened fauna species that had suitable habitat in the study area. The targeted fauna surveys adhered to the methods described in the *Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities – Working Draft 2004* (Department of Environment and Conservation 2004) and the following guidelines:

- *Threatened species survey and assessment guidelines: field survey methods for fauna: Amphibians* (Department of Environment and Climate Change 2009)
- *Survey Guidelines for Australia's Threatened Frogs - guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment Water Heritage and the Arts 2010a)
- *Survey guidelines for Australia's threatened bats - Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment Water Heritage and the Arts 2010b)
- *Survey guidelines for Australia's threatened mammals - Guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment Water Heritage and the Arts 2011)
- *Survey guidelines for Australia's threatened birds - Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of Environment Water Heritage and the Arts 2010c).

The nationally listed threatened species identified from the background review and field surveys were considered in terms of their likelihood to occur in the habitats present within the study area based on their identified habitat requirements. The likelihood of occurrence was classified according to the criteria described **Table 3-1**. The presence of all potentially occurring threatened species were targeted during the surveys with particular emphasis on those species with a high or moderate likelihood of occurrence. Species with a high or moderate likelihood of occurrence were subject to assessments of significance under the EPBC Act.

Table 3-1 Likelihood of occurrence includes one or more of the following criteria

Likelihood of Occurrence	Criteria
Unlikely	<ul style="list-style-type: none"> • Species highly restricted to certain geographical areas not within the proposed action footprint. • Specific habitat requirements are not present in the study area.
Low	<ul style="list-style-type: none"> • Species not recorded during field surveys and fit one or more of the following criteria: • Have not been recorded previously in the study area/surrounds and for which the study area is beyond the current distribution range. • Use specific habitats or resources not present in the study area. • Are a non-cryptic perennial flora species that were specifically targeted by surveys and were not recorded.
Moderate	<ul style="list-style-type: none"> • Species not recorded during the field surveys that fit one or more of the following criteria: • Have infrequently been recorded previously in the study area/surrounds. • Use specific habitats or resources present in the study area but in a poor or modified condition. • Are unlikely to maintain sedentary populations, however may seasonally use resources within the study area opportunistically or during migration. • Are cryptic flowering flora species that were not seasonally targeted by surveys and were not recorded.
High	<ul style="list-style-type: none"> • Species recorded during the field surveys or species not recorded that fit one or more of the following criteria: • Have frequently been recorded previously in the study area/surrounds. • Use habitat types or resources that are present in the study area that are in abundance and/or in good condition within the study area. • Are known or likely to maintain resident populations surrounding the study area. • Are known or likely to visit the site during regular seasonal movements or migration.

The listed threatened species and ecological communities that were recorded or may occur are summarised below.

Threatened ecological communities

Eight listed threatened ecological communities (TECs) were identified during desktop searches and include the following:

- Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion (endangered)
- Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (critically endangered)
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (critically endangered)
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion (critically endangered)
- Temperate Highland Peat Swamps on Sandstone (endangered)
- Turpentine-Ironbark Forest in the Sydney Basin Bioregion (critically endangered)
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (endangered)
- Western Sydney Dry Rainforest and Moist Woodland on Shale (critically endangered).

Of these eight listed TECs, only the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (referred to herein as the TEC) is known to occur within the study area. This TEC was positively identified within the study area during the field surveys completed for the Biodiversity Assessment. None of the remaining TECs are present within the study area. Two Plant Community Types (PCTs) representative of the TEC are present in the study area including:

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCTID 849)
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCTID 850).

Detailed floristic plots were undertaken within the patches of PCT 849 and PCT 850 within the study area to determine vegetation quality. These two PCTs were found to be present in varying levels of condition. The condition of patches was assessed according to the criteria provided in the *Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* (Threatened Species Scientific Committee 2008) (see **Table 3-2**). Only the highest quality patches of these two PCTs are considered to be consistent with the EPBC Act listing.

Table 3-2 Condition thresholds for patches that meet the description for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Category and rationale	Thresholds
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW	Minimum patch size is ≥ 0.5 ha AND ≥ 50 percent of the perennial understorey vegetation cover is made up of native species
OR	
B. larger patches which are inherently valuable due to their rarity	The patch size is ≥ 5 ha AND ≥ 30 percent of the perennial understorey vegetation cover is made up of native species
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape	The patch size is ≥ 0.5 ha; AND ≥ 30 percent of the perennial understorey vegetation cover is made up of native species; AND The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥ 5 ha in area
OR	

D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain	<p>The patch size is ≥ 0.5 ha in size;</p> <p>AND</p> <p>≥ 30 percent of the perennial understorey vegetation cover is made up of native species;</p> <p>AND</p> <p>The patch has at least one tree with hollows per hectare or at least one large tree (≥ 80 cm dbh) per hectare from the upper tree layer outlined from the community description.</p>
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In accordance with the condition criteria in **Table 3-2**, two categories of the TEC are present within the study area:

- Category A - core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW
- Category C - patches with connectivity to other large native vegetation remnants in the landscape (this category also includes areas of Derived Native Grasslands where the grasslands are contiguous with the TEC).

Within the study area, the patches of Category A TEC (patches that meet the core thresholds) are located in two main areas: the southern portion of the Defence Establishment Orchard Hills and on private properties along Willowdene Avenue (see **Figure 3.1a**).

There is part of one larger patch (>5 hectares in size) within the study area which is on private property off Willowdene Avenue. An additional Category B large patch is present outside of the study area along Willowdene Avenue but will not be impacted by the proposed action (see **Figure 3.1a**).

The Category C patches are lower condition patches of the TEC and Derived Native Grasslands that are contiguous with Category A patches. These Category C patches are located on private property off Willowdene Avenue and on the southern portion of the Defence Establishment Orchard Hills (see **Figure 3.1b**).

Table 3-3 Condition of vegetation in patches of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest within the study area

Plot name	Perennial native ground cover %	Patch size (approximate ha)	Category
P2-3	52	>5	A
P2-2	42	>5	C
P2-1	88	>5	A
34-2	96	>5	A
341	92	>5	A
332	70	>5	A
33 DNG	78	>5	C (derived native grassland)
P2 DNG	64	>5	C (derived native grassland)
394	28*	>5	C
292	78	>5	A
291	86	>5	A
27	86	>5	A
P2 CPW regen	86	>5	A

Notes: All plots were undertaken in vegetation patches larger than 5 hectares (small-scale disturbances in the vegetation that do not significantly alter the overall functionality of the ecological community are included in the patches and vegetation continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present are considered to be the same patch). Plot 394 was measured to possess 28% native perennial understorey vegetation but this patch is included in Category C as a precautionary measure as any additional plots undertaken in the future may result in a higher native perennial ground cover percentage result.

Threatened flora species

The PMST search (refer to **Attachment C**) identified 26 threatened flora species (or their habitats) with habitat in the 10 kilometre search radius around the proposed action (see likelihood of occurrence in **Table 3-4**).

The field surveys recorded one threatened flora species identified in the EPBC Act PMST report: *Pultenaea parviflora* (listed as vulnerable under the EPBC Act). No other threatened plant species were recorded during the surveys. For many of the threatened flora species identified in the PMST report (see **Attachment C**), the study area does not provide suitable habitat.

Three *Pultenaea parviflora* plants were found during the field surveys. The plants are located in two areas within the western road reserve of the Northern Road. Two plants are present in the road reserve at 2465 The Northern Road Mulgoa (E 285619, N 6254119) and one plant is present at the top of the road cutting approximately 420 m south of the first two plants on the western side of the Northern Road at 2509 The Northern Road Mulgoa (E 285581, N 6253696). Based on the data from the OEH Atlas of NSW Wildlife, the *Pultenaea parviflora* plants within the study area would represent an extension of the known south western distribution of this species in the Sydney Basin Bioregion.

Targeted surveys for other EPBC Act listed threatened flora species was undertaken including detailed survey for *Pimelea spicata*. Three *Pimelea spicata* reference sites were surveyed in January 2016 including the Mt Annan Botanic Gardens, Camden Golf Course, and Western Sydney Parklands. *Pimelea spicata* was flowering at all three reference sites during the survey period. *Pimelea spicata* was not recorded during the surveys undertaken for the Biodiversity Assessment despite targeted survey in habitat using parallel transects.

Table 3-4 Likelihood of occurrence for listed threatened flora species

Common name	Scientific name	EPBC Act status	Habitat preference	Likelihood of occurrence
Bynoes Wattle	<i>Acacia bynoeana</i>	V	The occurrence of <i>Acacia bynoeana</i> to the north of the study area (Londonderry, Llandilo, Agnes Banks, Berkshire Park) is strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand). In this area <i>Acacia bynoeana</i> is found in vegetation types including Castlereagh Scribbly Gum Woodland and Cooks River Castlereagh Ironbark Forest.	Low. The study area contains the heavy clay soils (Luddenham and Blacktown formations) of the Cumberland Plain with some small deposits of Tertiary alluvium (South Creek formation). The study area does not contain any vegetation representative of the Castlereagh Scribbly Gum Woodland or Cooks River Castlereagh Ironbark Forest. As such, there is no suitable habitat for <i>Acacia bynoeana</i> in the study area.
Downy Wattle	<i>Acacia pubescens</i>	V	In north-west Sydney, <i>Acacia pubescens</i> is strongly associated with the alluvial Hawkesbury – Nepean Terrace Gravels (ferruginised clay and consolidated sand of the Londonderry Clay, the conglomerate of the Rickabys Creek Gravels). Closer to the study area, <i>Acacia pubescens</i> occurs to on the Cumberland Plain landscape on the residual Bringelly Shale and Ashfield Shale where there is influence from the quaternary alluvium of the Hawkesbury – Nepean Channels and Floodplains (e.g. Kemps Creek and Ropes Creek). The gravelly Berkshire Park soil landscape is also present at Kemps Creek where this species can be found. <i>Acacia pubescens</i> is associated with Shale/Gravel Transition Forest and	Low. The study area contains the heavy clay soils (Luddenham and Blacktown formations) of the Cumberland Plain with some small deposits of Tertiary alluvium (South Creek formation). <i>Acacia pubescens</i> is a reasonably large non-cryptic shrub that can be readily detected via the random meander technique within suitable habitats. This species was not found during the survey and the habitat present in the study area is not suitable.

			contiguous Shale Plains Woodland that has a gravel influence. This species is also found in Castlereagh Scribbly Gum Woodland at Kemps Creek and Castlereagh.	
<i>Allocasuarina glareicola</i>	<i>Allocasuarina glareicola</i>	E	<i>Allocasuarina glareicola</i> is restricted to a few small populations in and around Castlereagh Nature Reserve, north-east of Penrith, growing on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. A record of this species also exists approximately 25 km to the south east of the study area from Heathcote Road (recorded in 1996) growing in open woodland of <i>Eucalyptus sclerophylla</i> , <i>Angophora bakeri</i> and <i>Eucalyptus robusta</i> on laterite with surficial ironstone nodules.	Unlikely. The study area contains the heavy clay soils (Luddenham and Blacktown formations) of the Cumberland Plain with some small deposits of Tertiary alluvium (South Creek formation). There is no suitable habitat for <i>Allocasuarina glareicola</i> in the study area.
<i>Asterolasia elegans</i>	<i>Asterolasia elegans</i>	E	<i>Asterolasia elegans</i> is endemic to and has a disjunct distribution within the hills north of Sydney. It only occurs north of Maroota.	Low. This species is not known from the Cumberland region. There is no suitable habitat for <i>Asterolasia elegans</i> in the study area.
Leafless Tongue Orchid	<i>Cryptostylis hunteriana</i>	V	<i>Cryptostylis hunteriana</i> has been reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgeland, <i>Xanthorrhoea</i> spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). This species has never been recorded from the Cumberland Plain.	Low. This species has only been found in the far eastern portion of the Cumberland region in the Ku-ring-gai LGA. There is no suitable habitat for <i>Cryptostylis hunteriana</i> in the study area.
White-flowered Wax Plant	<i>Cynanchum elegans</i>	E	A nearby record of <i>Cynanchum elegans</i> exists at Bringelly recorded in 1992 in PCT 850. Habitat for <i>Cynanchum elegans</i> may be present in PCT 835, 849 and 850. However, habitat for <i>Cynanchum elegans</i> on the Cumberland Plain is thought to be restricted to small isolated remnant patches of dry rainforest.	Low. Targeted surveys for <i>Cynanchum elegans</i> failed to detect this species within the study area. No suitable dry rainforest habitat is present.
Camden White Gum	<i>Eucalyptus benthamii</i>	V	In western Sydney, <i>Eucalyptus benthamii</i> is restricted to the Hawkesbury - Nepean Channels and Floodplains and immediately adjacent areas of the Cumberland Plain, Kurrajong Fault Scarp and Silverdale Slopes. <i>Eucalyptus benthamii</i> grows on the Quaternary alluvium of the Nepean River on the Richmond soil landscape (sand and gravel). The population along the Grose River is on alluvial soils of the Freemans Reach soil landscape. Highly restricted in its habitat requirements, <i>Eucalyptus benthamii</i> requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Associated species that also occur with <i>Eucalyptus benthamii</i>	Low. No suitable habitat for <i>Eucalyptus benthamii</i> is present in the study area. The nearest population of <i>Eucalyptus benthamii</i> to the study area is along the Nepean River at Wallacia (Fowler reserve, Blaxland's Crossing Reserve) where it occurs on the alluvial soils. The record of <i>Eucalyptus benthamii</i> from Elizabeth Drive near the roundabout on the Northern Road is erroneous as the data indicates this record is from Fowler Reserve Wallacia. The record on Mulgoa Road to the south-west of the Mulgoa Nature Reserve is also erroneous as the data indicates this record is from Bents Basin.

			on the alluvial floodplains include <i>Eucalyptus elata</i> , <i>Eucalyptus baueriana</i> , <i>Eucalyptus amplifolia</i> , <i>Eucalyptus deanei</i> and <i>Angophora subvelutina</i> .	
Bauer's Midge Orchid	<i>Genoplesium baueri</i>	E	<i>Genoplesium baueri</i> generally occurs within coastal areas from Ulladulla on the south coast to Port Stephens on the mid-north coast, although it has been recorded from as far west as Woodford in the Blue Mountains and Penrose State Forest in the southern highlands. It usually grows in heathland to shrubby woodland on sands or sandy loams or open forest, shrubby forest and heathy forest on well-drained sandy and gravelly soils.	Low. The study area contains the heavy clay soils (Luddenham and Blacktown formations) of the Cumberland Plain with some small deposits of Tertiary alluvium (South Creek formation). There is no suitable habitat for <i>Genoplesium baueri</i> in the study area.
Small-flower Grevillea	<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	<i>Grevillea parviflora</i> subsp. <i>parviflora</i> occur sporadically throughout the Sydney Basin. It occurs on ridge crests, upper slopes or flat plains in both low-lying areas between 30–65 m above sea level and on higher topography between 200–300 m above sea level south of Sydney. It occurs in sandy or light clay soils, usually over thin shales often with lateritic ironstone gravels which are often infertile and poorly drained. Soils are mostly derived from Tertiary sands or alluvium and from the Mittagong Formation with alternating bands of shale and fine grained sandstones. This species is known from Kemps Creek on the sandy lateritic soils and a recent record from Ropes Creek at Mt Druitt on the alluvial South Creek formation soils.	Low. There is no suitable habitat for <i>Grevillea parviflora</i> subsp. <i>parviflora</i> in the study area. The portion of the study area that possesses alluvial South Creek formation soils is not suitable for this species.
Wingless Raspwort	<i>Haloragis exalata</i> subsp. <i>exalata</i>	V	<i>Haloragis exalata</i> subsp. <i>exalata</i> is presently known from a range of vegetation types, all of which appear to have a history of recurrent disturbance. It appears to be a post-disturbance coloniser, based on observations of large numbers of plants on disturbed roadsides, cleared power-line easements, and recently burnt or flooded areas.	Low. There is no suitable habitat for <i>Haloragis exalata</i> subsp. <i>exalata</i> in the study area and this species has not been recorded from the locality in the past.
Deane's Paperbark	<i>Melaleuca deanei</i>	V	<i>Melaleuca deanei</i> grows in wet heath on sandstone, sandy soils and woodlands. The nearest records of this species to the study area are from the Blue Mountains National Park. <i>Melaleuca deanei</i> was recorded in 2007 from the rail corridor at Vineyard between Quakers Hill and Riverstone train stations (this record is an anomaly).	Low. There is no suitable sandstone habitat for <i>Melaleuca deanei</i> in the study area.
<i>Micromyrtus minutiflora</i>	<i>Micromyrtus minutiflora</i>	V	The occurrences of <i>Micromyrtus minutiflora</i> to the north of the study area (Londonderry, Llandilo, Agnes Banks, Berkshire Park) is strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay	Low. There is no suitable sandstone habitat for <i>Micromyrtus minutiflora</i> in the study area.

			geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand). <i>Micromyrtus minutiflora</i> was recorded at the Fernhill Western Precinct at Mulgoa in 2014 approximately 6 km west of the study area (on the Kurrajong Fault Scarp landscape).	
Omeo Storksbill	<i>Pelargonium</i> sp. Striatellum (G.W.Carr 10345)	E	<i>Pelargonium</i> sp. Striatellum is only known from lake-beds on the basalt plains of the Monaro and one at Lake Bathurst.	Low. There is no suitable habitat for <i>Pelargonium</i> sp. Striatellum (G.W.Carr 10345) in the study area.
Needle Geebung	<i>Persoonia acerosa</i>	V	<i>Persoonia acerosa</i> is mainly found in Katoomba, Wentworth Falls and Springwood in the Blue Mountains. It grows in heath, scrubby low-woodland or dry sclerophyll forest. The species is found mostly on ridge-tops and plateau areas, growing in sandy topsoils over clayey subsoils.	Low. This species is not known from the Cumberland region. There is no suitable habitat for <i>Persoonia acerosa</i> in the study area.
Hairy Geebung	<i>Persoonia hirsuta</i>	E	<i>Persoonia hirsuta</i> is frequently found on ridge tops and the mid slopes of hills and rises. It grows in sandy to stony soils derived from sandstone or very rarely on shale, from near sea level to 600 m altitude. Known from Berkshire Park and Agnes Banks to the north of Penrith and Blaxland and Springwood in the Blue Mountains.	Low. There is no suitable habitat for <i>Persoonia hirsuta</i> in the study area. The study area is dominated by heavy clay soils with small areas of alluvium.
Nodding Geebung	<i>Persoonia nutans</i>	E	<i>Persoonia nutans</i> is restricted to the Cumberland Plain. It is known from an area between Richmond and Macquarie Fields, particularly near the Nepean and Georges Rivers. The range of the species is fragmented, with approximately 99% of the known populations occurring in the north of the distribution at Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs. This species is also known from Kemps Creek on the sandy lateritic soils. <i>Persoonia nutans</i> is strongly associated with the Hawkesbury – Nepean Terrace Gravels and the presence of the Londonderry Clay geological formation (clay with sand – top layer hard, semi-indurated zone of cemented ironstone pisolites) with the Berkshire Park and Agnes Banks soil landscapes (laterite and sand).	Low. There is no suitable habitat for <i>Persoonia nutans</i> in the study area. The study area is dominated by heavy clay soils with small areas of alluvium.
<i>Pimelea curviflora</i> subsp. <i>curviflora</i>	<i>Pimelea curviflora</i> subsp. <i>curviflora</i>	V	<i>Pimelea curviflora</i> subsp. <i>curviflora</i> occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils.	Low. There is no suitable habitat for <i>Pimelea curviflora</i> subsp. <i>curviflora</i> in the study area.
Spiked Rice-flower	<i>Pimelea spicata</i>	E	<i>Pimelea spicata</i> is found on heavy clay soils which are prevalent in the study area. This species can grow in disturbed habitats dominated by African Olive. Likely to be restricted to areas with little to no grazing pressure. This species may occur in patches of	Low. While some areas of suitable habitat are present in the study area this species was not detected during targeted surveys. Three reference sites were checked during the survey

			PCT849 or PCT850, particularly those that aren't heavily grazed.	period to gauge flowering status. <i>Pimelea spicata</i> was flowering at all three reference sites during the survey period. Flowering conditions were optimal during the survey. As this species was targeted by the surveys during optimal flowering, and not recorded, it is considered to have a low likelihood of occurrence.
Brown Pomaderris	<i>Pomaderris brunnea</i>	V	Within the Hawkesbury–Nepean region, <i>Pomaderris brunnea</i> is known from a small area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It is largely restricted to the Picton – Razorback Hills and Nattai Plateau. It is also found near Camden on the Cumberland Plain, Hawkesbury – Nepean Channels and Floodplains, and Hawkesbury – Nepean Terrace Gravels. This species shows a strong preference for alluvial soils and the shale/sandstone transitional zone of the residual Lucas Heights soil landscape around Bargo. Suitable habitat is the Sydney Hinterland Transitional Woodland around Bargo and the Alluvial Woodland and Riparian Forest along the Nepean River at Camden.	Low. The study area is outside of the known distribution for this species (nearest records 18 km south near Camden). <i>Pomaderris brunnea</i> is a reasonably large non-cryptic shrub that can be readily detected via the random meander technique within suitable habitats. Despite surveys targeting PCT 835 (Forest Red Gum – Rough Barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion), this species was not recorded within the study area.
Illawarra Greenhood	<i>Pterostylis gibbosa</i>	E	<i>Pterostylis gibbosa</i> is currently known from only five locations consisting of approximately 4,500 individuals. Extensive surveys conducted as part of the implementation of the recovery plan have failed to locate any populations on the Cumberland Plain in western Sydney, where it was originally discovered in 1803. It is considered that the species is probably now extinct on the Cumberland Plain.	Low. This species has not been collected from the Cumberland Plain since 1803. Between 1996 and 1998, surveys in western Sydney were conducted by the National Parks and Wildlife Service and Australian Native Orchid Society in Prospect Reservoir, defence land at Orchard Hills, Holsworthy and St Marys, Shanes Park, Kemps Creek, St Andrew's, Longneck Lagoon, and Nurragingy Reserve. No <i>P. gibbosa</i> was found.
Sydney Plains Greenhood	<i>Pterostylis saxicola</i>	E	<i>Pterostylis saxicola</i> is a narrow endemic restricted to the greater Sydney region of NSW, and occurs between Picnic Point and Picton. In 1997, it was known from five locations: near Yeramba Lagoon in Georges River National Park, Ingleburn, Holsworthy Military Area, Peter Meadows Creek and St Marys Towers near Douglas Park. The only record of <i>Pterostylis saxicola</i> near to the study area is from the vicinity of Arndell Park. This record was made in 1804. This species grows in heathy forest, sclerophyll forest or woodland in shallow sandy soil over flat sheets of sandstone rock shelves above cliff lines and also in crevices between sandstone boulders; often in close proximity to streams.	Unlikely. There is no suitable habitat for <i>Pterostylis saxicola</i> in the study area.
Smooth Bush-pea	<i>Pultenaea glabra</i>	V	<i>Pultenaea glabra</i> is restricted to the higher Blue Mountains and has been recorded from the Katoomba-	Unlikely. There is no suitable habitat for

			Hazelbrook and Mount Victoria areas.	<i>Pultenaea glabra</i> in the study area.
Pultenaea parviflora	<i>Pultenaea parviflora</i>	V	<i>Pultenaea parviflora</i> is confined to the Cumberland Plain and is mainly found between Penrith and Windsor. <i>Pultenaea parviflora</i> is generally found in scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on Wianamatta shale, tertiary alluvium or laterised clays, and in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	Present. Three <i>Pultenaea parviflora</i> plants were recorded in two locations adjacent to the Northern Road during the field surveys.
Eastern Underground Orchid	<i>Rhizanthella slateri</i>	E	<i>Rhizanthella slateri</i> is currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. <i>Rhizanthella slateri</i> grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available.	Low. While the preferred habitat for this species is unknown, it has not been recorded near the study area in the past despite significant development that has disturbed the soil.
Kangaloon Sun Orchid	<i>Thelymitra kangaloonica</i>	CE	<i>Thelymitra kangaloonica</i> is known from three locations near Robertson in the Southern Highlands. It grows in seasonally swampy sedgeland on grey silty clay loam at 600–700 m above sea level.	Unlikely. There is no suitable habitat for <i>Thelymitra kangaloonica</i> in the study area.
Austral Toadflax	<i>Thesium australe</i>	V	<i>Thesium australe</i> is semi-parasitic on roots of a range of grass species, notably <i>Themeda triandra</i> .	Low. The nearest record to the study area is from Camden. This species has not been recorded in any other locations in western Sydney despite significant survey effort. It was not recorded during floristic surveys of derived native grasslands in the study area and is considered to have a low likelihood of occurrence in the study area.

Threatened fauna species

The PMST search (refer to **Attachment C**) identified 19 threatened fauna species with habitat in the 10 kilometre search radius around the proposed action. This includes five birds, four frogs, six mammals, one reptile, one invertebrate, and two fish species. Details of survey effort and likelihood of occurrence assessment are provided below in **Table 3-7**.

Green and Golden Bell Frog (*Litoria aurea*)

There are no reported existing populations of the Green and Golden Bell Frog (*Litoria aurea*) in the study area. The most recent record of this species nearby is from Gow Park Mulgoa from 1999. Recent targeted surveys conducted for the Badgerys Creek airport site which adjoins the study area (GHD 2015) did not detect a population. Despite this, suitable habitat does occur and targeted surveys were conducted. In this regard, there are numerous farm dams in the study area with various dimensions and depths, many in isolated locations and others connected along drainage lines. The presence of emergent and surrounding vegetation also varies considerably, from completely absent and unshaded dams to a species rich wetland type environment with abundant emergent vegetation and surrounding tree canopy with grassy understorey. Dams in rural properties are impacted by grazing cattle and on residential or Defence land by run-off, treated effluent and weeds.

Surveys were carried out with regard to the significant impact guidelines for this species (DEWHA 2009) and the Commonwealth survey guidelines for threatened frogs (DEWHA 2010). The referral guidelines recommend an initial habitat assessment followed by at least four nights of surveys between September and March, during warm and windless weather conditions following rainfall. Targeted surveys were conducted in January and February 2016 (weather conditions provided in **Table 3-5**). An initial habitat assessment was conducted to stratify the

habitat available and target survey effort at sites where habitats are most suited to *Litoria aurea*. To determine this, a review of literature on the habitat requirements of the species was conducted. Pyke and White (1996) document habitat requirements of the species from a review of 155 known sites in NSW. These authors document the criteria found most consistently at sites that support breeding and non-breeding populations, this included the following:

- a. Presence of emergent vegetation providing shelter sites
- b. Moderate to high level disturbance
- c. Aquatic plant species present (especially *Typha* spp.)
- d. Still or low flowing water
- e. Run-off urban / industrial / grazing or parkland
- f. Substrate sand, or rock
- g. Shallow water depth <50 cm
- h. Nearby vegetation low, grassland, or shrubland or woodland
- i. Unshaded or partial shade
- j. Areas of grass nearby
- k. No visible signs of pollution
- l. *Crinia signifera* or *Limnodynastes peroni* present
- m. *Gambusia holbrooki* absent

The initial habitat assessment considered all dams within 200 metres of the project footprint which were assessed against the criteria described above. Dams up-slope from the road and outside of the predicted impact zone were not assessed. The habitat assessment scored each of the habitat criteria as being either, present (1) or absent (0) to provide a total score out of 13. All sites were on clay substrates so scored 0 for criteria f 'substrate sand, or rock'. Sites that scored ≥ 10 were identified for targeted nocturnal surveys ($n = 13$). Sites without emergent vegetation providing shelter sites for *L. aurea* or that scored less than 10 were considered to have a very low chance of supporting a population and no nocturnal surveys were conducted.

Nocturnal surveys were conducted at 5 sites over 6 nights, between the 20th January and 2nd February 2016, weather conditions are shown in **Table 3-5**. A site consisted of multiple dams in close proximity providing opportunities for movements of *Litoria aurea*, these were sampled separately to cover the entire area, and resulted in sampling 13 dams in total (refer **Table 3-6**). Isolated dams were sampled on more than one occasion. The habitat at DEOH consisted of five large dams connected by a series of narrow vegetated channels, the survey sampled all the dam and channel habitats in this location over 4 consecutive nights.

Each dam was searched by two ecologists at least once during the survey period with the duration of each sampling event extending between 0.5 and 1 hour per site depending on the size of the dam (**Table 3-6**). The survey involved a spotlight search of the entire perimeter of the site focusing on the upper water column and within emergent vegetation. Call playback was used at each site which involved playing calls through a 20W loudhailer for 2-5 minutes at each location. Smaller sites involved a single broadcast point, while larger sites and densely vegetated sites used multiple call sites whilst searching the perimeter of the dam. Survey effort is detailed in **Table 3-6**.

Table 3-5 Weather and rainfall conditions during nocturnal surveys

Date	Min Temp (OC)	Max Temp (OC)	Wind (3pm)	Rainfall (24 hours)	Total rainfall in 7 days prior to survey
20/01/2016	16.8	38.9	Slight NNW 11 km/hr	0 mm	30.6 mm
21/01/2016	20.6	38.5	Calm NE 7 km/hr	0 mm	48.2 mm
01/02/2016	17.1	26.9	Slight SSW 11 km/hr	0.2 mm	89.6 mm
02/02/2016	13.5	28.6	Calm E 9 km/hr	0.8 mm	89.6 mm
03/02/2016	15.2	32.3	Calm NNW 6 km./hr	0 mm	89.6 mm
04/02/2016	17.8	24.9	Moderate SSE 28 km/hr	2.8 mm	89.6 mm

Table 3-6 Details of survey sites and sampling events for targeted nocturnal surveys

Survey site	Survey nights						Total duration (hours)	No. sampling events
	1	2	3	4	5	6		
1a. Willowdene Rd south	20/01	21/01					1.0	1
1b. Willowdene Rd south	20/01	21/01					2.0	2
2. Northern bridge on xmas tree farm		21/01					1.0	3
3a. Large subdivision property				2/02			0.5	4
3b. Large subdivision property					3/02		0.5	5
3c. Large subdivision property			1/02				0.5	6
3d. Large subdivision property						4/02	0.5	7
4a. DEOH			1/02				1.0	8
4b. DEOH			1/02				1.0	9
4c. DEOH				2/02			1.0	10
4d. DEOH					3/02		1.0	11
4e. DEOH						4/02	1.0	12
5. opposite golf course				2/02			0.5	13
5 sites (13 dams)							10.5 hrs (21 person hrs)	

Australasian Bittern (*Botaurus poiciloptilus*)

There is one record of the cryptic Australasian Bittern in the study area, in 2003 to the south of Badgerys Creek, the species is considered to have a low to moderate chance of occurring. Spotlighting and call playback targeting Australasian Bittern was conducted over 6 nights by two ecologists using 50W spotlights and 20W loudhailer. The survey times varied between 0.5 to 2.0 hours depending on the size of the site and concentrated on densely vegetated dams and adjoining riparian habitats and were conducted following the targeted frog surveys. In total 8 sites were sampled consistent with frog sites 1a and 1b, 2, and 4a-4e. Call playback used a single point broadcast for 5 minutes duration at the start of the survey and then quite searching and listening for individuals during the remainder of the survey. Surveys for the Australasian Bittern did not record any birds present.

Koala (*Phascolarctos cinereus*)

There is one historic record of koala from the study area in 1999 from west of Mulgoa Nature Reserve near the Warragamba River around 8km from the study area. Surveys targeting koala involved scat searches conducted over 40 plots (20 x 50 m) in woodland habitats. These surveys were conducted concurrently with the vegetation condition assessment with sites stratified by plant community type and condition.

Spotlighting and call playback targeted larger woodland habitats and was conducted at two locations, 1) in the DEOH area along the drainage area in the north-western end of the site and 2) within suitable habitat along Willowdene Avenue in the southern end of the study area. The search involved two ecologists walking a transect of minimum 500 m using 50W spotlights. Call playback was used at the start of each transect where the call of the species was played for 5 minutes from a loudhailer.

Four of the 19 threatened fauna species identified in the PMST report were identified as having a moderate to high likelihood of occurring within the study area (but not recorded during the survey). These are:

- Regent Honeyeater
- Swift Parrot
- Large-eared Pied Bat
- Grey-headed Flying-fox (foraging habitat only).

Table 3-7 Likelihood of occurrence for listed threatened fauna species

Common name	Scientific name	EPBC Act status	Habitat preference	Likelihood of occurrence
Green and Golden Bell Frog	<i>Litoria aurea</i>	V	This species is known to be associated with PCT835, PCT849, and PCT850 and suitable foraging and breeding habitat was noted from a number of artificial dam habitats both on stream and off-stream.	Low. Targeted surveys for the Green and Golden Bell Frog did not record this species as present. The habitat in wetlands throughout the study area appears suitable, however many of the dams are isolated and infested with mosquito fish and the most recent record of this species nearby is from Gow Park, Mulgoa from 1999.
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	V	Found in heath, woodland and open forest with sandy soils.	Unlikely. No suitable habitat for this species is present in the study area.
Littlejohns Tree Frog	<i>Litoria littlejohni</i>	V	It occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops.	Unlikely. No suitable habitat for this species is present in the study area.
Stuttering Frog	<i>Mixophyes balbus</i>	V	Forages and lives amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m. They breed around shallow, flowing rocky streams from late spring to summer.	Unlikely. No suitable habitat for this species is present in the study area.
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	Forages over a broad range of open forest and woodland habitats, this species is a cave roosting bat which favours sandstone escarpment habitats for roosting, in the form of shallow overhangs, crevices and caves.	Moderate. This species is known to occur in the Mulgoa Nature Reserve and may also forage over the study area.
Spotted-tailed Quoll	<i>Dasyurus maculatus maculatus</i>	E	Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites.	Unlikely. Required habitat components are not present in the study area. Habitat for the Spotted-tail Quoll within the study area is generally poor quality with a general lack of sufficient habitat size and quantity, in particular suitable den sites (i.e. no large hollow logs, few large hollow bearing trees, no rock outcrops, and no caves) are absent. The Spotted-tail Quoll has a low likelihood of occurrence in the study area.
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>	V	Open forest habitats on steep terrain with exposed rocks, rock overhangs and platforms.	Unlikely. There is no suitable habitat for this species in the study area.
Koala	<i>Phascolarctos cinereus</i>	V	Forest Red Gum (<i>Eucalyptus tereticornis</i>) is present in PCT835, PCT849 and PCT850 at varying densities and due to the abundance of known food tree species the Koala is considered to potentially occur, however there are no recent accounts of a koala population in the study area	Low. Suitable feed tree species for the Koala are present throughout the vegetation in the study area (e.g. <i>Eucalyptus tereticornis</i>). However, targeted surveys did not record any evidence of the Koala within the

			and the likelihood of occurring is considered low.	study area. The nearest Koala records are from the lower Blue Mountains (>5 km west in different habitat types) and Campbelltown (>20 km south).
New Holland Mouse	<i>Pseudomys noavehollandiae</i>	V	Distribution is fragmented across all eastern states of Australia, where it inhabits open heath lands, open woodlands with heath understorey and vegetated sand dunes.	Unlikely. This species has not been recorded from western Sydney and no suitable habitat is present in the study area.
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	Forages on nectar and pollen in sclerophyll forests and on rainforest fruits and vines, orchards, gardens.	High. This species is likely to forage in the study area.
Dural Land Snail	<i>Pommerhelix duralensis</i>	E	The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species is known to occur as far north as St Albans, in East Kurrajong and then south along the footslopes of the Blue Mountains as far south as The Oaks. Southeast from St Albans, the species is found across The Hills Shire Local Government Area and south to Parramatta. The Dural Land Snail superficially resembles the related species <i>Meridolum corneovirens</i> (Cumberland Plain Land Snail), with which the Dural Land Snail is parapatric (the species' ranges are immediately adjacent to each other but do not significantly overlap).	Low. No habitat is present for the Dural Land Snail (the study area provides known habitat for the Cumberland Plain Land Snail which is parapatric with the Dural Land Snail (the species ranges are immediately adjacent but do not overlap).
Australasian Bittern	<i>Botaurus poiciloptilus</i>	E	They are widespread but uncommon over south-eastern Australia. It extends mainly along the coasts of eastern Australia and is found all over NSW except for the far north west. It inhabits freshwater wetlands with tall dense vegetation where it feeds in shallow waters.	Low. Targeted surveys for the Australasian Bittern did not record this species as present.
Painted Honeyeater	<i>Grantiella picta</i>	V	The painted honeyeater is the most specialised of Australia's honeyeaters. Its diet mainly consists of mistletoe fruits.	Low. The Painted Honeyeater has not been recorded in the locality since the 1990s.
Regent Honeyeater	<i>Anthochaera phrygia</i>	CE	Records are associated with PCT835, PCT849 and PCT850 and small fragments of higher quality shale hills woodland may be utilised by this species.	Moderate. This species may occasionally visit the habitat in the study area to forage.
Swift Parrot	<i>Lathamus discolor</i>	E	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Red Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>).	Moderate. This species may forage in the study area when on the mainland.

Australian Painted Snipe	<i>Rostratula australis</i>	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low. The wetland habitats are not considered optimal for the Australian Painted Snipe.
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	V	Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer.	Unlikely. No suitable habitat is present in the study area.
Macquarie Perch	<i>Macquaria australasica</i>	E	Now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW. It is also found in the Cataract Dam in the Nepean River catchment, as well as a 2008 record from Georges River near Campbelltown.	Unlikely. No suitable river habitat is present in the study area.
Australian Grayling	<i>Prototroctes maraena</i>	V	Inhabits cool, clear, freshwater streams with gravel substrate and areas alternating between pools and riffle zones. Also associated with clear, gravel-bottomed habitats in the Mitchell and Wonnangatta Rivers and in a muddy-bottomed, heavily silted habitat in the Tarwin River can be found over 100 km upstream.	Unlikely. No suitable river habitat is present in the study area.

Nature and extent of likely impact

Threatened ecological communities

Calculations of the extent of direct clearing required are based on a 90 m buffer from the centre line of the road design (180 m corridor), and represent a worst case scenario that has scope to be reduced at the detailed design stage. The clearing extent is an estimate and the actual extent of clearing will be refined during the environmental impact assessment process with measures to avoid and minimise implemented as much as possible. Based on the estimated clearing corridor, the proposed action would result in the direct clearing of approximately 28 hectares of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community.

This clearing includes:

- 14 hectares of core Category A vegetation
- 4 hectares of Category C vegetation
- 10 hectares of Category C Derived Native Grassland.

The larger and more diverse a patch of the TEC is, the greater the likely biodiversity value and its sustainability. The action will impact on patches larger than five hectares in size. The patches to be impacted are high quality (up to 96 percent native groundcover, native species richness of up to 47 species in a plot). Additionally, the action will impact on local links which connect patches of vegetation.

Due to the conservation status of the TEC (i.e. critically endangered), the high quality of the patches to be impacted, the extent of direct impacts, and likely indirect impacts, a significant impact to the Cumberland Plain TEC is predicted. A summary of the assessment of significance is provided in **Table 3-8** the assessment of significance is provided in Attachment B).

Table 3-8 Summary of EPBC assessment of significance for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

Species/Ecological Community	*Significant impact criteria							Likely significant impact?
	1	2	3	4	5	6	7	
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Y	Y	Y	Y	Y	Y	Y	Yes
<p>* Significant impact criteria for critically endangered ecological communities</p> <ol style="list-style-type: none"> 1) reduce the extent of an ecological community 2) fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines 3) adversely affect habitat critical to the survival of an ecological community 4) modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns 5) cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting 6) cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: <ol style="list-style-type: none"> a. assisting invasive species, that are harmful to the listed ecological community, to become established, or b. causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or 7) interfere with the recovery of an ecological community 								

Threatened flora

The proposed action would result in the direct clearing of three *Pultenaea parviflora* plants for the construction of batters. The area of surrounding habitat likely to possess a soil seedbank for this species is approximately 0.6 hectares. All three *Pultenaea parviflora* plants and the soil seedbank in the immediate area of the plants would be removed by the action.

The definition of an important population as provided in the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (DoE 2013) is a "... a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range".

The sub-population of *Pultenaea parviflora* within the study area is unlikely to be a key source population for breeding or dispersal as it is very small (three plants) and isolated from the other main population centres for this species. The sub-population within the study area is likely to be part of the larger population on the Defence Establishment Orchard Hills. The sub-population of *Pultenaea parviflora* within the study area is, however, at the south western edge of the species' range in the Sydney Basin Bioregion and may possess genetic diversity unlike more central populations. The removal of these three plants would contract the known range of this species to approximately three kilometres to the east as the closest known population is in the Defence Establishment Orchard Hills. As such, the population of *Pultenaea parviflora* within the study area can be considered as important.

A 'significant impact' is defined as an impact which is important, notable, or of consequence, having regard to its context or intensity (DoE, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts (DoE, 2013). A summary of the assessment of significance for *Pultenaea parviflora* is provided in **Table 3-9**. A significant impact is not likely for this species. The assessment of significance is provided in **Attachment B**.

Table 3-9 Summary of EPBC assessment of significance for *Pultenaea parviflora*

Species	*Significant impact criteria									Likely Significant Impact	Important Population +
	1	2	3	4	5	6	7	8	9		
<i>Pultenaea parviflora</i>	Y	Potentially	N	N	Y	N	N	N	N	No	Yes
<p>* Assessment of significance questions for vulnerable species</p> <ol style="list-style-type: none"> 1) lead to a long-term decrease in the size of an important population of a species 2) reduce the area of occupancy of an important population 3) fragment an existing important population into two or more populations 4) adversely affect habitat critical to the survival of a species 5) disrupt the breeding cycle of an important population 6) modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 7) result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 8) introduce disease that may cause the species to decline, or 9) interfere substantially with the recovery of the species. 											
<p>+ Important Population as determined by the EPBC Act is a population of a vulnerable species that:</p> <ul style="list-style-type: none"> • is likely to be key source populations either for breeding or dispersal • is likely to be necessary for maintaining genetic diversity • is at or near the limit of the species range 											

Four of the 19 threatened fauna species identified in the EPBC PMST report were identified as having a moderate to high likelihood of occurring within the study area (these species were not recorded during the survey). These included:

- Regent Honeyeater
- Swift Parrot
- Large-eared Pied Bat
- Grey-headed Flying-fox.

The populations of the Large-eared Pied Bat and Grey-headed Flying-fox would be considered 'important' as defined under the EPBC Act. For the Large-eared Pied Bat, recognised important populations that support higher numbers of individuals include those present in the sandstone escarpments of the Sydney Basin. Any Large-eared Pied Bats that would forage in the study area are likely to roost in the sandstone escarpments of the lower Blue Mountains. As such, the population of Large-eared Pied Bat that may utilise the study area is considered to be important. The Grey-headed Flying-fox exists as a single interconnected population in Australia. As such, it is considered an important population.

A significant impact to these four species from the action is considered unlikely. A summary of the results of the significance assessments for threatened fauna listed under the EPBC Act and which would potentially be impacted by the proposed action are included in **Table 3-10**. The assessments of significance are provided in **Attachment B**.

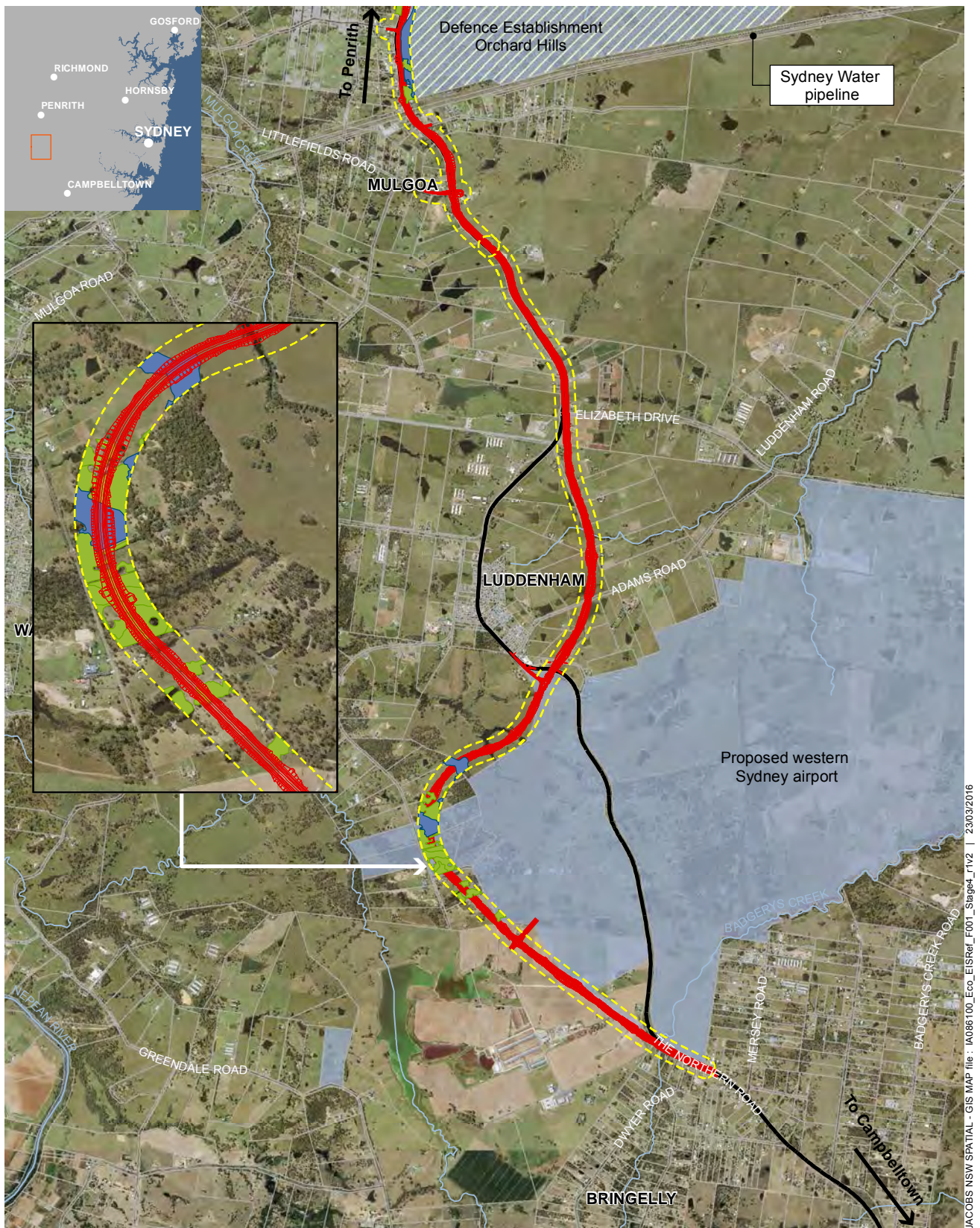
Table 3-10 Summary of threatened fauna species assessments of significance completed for the proposed action

Species	*Significant impact criteria									Likely Significant Impact	Important Population +
	1	2	3	4	5	6	7	8	9		
Critically endangered and endangered species											
Regent Honeyeater (<i>Anthochaera phrygia</i>)	N	N	N	N	N	N	N	N	N	No	NA
Swift Parrot (<i>Lathamus discolor</i>)	N	N	N	N	N	N	N	N	N	No	NA

* Assessment of significance questions											
<div>1) Lead to a long-term decrease in the size of a population;</div> <div>2) Reduce the area of occupancy of the species;</div> <div>3) Fragment an existing population into two or more populations;</div> <div>4) Adversely affect habitat critical to the survival of a species;</div> <div>5) Disrupt the breeding cycle of a population;</div> <div>6) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;</div> <div>7) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;</div> <div>8) Introduce disease that may cause the species to decline; or</div> <div>9) Interfere with the recovery of the species.</div>											
Species	*Significant impact criteria									Likely Significant Impact	Important Population +
	1	2	3	4	5	6	7	8	9		
Vulnerable fauna											
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	N	N	N	N	N	N	N	N	N	No	Yes
Large-eared Pied Bat (<i>Chalinolobus dwyeri</i>)	N	N	N	N	N	N	N	N	N	No	Yes
* Assessment of significance questions for vulnerable species											
<div>1) Lead to a long-term decrease in the size of an important population of a species</div> <div>2) Reduce the area of occupancy of an important population</div> <div>3) Fragment an existing important population into two or more populations</div> <div>4) Adversely affect habitat critical to the survival of a species</div> <div>5) Disrupt the breeding cycle of an important population</div> <div>6) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</div> <div>7) Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</div> <div>8) Introduce disease that may cause the species to decline, or</div> <div>9) Interfere substantially with the recovery of the species.</div>											
+ Important Population as determined by the EPBC Act is a population of a vulnerable species that:											
<div>• is likely to be key source populations either for breeding or dispersal</div> <div>• is likely to be necessary for maintaining genetic diversity</div> <div>• is at or near the limit of the species range</div>											
* Y= Yes (negative impact), N = No (no or positive impact), X = not applicable											

Mitigation measures to manage direct and indirect impacts to listed threatened species and ecological communities are outlined in **Chapter 5**. Due to the nature of the action and the predicted impacts, residual impacts are likely.

Due to the significant impact to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community, offsets are required to compensate for the impacts of the project. It is proposed that regardless of whether the Bilateral Agreement would apply to the proposed action that, for consistency, offsets for the TEC will be provided in accordance with the *Framework for Biodiversity Assessment* (OEH 2014).



JACOBS NSW SPATIAL - GIS MAP file : JA086100_Eco_EISRef_F001_Stage4_r1v2 | 23/03/2016

Legend

- The Northern Road upgrade Glenmore Parkway to Mersey Road
- The Northern Road
- Commonwealth lands
- Defence Establishment Orchard Hills
- Ecology study area

Vegetation impact (EPBC Act)

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest - Category A
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest - Category C

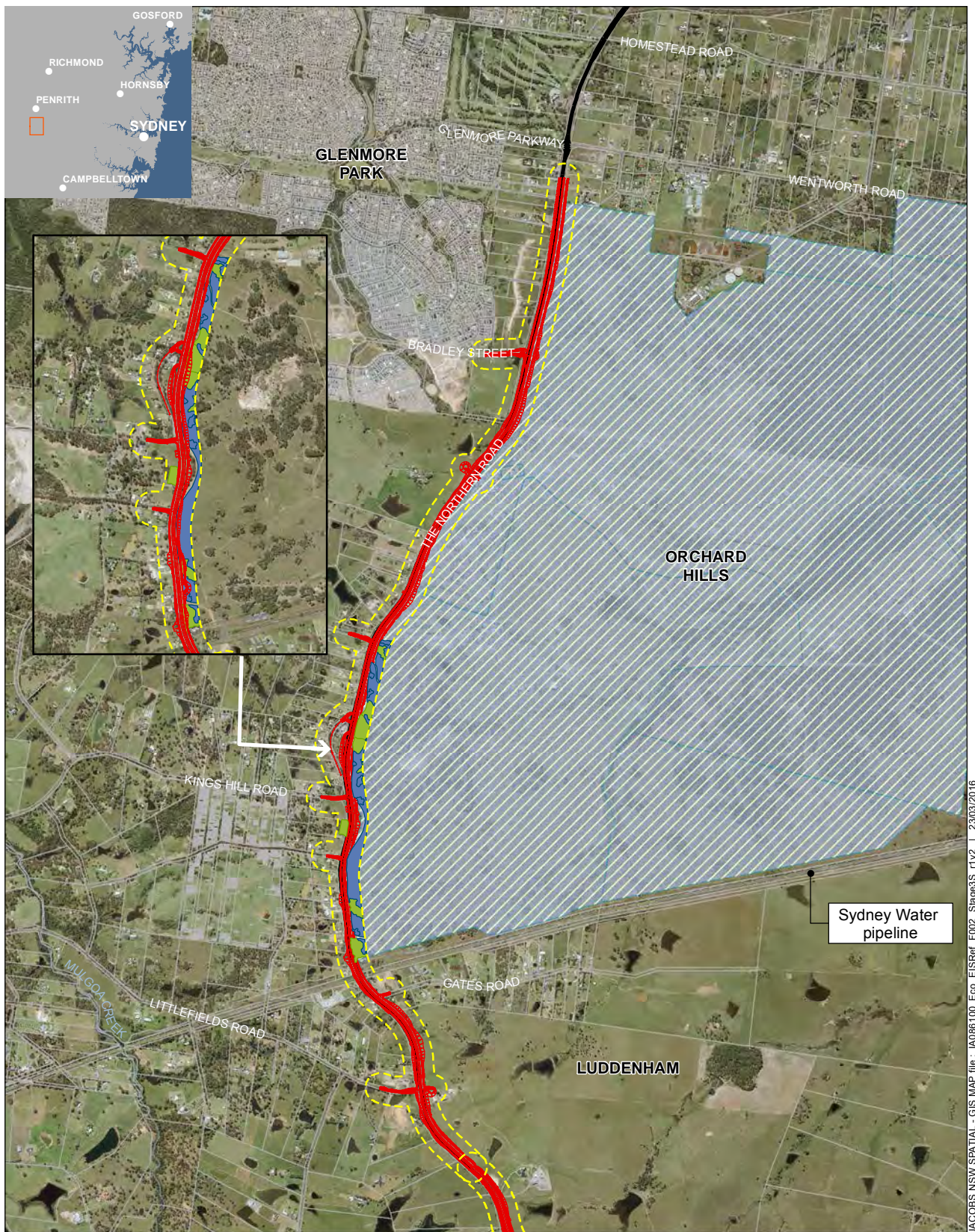
0 1 2 Km
1:50,000 @ A4



Data sources

Jacobs 2015
LPI 2015
RMS 2015

Figure 3-1A | The Northern Road upgrade Littlefields Road to Mersey Road – Vegetation impact



JACOBS NSW SPATIAL - GIS MAP file : JA086100_Eco_EISRef_F002_Stage3S_r1v2 | 23/03/2016

Legend

- The Northern Road upgrade Glenmore Parkway to Mersey Road
- The Northern Road
- Commonwealth lands
- Defence Establishment Orchard Hills
- Ecology study area

Vegetation impact (EPBC Act)

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest - Category A
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest - Category C

0 0.5 1 Km
1:35,000 @ A4



Figure 3-1B | The Northern Road upgrade Glenmore Parkway to Littlefields Road – Vegetation impact

Data sources

Jacobs 2015
LPI 2015
RMS 2015

3.1 (e) Listed migratory species

Description

A search of the PMST conducted on November 2015 identified 13 listed migratory species or their habitat as occurring within 10 kilometres of the proposed action. Two additional migratory species, the Black-tailed Godwit and Common Greenshank, were identified from the OEH Atlas of NSW Wildlife database search undertaken for the Biodiversity Assessment.

A habitat assessment was undertaken to determine the likelihood of occurrence of listed migratory species within the study area.

Surveys for birds were undertaken as part of the field surveys for the EIS. The surveys included area surveys over two hectares for 20 minutes each conducted in late spring and summer during which time most of the listed migratory species are present in eastern Australia. Specific habitats including wetlands were targeted during the survey.

No migratory species were recorded during the targeted bird surveys, however, the Latham's Snipe was recorded opportunistically in the study area on three occasions. It was recorded in the same location in an area of flooded grassland on Defence Establishment Orchard Hills. The Latham's Snipe is considered likely to utilise the extensive network of farm dams, however this habitat is not considered to comprise important habitat.

'Important habitat' for a migratory species is defined as (DoE 2013):

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- habitat that is of critical importance to the species at particular life-cycle stages
- habitat utilised by a migratory species which is at the limit of the species range
- habitat within an area where the species is declining.

Table 3-11 lists the 15 listed migratory species that have either been observed or are considered likely to occur within the proposed action's footprint. An assessment of the likely occurrence of these species and the presence of important habitat is included.

Table 3-11 Likelihood of occurrence for listed migratory species in the locality of the proposed action

Common name	Scientific name	EPBC Act status	Habitat preference	Type of presence (PMST)	Likelihood of occurrence	Presence of 'important habitat' in the study area
Migratory marine birds						
Fork-tailed Swift	<i>Apus pacificus</i>	Marine, Migratory (CAMBA, JAMBA, ROKAMBA)	A non-breeding migrant to Australia. The species breeds in Asia and migrate to Australia in the summer from which they spend most of their life-cycle on the wing.	Species or species habitat likely to occur within area	Moderate	No
Migratory terrestrial species						
Oriental Cuckoo	<i>Cuculus optatus</i>	Migratory (CAMBA, JAMBA, ROKAMBA)	A non-breeding migrant to Australia. This species has an extremely large range, breeding from European Russia in the west to Japan and northern Siberia in the East. During winter, birds occur throughout Indonesia, the Philippines, Papua New Guinea and in northern and	Species or species habitat may occur within area	Low	No

			eastern Australia			
White-throated Needletail	<i>Hirundapus caudacutus</i>	Marine, Migratory (CAMBA, JAMBA)	A non-breeding migrant to Australia (present October-April). It is widespread across eastern and south-eastern Australia. An aerial foraging species which occupies a range of habitats from open modified landscapes to woodland and forest.	Species or species habitat known to occur within area	Moderate	No
Rainbow Bee-eater	<i>Merops ornatus</i>	Marine, Migratory (JAMBA)	Widely distributed throughout Australia and eastern Indonesia, including Bali, the Lesser Sundas and Sulawesi, and east to Papua New Guinea, the Bismarck Archipelago and, rarely, the Solomon Islands. Occurs mainly in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation.	Species or species habitat may occur within area	Moderate	No
Black-faced Monarch	<i>Monarcha melanopsis</i>	Marine, Migratory (Bonn)	Breeds in eastern coastal Australia during summer and migrates to spend the non-breeding winter period in New Guinea. Inhabits rainforests, eucalypt forests and coastal scrubs. Breeds in rainforest habitat. Exhibit migratory behaviour, spending spring, summer and autumn in eastern Australia, and wintering in southern and eastern Papua New Guinea from March to August.	Species or species habitat known to occur within area	Low	No
Spectacled Monarch	<i>Monarcha trivirgatus</i>	Marine, Migratory (Bonn)	Largely confined to the north east and east coastal and near coastal regions of Australia. All sub-species occupy dense vegetation, mainly in rainforest but also in moist or wet sclerophyll forest and occasionally in other densely vegetated habitats such as mangroves, drier forest, woodlands, parks and gardens. Breeding has been recorded from September to April.	Species or species habitat known to occur within area	Low	No
Yellow Wagtail	<i>Motacilla flava</i>	Marine, Migratory (CAMBA, JAMBA, ROKAMBA)	The Yellow Wagtail is a regular wet season visitor to northern Australia. Increasing records in NSW suggest this species is an occasional but regular summer visitor to the Hunter River region. The species is considered a vagrant to Victoria, South	Species or species habitat likely to occur within area	Low	No

			Australia and southern Western Australia.			
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	Marine, Migratory (Bonn)	Found extensively along the Great Dividing Range along the eastern and south-east seaboard of Australia. Predominantly forests, in particular thick vegetation in gullies. It is a breeding summer migrant to the south-east and Tasmania.	Species or species habitat known to occur within area	Moderate	No
Rufous Fantail	<i>Rhipidura rufifrons</i>	Marine, Migratory (Bonn)	Occurs in south-eastern mainland Australia, from approximately Brisbane, through NSW and Victoria and across to the eastern side of the Adelaide Hills. This sub-species primarily breeds in forests within 300 km of the coast, and migrates northwards during non-breeding periods.	Species or species habitat known to occur within area	Moderate	No
Migratory wetland species						
Great Egret	<i>Ardea alba</i>	Marine, Migratory (CAMBA, JAMBA)	Prefers shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	Breeding known to occur within area	Moderate	No
Cattle Egret	<i>Ardea ibis</i>	Marine, Migratory (CAMBA, JAMBA)	Grasslands, woodlands and wetlands, and is not common in arid areas. It also uses pastures and croplands, especially where drainage is poor. Often seen with cattle.	Species or species habitat may occur within area	High	No
Latham's Snipe	<i>Gallinago hardwickii</i>	Marine, Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	Wetlands, wet meadows, flooded grassy paddocks, open grassland and drainage areas	Species or species habitat may occur within area	Present Recorded in the Defence site in flooded grassland	No
Black-tailed Godwit	<i>Limosa limosa</i>	Marine, Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	A non-breeding migrant to Australia. For populations occurring in the East Asian Australasian Flyway breeding probably occurs in the far-east Russia. Commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit	Recorded at Queens Hills Swamp at Mulgoa in 1982	Low	No
Eastern Osprey	<i>Pandion cristatus</i> syn. <i>Pandion haliaetus</i>	Marine, Migratory (Bonn)	This subspecies occurs from Borneo and Java through Wallacea and New Guinea to Australia and New Caledonia. In Australia, Ospreys are found right around the mainland coastline. The breeding range extends from	Species or species habitat known to occur within area	Low	No

			Esperance in Western Australia around to Cape Keraudren in the Pilbara and from Broome in the Kimberley across the northern coast of Australia (including many offshore islands) to Ulladulla in NSW. Favoured habitats are coastal areas, especially the mouths of large rivers, lagoons and lakes but also along the larger coastal rivers.			
Common Greenshank	<i>Tringa nebularia</i>	Marine, Migratory (Bonn, CAMBA, JAMBA, ROKAMBA)	A non-breeding migrant to Australia. Found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass.	Recorded at a dam in Orchard Hills in 2006 south east of the Luddenham booster station.	Low	No

Notes:

CAMBA – China-Australia Migratory Bird Agreement

JAMBA – Japan-Australia Migratory Bird Agreement

ROKAMBA – Republic of Korea-Australia Migratory Bird Agreement

Bonn – Convention to the Conservation of Migratory Species of Wild Animals (Bonn Convention)

Nature and extent of likely impact

An assessment of significance pursuant to the Significant Impact Guidelines 1.1 (DoE 2013) was completed for recorded migratory species and those with a moderate or high likelihood of occurrence and is included in **Attachment B**. The assessment concluded that although the proposed action is expected to result in the loss of occasional habitat for migratory species, but not important habitat, the proposed action is unlikely to result in a significant impact on migratory species listed under the EPBC Act.

3.1 (f) Commonwealth marine area

(If the action is in the Commonwealth marine area, complete 3.2(c) instead. This section is for actions taken outside the Commonwealth marine area that may have impacts on that area.)

Description

There are no Commonwealth Marine Areas located within 10 km of the proposed action (DotE 2015, **Attachment C**).

Nature and extent of likely impact

The proposed action will not result in any direct or indirect impacts on Commonwealth Marine Areas.

3.1 (g) Commonwealth land

(If the action is on Commonwealth land, complete 3.2(d) instead. This section is for actions taken outside Commonwealth land that may have impacts on that land.)

Description

See section 3.2.

Nature and extent of likely impact

See section 3.2.

3.1 (h) The Great Barrier Reef Marine Park**Description**

The proposed action is not located within or near the Great Barrier Reef Marine Park.

Nature and extent of likely impact

The proposed action will not result in any impacts on the Great Barrier Reef Marine Park.

3.1 (i) A water resource, in relation to coal seam gas development and large coal mining development**Description**

The proposed action does not involve a coal seam gas or large coal mining development.

Nature and extent of likely impact

Not applicable

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	Is the proposed action a nuclear action?	X	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment

Not applicable

3.2 (b)	Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?	X	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment

Not applicable

3.2 (c)	Is the proposed action to be taken in a Commonwealth marine area?	X	No
			Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))

Not applicable

3.2 (d)

Is the proposed action to be taken on Commonwealth land?		No
	X	Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))

The action will impact upon the following areas of Commonwealth land:

- Lot32/DP259698 – Planned western Sydney airport site
- Lot22/DP258581 – Planned western Sydney airport site
- Lot1/DP838361 – Planned western Sydney airport site
- Lot1/DP238092 – Defence Establishment Orchard Hills
- Lot3/DP238092 – Defence Establishment Orchard Hills

The potential impact to Commonwealth Land is estimated below:

	Defence Estate Orchard Hills	Western Sydney airport land
Operational footprint	25 ha	27 ha
Construction footprint (additional to operation requirements)	2 ha	4 ha
Total	27 ha	31 ha

Some minor refinements to the area of Commonwealth land required for construction may be identified during detailed design or by the construction contractor and would be negotiated with the Commonwealth.

Roads and Maritime has entered in negotiations with Department of Defence to acquire a strip of land along the western side of the Defence Establishment Orchard Hills. The section of The Northern Road adjacent to Defence Establishment Orchard Hills would be widened using this strip of land (i.e. the existing road would be widened to the east). This would avoid significant private property acquisition if The Northern Road was to be widened to the west.

The proposed action will also impact on land purchased by the Australian Government for the planned western Sydney airport. Roads and Maritime has undertaken consultation with Department of Infrastructure and Regional Development (DIRD) and has reached agreement to use some areas of land on the edge of the western Sydney airport site for the realigned section of The Northern Road. These areas of land are not essential to the proposed operational needs of the western Sydney airport and Roads and Maritime would continue to consult with DIRD to ensure that the design and construction of the proposed action does not impact planned western Sydney airport operations. Furthermore, the proposal alignment would provide access during construction of the western Sydney airport and would provide the major freight access to the southern section of the western Sydney airport. **Figure 1-2** and **Figure 1-3** shows impacts on Commonwealth land.

The following section has been prepared based on the *Significant Impact Guidelines 1.2 - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (Commonwealth of Australia 2013).

Impacts on landscapes and soils

The proposed action would not involve medium or large-scale excavation of soil or minerals within the areas of Commonwealth Land and would not result in substantially altering the natural landscapes features of the proposal corridor with the Commonwealth Land areas.

Further information regarding the potential impacts to topography, salinity and Acid Sulphate Soils for the entire proposal corridor is provided in Section 3.3.

Impacts on coastal landscapes and processes

The proposed action would not have any direct or indirect impact on any coastal landscapes and processes.

Impacts on ocean forms, ocean processes and ocean life

The proposed action would not impact on any direct or indirect impact on ocean forms, ocean processes and ocean life.

Impacts on water resources

The proposal corridor is located within the Hawkesbury-Nepean Catchment. The named waterways within and around the proposal corridor include Badgerys Creek, Duncans Creek, Cosgroves Creek, Jerrys Creek and Mulgoa Creek. Of these, Badgerys Creek is located on Commonwealth Land in the vicinity of the planned western Sydney airport site. Clearing, agriculture and the construction of in-stream dams have affected the physical stability of Badgerys Creek at the airport site.

The proposed action would include the construction of new bridges and culverts at:

- The dairy farm north of Mersey Road, Bringelly
- Duncans Creek, Bringelly
- Adams Road, Luddenham.

There would not be any channelizing, diverting or impounding of waterways or substantial alteration of drainage patterns as a result of the proposed action. Clearing and earthworks would increase the surface area, and in some places the slope, of exposed soil surfaces adjacent to watercourses along the proposal corridor, potentially leading to increased erosion and associated water quality risks.

Previous studies conducted at the planned western Sydney airport site indicate that generally poor quality with limited beneficial use or environmental value aquatic habitats exist. Given the relatively shallow nature of construction of the proposed action, impacts to groundwater are likely to be minimal.

The proposed action is considered unlikely to significantly reduce the quantity, quality or availability of surface or ground water. Further information on watercourses located within the proposal corridor is provided in Section 3.3 (b).

Pollutants, chemicals, and toxic substances

Construction of the proposal may have short-term localised impacts on air quality as a result of clearing activities, stockpiling and managing of topsoil and other construction related activities leading to the creation of airborne dust on the Commonwealth Land areas although this would be no different to impacts expected elsewhere along the proposal corridor.

The upgrade of The Northern Road would increase the carrying capacity of The Northern Road to accommodate forecast traffic growth. This increase in traffic would have the potential to impact on local air quality through vehicle emissions. The potential air quality impacts of this increase in traffic would be assessed within the project EIS.

Construction and operation of the proposed action is unlikely to generate large quantities of smoke, fumes, chemicals, nutrients, or other pollutants which will substantially reduce local air quality or water quality.

Additionally, construction and operation of the project would not require the use of large quantities of explosive, toxic, radioactive, carcinogenic, or mutagenic substances.

Impacts on plants

Within the area of Commonwealth Land required for the proposed action, impacts to EPBC listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community are expected.

Calculations of the extent of direct clearing required are based on a 90 m buffer from the centre line of the road design, and represent a worst case scenario that has scope to be reduced at the detailed design stage. The proposed action would result in the direct clearing of approximately 19 hectares of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community within the Commonwealth Land areas associated with the Defence Establishment Orchard Hills and the western Sydney airport site. This clearing includes:

- 9.5 hectares of core Category A vegetation
- 10 hectares of Category C vegetation

These calculations are included in the overall impact to Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community outlined in Section 3.1(d). As outlined in Section 6.3 of this referral, the potential impact on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community is considered significant.

During the field surveys the endangered *Marsdenia viridiflora* subsp. *viridiflora* population was recorded in four locations (all relatively disturbed) adjacent to the current The Northern Road alignment on the Defence Establishment Orchard Hills fence.

Impacts on animals

Four of the 19 threatened fauna species identified in the EPBC PMST report were identified as having a moderate to high likelihood of occurring within the study area. These included:

- Regent Honeyeater
- Swift Parrot
- Large-eared Pied Bat
- Grey-headed Flying-fox.

A significant impact to these four species from the proposed action is considered unlikely, including on areas of Commonwealth Land. It is also considered unlikely that the proposed action would significantly impact any of the listed migratory species identified in Section 3.1(d).

Further detail on the potential impacts of listed EPBC communities and species is outlined in Section 3.1(d) and **Attachment B**.

Impacts on people and communities

The proposed action is part of the Western Sydney Infrastructure Plan, a package of major road infrastructure upgrades funded by the Australian and NSW governments to enable the development of western Sydney airport at Badgerys Creek, employment zones such as Western Sydney Priority Growth Area (WSPGA) and growth centres such as South West Priority Land Release Area (SWPLRA). As such, the proposed action would provide additional infrastructure for the Western Sydney region. Additionally, an upgrade of The Northern Road would increase safety for motorists and pedestrians and the broader community along the proposal corridor.

The proposed action would not result in a reduction in the availability of community services or infrastructure which have direct or indirect impacts on the environment, including water supply, power supply, roads, waste disposal, and housing. The proposed action is a combination of upgrading the existing The Northern Road and new alignment through rural, residential areas. This would not result in physical dislocation of individuals or communities.

Impacts on heritage

There is a potential for the proposed action to impact Commonwealth Heritage Places or other places recognised as having heritage values on Heritage Land.

The Orchard Hills heritage item is regarded as a core biodiversity area for conservation of Cumberland Plain Woodland, listed as an endangered ecological community at both State and Commonwealth level. The Orchard Hills Defence Establishment is also associated with the Mulgoa Irrigation Scheme established in 1890. There are remnants of the irrigation canal under The Northern Road. As yet the heritage values of the irrigation channels have not been fully identified or assessed. The irrigation canals will likely be impacted by the proposed action based on desktop assessment. Further site inspections are planned to support the preparation of the EIS.

Extensive searches of the OEH Aboriginal Heritage Information Management System (AHIMS) were undertaken for the areas surrounding the proposal corridor. These searches found a total of six Aboriginal heritage items within the proposal corridor. In addition to these search results, archaeological site investigations as part of the preparation of the EIS for the proposed action have identified a further 22 new Aboriginal heritage items. Of the identified Aboriginal items, eight are potentially located in Commonwealth Lands (7 along the edge of the existing The Northern Road within the Orchard Hills Defence Establishment and one near the planned western Sydney airport site).

Roads and Maritime will be preparing a detailed Cultural Heritage Assessment Report which will identify and investigate the Aboriginal archaeological and cultural heritage values along the proposal corridor and provide recommendation on any further archaeological work that may be required prior to construction. **Section 3.3** outlines other important features of the environment that may be impacted by the proposed action. For the proposed action, this included the entire proposal corridor including those areas within the identified Commonwealth Lands.

3.2 (e)

Is the proposed action to be taken in the Great Barrier Reef Marine Park?

X

No

Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))

Not applicable

3.3 Other important features of the environment

3.3 (a) Flora and fauna

The field survey identified the following TECs as listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) as occurring in the study area (refer **Table 3-12**).

Table 3-12 Threatened ecological communities listed under the NSW TSC Act present in the study area

Species	Status TSC Act	Occurrence in the study area	Potential impacts (ha)
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically endangered	This TEC occurs throughout the study area. Quality is variable from scattered canopy trees with mown or grazed understorey, to patches with mid-storey dominated by African Olive, to high quality patches with high native species richness and dominated by native species. Derived native grasslands are also present. There is approximately 69 hectares of this TEC in the study area. Table 3-15 identifies the extent and condition of Derived Native Grasslands within the study area.	51

Species	Status TSC Act	Occurrence in the study area	Potential impacts (ha)
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	This TEC is restricted to drainage lines and generally exists as small fragmented and poor quality remnants. The best examples occur on the Defence Establishment Orchard Hills. There is approximately 5 hectares of this TEC present in the study area.	5
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered	This TEC occurs scattered throughout the study area and is present as man-made dams. The highest quality patches of this TEC occur on the Defence Establishment Orchard Hills. There is approximately 13 hectares of this TEC in the study area.	8

The field survey identified the following threatened flora and fauna species and endangered populations listed under the TSC Act as occurring in the study area (refer **Table 3-13**).

Table 3-13 Threatened flora and fauna listed under the NSW TSC Act present in the study area

Species	Status TSC Act	Occurrence in the study area	Potential impacts
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Endangered population	During the field surveys the endangered <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> population was recorded in four locations (all relatively disturbed) adjacent to the current The Northern Road alignment (two locations on the Defence Establishment Orchard Hills fence, and roadside vegetation adjacent to 2509 Northern Road, and 2627 The Northern Road).	35 plants
<i>Pultenaea parviflora</i>	Vulnerable	Three plants of this species were recorded in two locations adjacent to the Northern Road.	3 plants
Swift Parrot	Endangered	Records are associated with PCT835, PCT849 and PCT850 and the fragments of higher quality shale hills woodland may be utilised by this species in winter. The survey program has not allowed for a dedicated winter survey for this species so presence has been assumed where suitable habitat occurs.	33 ha of potential foraging habitat
Regent Honeyeater	Critically endangered	Records are associated with PCT835, PCT849 and PCT850 and the fragments of higher quality shale hills woodland may be utilised by this species. This species has complex movement patterns and is most likely to be detected in and around the study area in late autumn to early spring. The survey program has not allowed for a dedicated winter survey for this species so presence has been assumed where suitable habitat occurs.	33 ha of potential habitat
Cumberland Plain Land Snail	Endangered	The targeted habitat condition assessment and searches for this species resulted in records of this species (alive and dead) within the study area. The higher quality areas of Cumberland Plain Woodland provide good habitat for this species.	20 ha of potential habitat

Threatened bats (Large-eared Pied Bat, Eastern Bentwing-bat, Eastern False Pipistrelle, Eastern Freetail-bat, Greater Broad-nosed Bat, Southern Myotis, and Yellow-bellied Sheathtail-bat)	Vulnerable	Habitat for these threatened bat species is widespread within the study area. Impacts based on clearing of all forest habitat and removal of farm dams and constructed wetlands	41 ha of potential habitat
Grey-headed Flying-fox	Vulnerable	This species is likely to forage in the woodlands and forests within the study area. Suitable flowering tree species are present which provide a foraging resource for this species. No roosting camps are present.	33 ha of potential habitat

3.3 (b) Hydrology, including water flows

The proposal corridor is located within the Hawkesbury-Nepean Catchment. The named waterways within and around the proposal corridor include Badgerys Creek, Duncans Creek, Cosgroves Creek, Jerrys Creek and Mulgoa Creek. Blaxland Creek, Surveyors Creek and Bringelly Creek are located close to the proposal corridor. The Nepean River runs parallel to the northern extent of The Northern Road about two to three kilometres to the west. Other unnamed drainage lines occur near the proposal corridor, many of which have been modified through a series of farms dams to support current and former agricultural activities.

The topography of the proposal corridor is relatively flat, with some areas prone to localised flooding. Flood prone land is present in the south west of the proposal corridor. It should be noted there are a large number of creeks crossing the proposal corridor and, therefore, localised flooding may occur in areas additional to those mapped.

Based on preliminary research, the waterways within the proposal corridor are deemed Class 2 or 3 waterways in accordance with Fairfull and Witheridge (2003) (see **Table 3-14**). Field surveys are currently being carried out to confirm these findings.

Table 3-14: Assessment of waterways within the proposal corridor

Waterway	Mulgoa Creek	Cosgroves Creek	Badgerys Creek	Jerry Creek	Duncans Creek
Class* 1	Class 2-3 Further investigation	Class 2-3 Further investigation	Class 2-3 Further investigation	Class 2-3 Further investigation	Class 2-3 Further investigation
Order* 2	1st Order	1st Order	1st Order	1st Order	1st Order
Key fish habitat* 3	Yes	Yes	Yes	Yes	Yes

*1 According to Fairfull and Witheridge (2003)

*2 According to Strahler (1952)

*3 According to DPI Fisheries mapping

3.3 (c) Soil and Vegetation characteristics

The topography of the proposal corridor is generally flat, with areas of steep topography located to the southwest of the proposal corridor.

The majority of the proposal corridor consists of Blacktown residual soils, with small patches of the erosion prone Luddenham soils in the southern half of the proposal corridor and two small patches of alluvial soils, one each at the northern and southern extents (Bannerman and Hazelton 1990). Richmond soils are found along parts of creek lines in the south west of the proposal corridor.

Blacktown soils are considered to offer poor soil drainage while Luddenham soils are considered to be highly susceptible to erosion (Bannerman and Hazelton 1990). An overlay of the proposal corridor on the Penrith 1:100 000 soil sheet map (Bannerman and Hazelton 1990) has been included in **Figure 3-2** and **Figure 3-3**.

Acid sulphate soils

No acid sulphate soils or areas currently considered potential acid sulphate soils are present within the proposal corridor.

Salinity

Patches of known salinity and other areas of moderate salinity potential are present within the proposal corridor. The entire The Northern Road proposal corridor is considered of low to moderate salinity potential (**Figure 3-4**).

The Northern Road - Soil Names

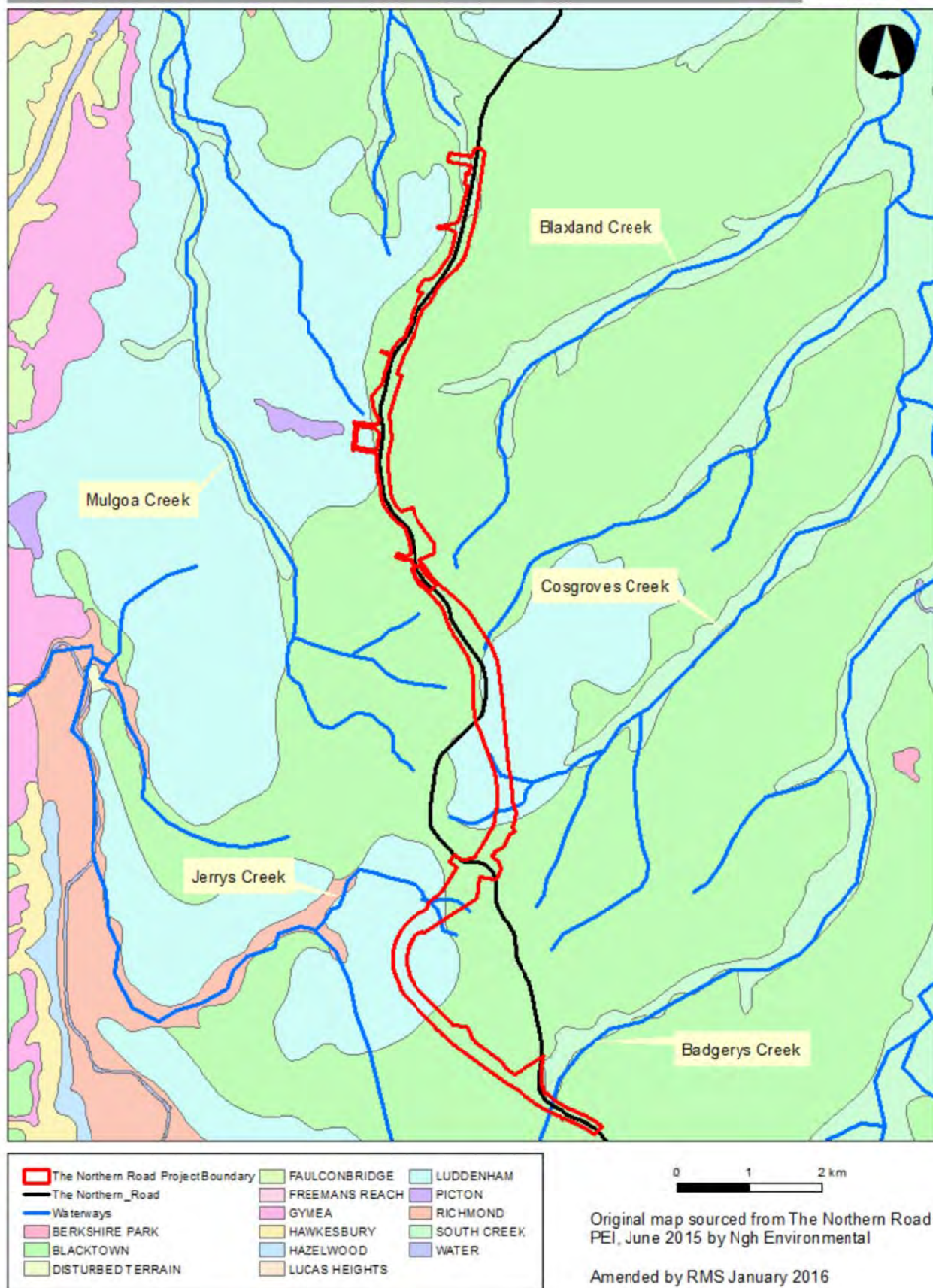


Figure 3-2 Soil names (source: Bannerman and Hazelton 1990)

The Northern Road - Soil Processes

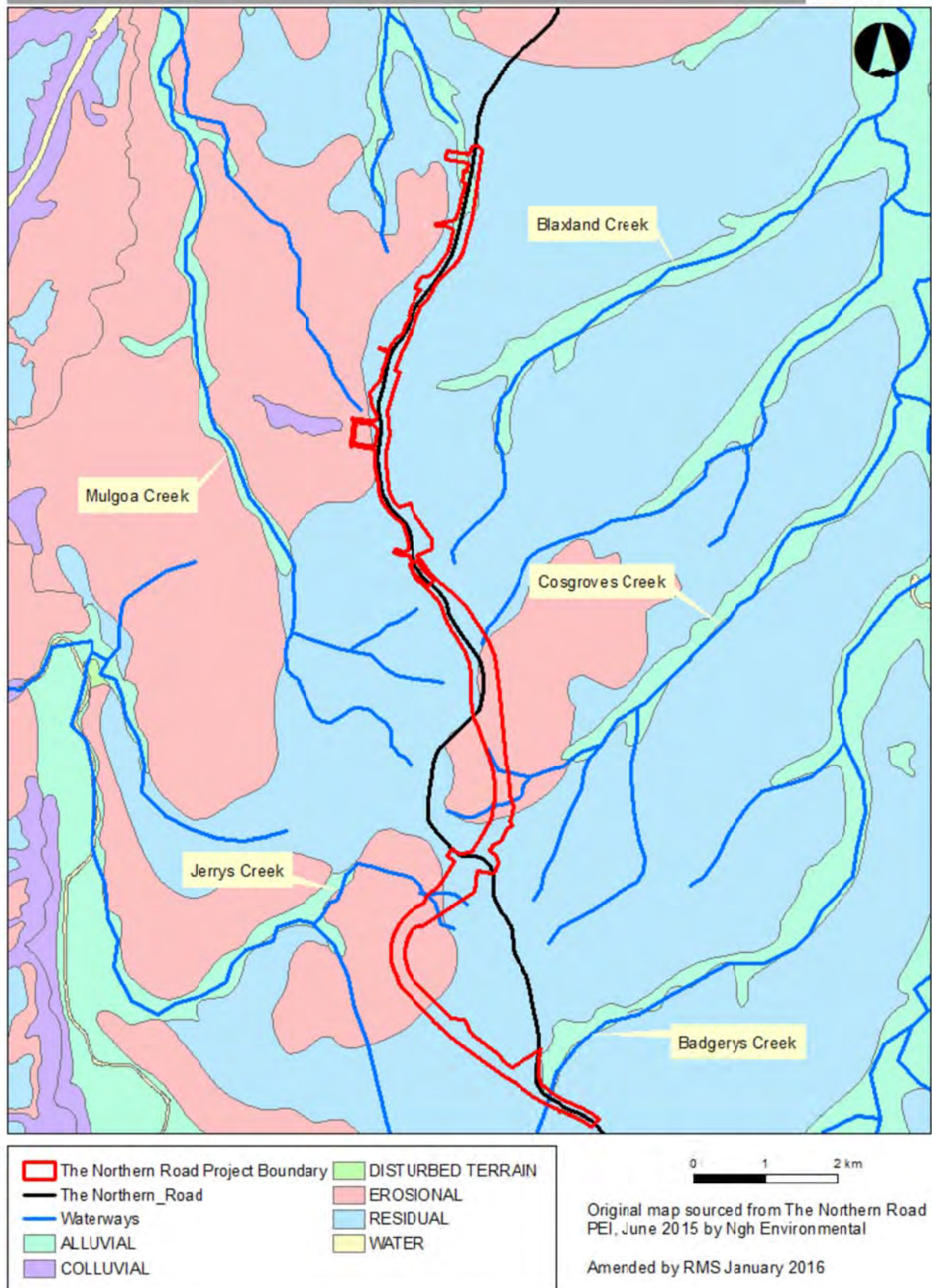


Figure 3-3 Soil processes (source: Bannerman and Hazelton 1990)

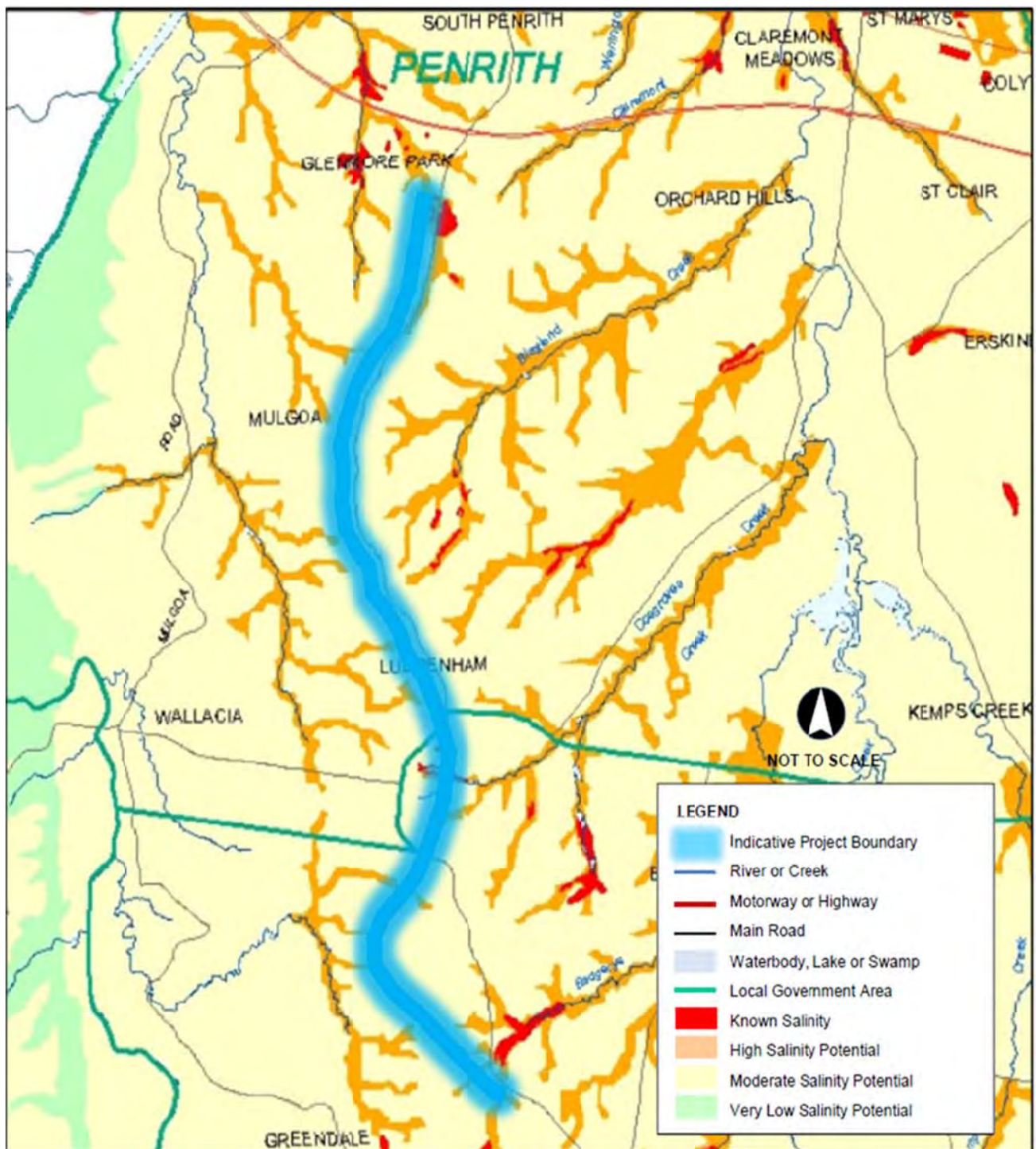


Figure 3-4 Salinity potential within the proposal corridor (source: DIPNR 2002)

3.3 (d) Outstanding natural features

The proposal corridor contains remnant natural bushland in varying degrees of condition (see section 3.1). There are no other outstanding natural features.

3.3 (e) Remnant native vegetation

The field survey identified the following PCTs as occurring in the proposal corridor (refer **Table 3-15**)

Table 3-15 Plant Community Types present in the proposal corridor

PCT name	PCT number	Condition*	Area (ha) in the proposal corridor
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	849	Moderate/Good	9
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	835	Moderate/Good	3
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	850	Moderate/Good	6
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	849	Low	8
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	850	Moderate/Good_Poor	5
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	835	Moderate/Good_Poor	2
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	850	Moderate/Good_High	3
Derived grasslands on shale hills of the Cumberland Plain (50-300m asl)	806	Moderate/Good_Derived grassland	37
Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion	1071	Moderate/Good_Other	13
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	850	Moderate/Good_Medium	1

Notes: * = Vegetation in Moderate/Good condition is all native vegetation that is not in low condition. Vegetation in Low condition is defined as:

- a) woody native vegetation with native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, and where either:
 - less than 50% of ground cover vegetation is indigenous species, or
 - greater than 90% of ground cover vegetation is cleared
- OR
- b) native grassland, wetland or herbfield where either:
 - less than 50% of ground cover vegetation is indigenous species, or
 - more than 90% of ground cover vegetation is cleared.

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

Not applicable

3.3 (g) Current state of the environment

The land impacted by the proposed action varies both in use and condition. The main sections with the proposed action area are:

- Glenmore Parkway, Glenmore Park to Littlefields Road, Luddenham - This section of the proposed action is located in a predominately rural residential environment. Large lot rural residential properties occur on both sides of the alignment as well as some commercial premises. A golf course and the Defence Establishment Orchard Hills are also located in this section. The majority of the land has been cleared of trees and other vegetation and replaced with grassed areas (i.e. lawns, pastures, golf courses, landscaping). Other flora species primarily consist of planted exotic and native garden and landscaping species. There are some large patches of remnant vegetation especially within the road reserve and the Defence Establishment Orchard Hills.
- Littlefields Road, Luddenham to Mersey Road, Bringelly – The section of the proposed action is located in a rural residential and rural landscape. Most of the native vegetation has been cleared for pasture or other agricultural enterprises. Weed infestation is significant in some areas. There are some large patches of remnant vegetation especially on some rural residential properties.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

The PMST and the following non-Aboriginal heritage databases have been searched:

- Protected Matters Search Tool (DoE 2015)
- World Heritage List (sourced from Australian Heritage Database)
- National Heritage List (sourced from Australian Heritage Database)
- Commonwealth Heritage List (sourced from Australian Heritage Database)
- NSW State Heritage Register (sourced from State Heritage Inventory)
- Liverpool LEP 2008 (sourced from State Heritage Inventory)
- Penrith LEP 2010 (sourced from State Heritage Inventory).

The search results are summarised in **Table 3-16**.

Table 3-16 Commonwealth Heritage places and other heritage value areas

Heritage Register	Listings
World Heritage List	None
Commonwealth Heritage List	Orchard Hills Cumberland Plain Woodland
National Heritage List	None
NSW State Heritage Register	None
RMS Section 170 Heritage and Conservation Register	None
Liverpool LEP	1970051 - Lawson's Inn Site 1970085 - Luddenham Public School 1970098 - Vicary's Winery Group 1970453 - Vicary's Winery Horse Shed (Former) 1970454 - Vicary's Winery Main House and Garden 1970159 - Vicary's Winery Vineyard 1970162 - Vicary's Winery Woolshed 1970178 - Vicary's Winery, Wine Tasting and Cellar Door Sales Building
Penrith LEP	2260116 - Brick Cottage 2260117 - Brick Cottage 2260118 - Timber Cottages 2260119 - Luddenham Progress Hall 2260120 - Luddenham Uniting Church 2260121 - Luddenham Uniting Church Cemetery 2260122 - St. James Church of England 2260123 - St. James Church of England Cemetery

Sixteen of the identified heritage items above are located in Luddenham and there is not expected to be any impact to these sites. It was noted that the Vicary's Winery Group listing included all individually listed buildings and structures within the same property. However, these items are still individually listed as the Vineyard, Woolshed, Horse Shed, Wine Tasting and Cellar Door Sales building and the Main Homestead.

The Orchard Hills heritage item is regarded as a core biodiversity area for conservation of Cumberland Plain Woodland, listed as an endangered ecological community at both State and Commonwealth level. The Orchard Hills Defence Establishment site is also associated with the Mulgoa Irrigation Scheme established in 1890. There are remnants of the irrigation canal under The Northern Road. As yet, the heritage values of the irrigation channels have not been identified or assessed.

The irrigation canals may be impacted by the proposed action based on desktop assessment. Further site inspections are planned to support the preparation of the EIS.

Implementation of standard approaches is expected to mitigate and manage the potential non-Aboriginal heritage impacts identified. Standard management and safeguard measures would be detailed in the Environmental Impact Statement for the proposed action. These would include:

- Where direct impact cannot be avoided, photographic archival recording would be undertaken in accordance with the Heritage Council of NSW guidelines
- Avoidance of impacts during construction through implementing no-go zones and informing workers of management and mitigation measures
- Implementation of an unexpected finds procedure for unidentified relics or sites encountered during construction
- Monitoring of indirect impacts during construction such as vibration in the vicinity of heritage items.

3.3 (i) Indigenous heritage values

Extensive searches of the OEH Aboriginal Heritage Information Management System (AHIMS) were undertaken for the areas surrounding the proposed action. These searches were undertaken on 7 August 2015 and 2 September 2015 respectively. These searches found a total of six Aboriginal heritage items within the proposal corridor. In addition to these search results, archaeological site investigations as part of the preparation of the EIS for the proposed action have identified a further 22 new Aboriginal heritage items. A summary of both the existing AHIMS search results as well as the new Aboriginal heritage items are included in **Table 3-17**.

Table 3-17: Summary of AHIMS search within The Northern Road proposal corridor

Site ID	Site name	Site context	Site feature
45-5-2636	B 6	Open Site	Artefact
45-5-4573	M4-17A Northern Road East	Open Site	Artefact
45-5-4574	M4-17B Northern Road East	Open Site	Artefact
45-5-4571	M4-17C Northern Road East	Open Site	Artefact
45-5-0408	Mulgoa Mulgoa 1	Open Site	Artefact
45-5-2484	Northern Road	Open Site	Artefact
New Recording	TNR-05	Open Site	Artefact
New Recording	TNR-06	Open Site	Artefact
New Recording	TNR-07	Open Site	Artefact
New Recording	TNR-08	Open Site	Artefact
New Recording	TNR-09	Open Site	Artefact
New Recording	TNR-10	Open Site	Artefact
New Recording	TNR-11	Open Site	Artefact
New Recording	TNR-12	Open Site	Artefact
New Recording	TNR-13	Open Site	Artefact
New Recording	TNR-14	Open Site	Artefact
New Recording	TNR-15	Open Site	Artefact
New Recording	TNR-PAD-01	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-02	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-03	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-04	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-05	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-06	Open Site	Potential Archaeological Deposit

New Recording	TNR-PAD-07	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-08	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-09	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-10	Open Site	Potential Archaeological Deposit
New Recording	TNR-PAD-11	Open Site	Potential Archaeological Deposit

As of November 2015, there were no Native Title claims in the proposal corridor, with no other current claims in the proposal corridor identified in the National Native Title Tribunal Register.

Roads and Maritime will prepare an Aboriginal Cultural Heritage Assessment Report in line with *Roads and Maritime Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI). The assessment will identify steps to avoid and minimise impacts:

- Summarise the findings and recommendations of the PACHCI Archaeological Survey Reports
- Identify and investigate the Aboriginal archaeological and cultural heritage values that are known or are predicted to be present by carrying out field surveys, test excavations and consultation with the registered Aboriginal stakeholders and Aboriginal knowledge holders, as required
- Prepare an assessment of known and potential impacts to Aboriginal objects, places and cultural values resulting from the construction and implementation of the proposed action
- Identify feasible and reasonable mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the measures)
- Prepare Aboriginal heritage constraints mapping
- Provide recommendation on any further archaeological work that may be required prior to construction.

3.3 (j) Other important or unique values of the environment

There are no National Parks or State Forest Areas located in or adjacent to the proposal corridor.

The proposal corridor does not include land reserved under the *National Parks and Wildlife Act 1974* or land or development regulated by State Environmental Planning Policy No. 14 - Coastal Wetlands, State Environmental Planning Policy No. 26 - Littoral Rainforests or State Environmental Planning Policy (State and Regional Development) 2011.

3.3 (k) Tenure of the action area (eg freehold, leasehold)

All land within the proposal corridor is freehold. Land owners within the proposal corridor include:

- Roads and Maritime
- Penrith City Council
- Liverpool City Council
- Department of Defence
- Australian Government
- Commercial and private properties.

Roads and Maritime will partially or fully acquire any properties that are permanently directly impacted by the proposal. In addition, Roads and Maritime may lease lands that would be suitable for ancillary facilities (construction compounds, set-down areas, etc)

3.3 (l) Existing land/marine uses of area

The proposal corridor is within the Penrith City Council and the Liverpool City Council LGAs. Land use in the proposal corridor is characterised by a mixture of low density residential, rural, commercial, defence, recreational and transport uses. While land clearing has occurred, remnant vegetation is still present within the proposal corridor. Land uses generally comprise:

- Private properties, including residential and businesses
- Farm land (primary production)
- Commonwealth land (the Defence Establishment Orchard Hills) – located along The Northern Road

- Commonwealth land (planned western Sydney airport site) – located in the south of the proposal corridor, south of Elizabeth Drive
- Public places such as schools (Luddenham Public School, Penrith Christian School and Mary Mackillop Primary School) and churches
- Recreational areas including Penrith Golf and Recreation Club, Orchard Hills Golf Club, Luddenham Showground, Sales Park, Wilmington Reserve and Freeburn Park.

Land use zones identified under the *Liverpool Local Environmental Plan 2008* and *Penrith Local Environmental Plan 2010* are outlined in Table 3-18.

Table 3-18 Land zones within the proposal corridor

LEP	Land Zone
<i>Liverpool Local Environmental Plan 2008</i>	<ul style="list-style-type: none"> • RU1 Primary Production • RU4 Rural Small Holdings • B1 Neighbourhood Centre • SP1 Special Activities • SP2 Infrastructure • RE1 Public recreation • R2 Low Density Residential • R5 Large Lot Residential
<i>Penrith Local Environmental Plan 2010</i>	<ul style="list-style-type: none"> • B6 Enterprise corridor • RU1 Primary Production • RU2 Rural Landscape • RU4 Primary Production Small Lots • RU5 Village • R2 Low Density Residential • R5 Large Lot Residential • SP1 Special Activities • SP2 Infrastructure • E2 Environmental Conservation • E3 Environmental Management • E4 Environmental Living • RE1 Private Recreation • RE2 Private Recreation

3.3 (m) Any proposed land/marine uses of area

Significant areas of current and future development are also located in or near the proposal corridor including:

South West Priority Land Release Area

The South West Priority Land Release Area (SWPLRA) is a major greenfield release area designed to meet anticipated housing demand within Sydney. Covering about 17,000 hectares across the Liverpool, Camden and Campbelltown LGAs, the growth centre will establish 18 new residential precincts and include about 110,000 new dwellings and over 300,000 residents. This represents an almost 75 percent increase over existing population levels to be realised over the next 30 years. This development will include establishment of new town centres at Leppington, Bringelly, Oran Park and Catherine Field, and is anticipated to generate over 20,000 new jobs within the area.

Western Sydney Priority Growth Area (WSPGA)

Identified as part of the draft Metropolitan Strategy for Sydney to 2031, the Western Sydney Priority Growth Area (WSPGA) identifies about 10,000 hectares of currently low intensity rural activity lands to be developed as a diverse employment centre, providing businesses in the region with land for industry and employment, catering for transport and logistics, warehousing and office space. Extending from the intersection of the M4 Western and M7 Motorways, to south of The Northern Road / Elizabeth Drive intersection, the WSPGA is anticipated to provide over 57,000 jobs over the next 30 years, and over 200,000 jobs once it is fully

established. The re-development of this area will involve substantial changes to the existing local road network, as well as placing significant pressure on arterial roads that will service the employment area.

Planned western Sydney airport

The development of the planned western Sydney airport was announced by the Australian Government in April 2014. The planned western Sydney airport will be located to the south of Elizabeth Drive and the east of the Luddenham town centre, and will result in increased traffic volumes using the regional road network. It is planned that the western Sydney airport would commence passenger flight operations in 2025 with about three million passengers per year (Department of Infrastructure and Regional Development, 2015).

4 Environmental outcomes

The following environmental outcomes, relevant to Matters of National Environmental Significance, would be achieved as a result of the proposed Action:

- No impacts to the World Heritage values of a declared World Heritage property.
- No impacts to the National Heritage values of a National Heritage Place.
- No impacts to the ecological character of a declared Ramsar wetland.
- No significant impacts to listed migratory species.
- No impacts to the environment in a Commonwealth marine area.
- No impacts to the Great Barrier Reef Marine Park.
- No significant impacts to a water resource, in relation to coal seam gas development and large coal mining development.

As outlined within this Referral (section 6.3) MNES likely to be impacted by the proposed action include potential impacts to listed threatened species and communities (sections 18 and 18A). Additionally, the proposal may impact parcels of Commonwealth land. The proposed action would not impact upon the ongoing use or purpose of the remainder of those parcels of land for Commonwealth purposes (i.e. Defence or Finance and Deregulation purposes). Furthermore, the proposed action would also not preclude any future use or substantial (re)development of the remainder of those parcels of land.

Due to the nature of the action and the predicted impacts, residual impacts are likely. There is likely to be a significant impact to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological communities. The biodiversity impacts of the action will be assessed according to the FBA which requires the preparation of a Biodiversity Offsets Strategy (BOS). The BOS will be developed with reference to the EPBC Act environmental offsets policy and the Offsets Assessment Guide.

It is anticipated that a Biobanking Assessment Report and Agreement Application could be finalised and submitted to the NSW Office of Environment and Heritage and the Department of Environment within 12 months of approval of the action.

The proposed action would require about 58 ha of Commonwealth land to be transferred. Upon transfer of the required land there are not expected to be any further impacts to Commonwealth Lands.

5 Measures to avoid or reduce impacts

Environmental considerations have been integrated into decision-making processes throughout the planning, options development and design of the proposed action, including application of the principles of avoiding, minimising and mitigating impacts. Measures to avoid, mitigate and offset impacts will be developed as part of the environmental impact assessment process.

The route selection process focused on avoiding or minimising clearing of native vegetation. The clearing figure for vegetation is likely to be revised further downwards as the construction footprint and buffer is further refined during detailed design and construction.

Environmental impacts have been identified on the basis of the concept design developed for the proposed action. Ways to minimise potential impacts to the environment would continue to be identified during the detailed design, construction, and operation stages of the proposed action.

Where design features are unable to avoid environmentally sensitive areas, measures to minimise and manage the direct and indirect potential impacts during construction and operation of the proposed action are being considered.

An Environmental Management Plan would be developed for the proposed action and would include the following sections related to management of environmental impacts:

- Staff induction and environmental awareness training
- Staff roles and responsibilities relative to environmental activities, reporting and compliance
- A series of management imperatives to address issues such as clearing of vegetation, sediment and erosion control, minimisation of noise, dust and light nuisance, safe driving and speed limits, behaviour code of practice.

Matters of National Environmental Significance

The necessity of undertaking the proposed action, including consideration of route options, alternatives and constraints, recognised the environmental sensitivities of the area. The scale and nature of works, particularly near the Luddenham and the planned western Sydney airport bypass means that it would not be feasible to avoid all impacts, especially with respect to vegetation clearance and impacts to Commonwealth Land. Steps have been taken during the design of the concept to minimise potential impacts, including modifications to design aimed at limiting impacts on Commonwealth Land and biodiversity values.

During the development of the design and the preparation of the EIS, further opportunities to avoid and minimise impacts to areas of ecological value will be explored. Roads and Maritime will carry out an assessment of impact on the ecological values of the proposal site and adjoining areas including terrestrial, riparian and aquatic areas. The assessment will be undertaken by an accredited consultant in accordance with the NSW Biodiversity Offsets Policy for Major Projects, including the Framework for Biodiversity Assessment.

Preparation of the EIS will include consideration of potential impacts to nationally listed species and ecological communities biodiversity. This will include use of relevant Commonwealth threatened species survey guidelines, application of the *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DoE, 2013), and consideration of applicable recovery plans, threat abatement plans and conservation guidance.

Where ecological impacts cannot be avoided or minimised through design, additional mitigation measures will be developed and documented in the EIS in accordance with Roads and Maritime Biodiversity Guidelines. Implementation of mitigation measures would occur as part of a project Construction Environmental Management Plan (CEMP). Standard mitigation measures will be implemented during construction, including:

- Pre-clearing surveys
- Exclusion zones to protect threatened flora and fauna populations
- Staged habitat removal or relocation of threatened species
- Management of unexpected species finds
- Management of invasive species, pests and diseases

- Measures to restore habitat features
- Landscape rehabilitation.

Offsetting

As part of the development of the EIS, a BOS is currently being developed in accordance with the NSW OEH's NSW biodiversity offsets policy for major projects. The BOS will be developed with reference to the *EPBC Act environmental offsets policy* and the *Offsets Assessment Guide* and be informed by the vegetation condition assessment and Biobanking Credit Calculator.

Other environmental issues

Specific measures to avoid, reduce or offset impacts associated with the construction and operation of the proposal in relation to other environmental issues would be identified as part of the EIS developed for the proposal. The EIS must meet the minimum form and content requirements in clauses 6 and 7 of Schedule 2 the Environmental Planning and Assessment Regulation 2000 and the EPBC Act. This will include identifying measures to avoid, minimise and if necessary, offset the predicted impacts, including detailed contingency plans for managing any significant risks to the environment. Likely mitigation measures relevant to the proposal are outlined below.

Traffic and transport

The Northern Road is a north-south arterial road in western Sydney connecting the South West Priority Land Release Area to the M4 Motorway and Penrith. Within the proposal area the existing road is generally a two-lane road with a speed limit of 80 kilometres per hour.

Roads and Maritime will carry out a more detailed assessment of the traffic, access and safety impacts of the proposal. The assessment will use traffic modelling to assess traffic impacts associated with the construction and operation of the proposal. The assessment will identify traffic impacts and undertake an assessment of existing local and regional traffic volumes and traffic patterns against forecast volumes and potential changes to traffic patterns associated with the proposal. The assessment will include:

- An assessment of interchange, intersection, road link and network capacity options to provide clear recommendations for input into the design
- Assessment of the traffic related impacts arising from construction vehicles as well as any changes in the road network as a result of construction activities
- Assessment of the traffic related impacts generally arising from completion of the proposal (the 'do something') as well as those that could be expected from the 'do nothing/do minimal' scenario, including assessment of impacts of the proposal on road users such as motorists, public transport, pedestrians and cyclists
- Analysis of historical crash data to ascertain the safety of the road network as well as outline the improvement in crash safety that would be likely to result from construction of the proposal
- Consideration of the future development of the Outer Sydney Orbital (M9) and potential access to the route, where possible
- Consideration of the future development of freight and passenger rail lines, where possible.

Noise and vibration

An assessment of the noise impacts of the proposal during operation, consistent with the Road Noise Policy (EPA 2011), NSW Industrial Noise Policy (EPA 2000) and relevant guidelines would be undertaken as part of the EIS with specific consideration of impacts to receivers. This assessment will identify reasonable and feasible mitigation measures to reduce noise on adjacent receivers that could include low noise pavement design, noise barriers and property treatments.

Roads and Maritime will carry out an assessment of the construction and operational noise and vibration impacts of the proposal. The assessment will:

- Describe the existing noise environment within the proposal corridor and surrounds, including baseline road traffic and background noise levels
- Assess noise and vibration impacts during construction and operation, on the identified sensitive receivers. The assessment of operational noise impacts will be carried out in accordance with the *NSW Roads and Maritime Environmental Noise Management Manual* (ENMM) or an updated iteration, *NSW Road Noise Policy 2011*, and *Australian Standard AS2702-1984: "Acoustics – Methods for the Measurement of Road Traffic Noise"*. The construction noise and vibration assessment will be carried out in accordance with the *NSW Interim Construction Noise Guideline (ICNG)*, and *Assessing Vibration: A Technical Guideline*
- Identify feasible and reasonable noise mitigation measures to address noise exceedances at sensitive receivers. Requirements for noise walls and other design features to minimise noise would need to be considered at the concept design stage in accordance with the *Roads and Maritime Noise Mitigation Guideline* (RMS 2015a).

Soils, water and hydrology

Erosion control measures would need to be implemented prior to and during construction to ensure sediment and pollutant loads do not have detrimental downstream effects. Additionally, run-off volumes from the additional impervious surfaces would need to be managed through the provision of appropriately engineered storm water retention ponds. Roads and Maritime will carry out an assessment of impacts on soils and water quality including providing recommendations for erosion and sediment control measures during construction and operation of the proposal. Recommendations will be consistent with the *Managing Urban Stormwater: Soils and Construction volume 1 and volume 2* series published by the former NSW Department of Environment and Climate Change (DECC) in 2008.

Roads and Maritime would also carry out a detailed assessment of the flooding impacts of the proposal. The assessment would describe the existing flood and drainage conditions in catchments relevant to the proposal and establish existing scenario flood levels and velocities for a range of design storm events. Flood and hydrology assessment have also provided input into the concept design to ensure the design meets required flood management objectives the proposal objective of providing minimum 20 year average recurrence interval flood immunity, and identify feasible and reasonable mitigation measures to minimise impacts to flooding.

Aboriginal and Non-Aboriginal Heritage

As part of the initial investigations, Aboriginal heritage assessments have commenced. This has included consultation and field work with the relevant Local Aboriginal Land Councils (LALCs). Further consultation with Aboriginal stakeholders is planned based around the Roads and Maritime PACHCI.

Statements of Heritage Impacts will be prepared for all identified Non-Aboriginal heritage items which could be directly or indirectly impacted by the proposal. This will include feasible and reasonable management measures including measures to avoid significant impacts, where possible.

Socio-economic

Roads and Maritime will carry out a socio-economic impact assessment in accordance with the current '*RMS - Environmental Planning and Impact Assessment Practice Note for Socio-Economic Assessment*', which will consider the construction and operational stages of the proposal, including the positive and negative, direct and indirect impacts. The assessment will identify feasible and reasonable management and safeguard measures, including measures to enhance the proposal's benefits to avoid, manage or mitigate its potential impacts.

Air Quality

Roads and Maritime will carry out an air quality investigation to evaluate the impact of emissions of key pollutants to inform mitigation and management measures for the design and operation of the proposal. The investigation will be based on the findings of the modelling, including all details of the methodology and comparisons with the relevant air quality assessment criteria for both the 'do minimum' and 'preferred option' scenarios. The assessment will identify feasible and reasonable management measures (particularly dust suppression measures) to be implemented.

6 Conclusion on the likelihood of significant impacts

6.1 Do you THINK your proposed action is a controlled action?

<input type="checkbox"/>	No, complete section 6.2
<input checked="" type="checkbox"/>	Yes, complete section 6.3

6.2 Proposed action IS NOT a controlled action.

Not applicable

6.3 Proposed action IS a controlled action

Matters likely to be impacted

<input type="checkbox"/>	World Heritage values (sections 12 and 15A)
<input type="checkbox"/>	National Heritage places (sections 15B and 15C)
<input type="checkbox"/>	Wetlands of international importance (sections 16 and 17B)
<input checked="" type="checkbox"/>	Listed threatened species and communities (sections 18 and 18A)
<input type="checkbox"/>	Listed migratory species (sections 20 and 20A)
<input type="checkbox"/>	Protection of the environment from nuclear actions (sections 21 and 22A)
<input type="checkbox"/>	Commonwealth marine environment (sections 23 and 24A)
<input type="checkbox"/>	Great Barrier Reef Marine Park (sections 24B and 24C)
<input type="checkbox"/>	A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
<input checked="" type="checkbox"/>	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
<input type="checkbox"/>	Protection of the environment from Commonwealth actions (section 28)
<input type="checkbox"/>	Commonwealth Heritage places overseas (sections 27B and 27C)

The decision to refer this proposal to the Department of Environment is based on the potential impacts to listed threatened species and communities (sections 18 and 18A) identified in section 3.1 of this document.

Based on the assumed, significant level of impact to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community, it has been concluded that the proposal is likely to have a significant ecological impact and is, therefore, a controlled action.

7 Environmental record of the responsible party

	Yes	No
<p>7.1 Does the party taking the action have a satisfactory record of responsible environmental management?</p> <p>Provide details</p> <p>Roads and Maritime is the proponent and has a strong history of working to ensure that road proposals first avoid impacts as the highest priority, and where impacts are likely, of taking steps to minimise, mitigate and offset such impacts.</p> <p>Roads and Maritime has engaged appropriately qualified and experienced ecologists to undertake environmental assessments for the proposal to ensure impacts to the environment are comprehensively considered and impacts avoided or minimised wherever possible.</p>	X	
<p>7.2 Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?</p> <p>If yes, provide details</p> <p>Yes. Roads and Maritime works closely with key NSW regulatory agencies including the EPA and OEHL to ensure compliance with statutory requirements but has occasionally been subject to legal proceedings with respect to environmental matters.</p>	X	
<p>7.3 If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?</p> <p>If yes, provide details of environmental policy and planning framework</p> <p>Roads and Maritime has set the environmental direction for the organisation in its Corporate Framework which seeks to minimise impacts on the natural, cultural and built environment from road use and Roads and Maritime activities.</p> <p>Roads and Maritime commitment to meeting this priority is demonstrated in its environmental policy and the environmental considerations incorporated into its activities. Roads and Maritime has detailed procedures and guidelines for undertaking environmental assessment of its activities, including specific requirements for biodiversity assessment, mapping biodiversity impacts during construction and offsetting unavoidable impacts.</p>	X	
<p>7.4 Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?</p> <p>Provide name of proposal and EPBC reference number (if known)</p> <ul style="list-style-type: none"> • WestConnex – New M5 2015/7520 • Pacific Highway upgrade, Oxley Highway to Kempsey 2012/6518. • Pacific Highway upgrade, Woolgoolga to Ballina 2012 6394. • Olympic Highway realignment, Kapooka 2013/6596. • Forty Bends, Lithgow 2013/6804. • Bells Line of Road 2014/7346. 	X	

8 Information sources and attachments

8.1 References

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Roads and Maritime/ Jacobs 2015, Rapid Biodiversity Assessment Stage 4: Methods and Findings
Threatened Species Scientific Committee (2008). *Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest*. [Online]. Department of the Environment, Water, Heritage and the Arts. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts. Available from:
<http://www.environment.gov.au/biodiversity/threatened/communities/pubs/112-listing-advice.pdf>.

8.2 Reliability and date of information

The information in this referral has been compiled directly from information prepared specifically for The Northern Road Upgrade, Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park. The information has generally been gathered between 2013 and 2016 and based on a combination of desktop assessment /database searches and targeted field investigations. Where required, the type, location and date of database searches has been outlined within this Referral. Additional studies, literature and reports used as background information are referenced in section 8.1 of this Referral

Further field investigations are being undertaken in support of the preparation of an Environmental Impact Statement for the proposal and to verify the reliability of information gathered in assessing the proposal to this point.

8.3 Attachments

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Figures provided within this document.
	GIS file delineating the boundary of the referral area (section 1)	✓	
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Figures provided within this document. Attachment C: Protected Matters Search Tool (dated 03/11/2015)
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)		Attachment D: <i>SSI 7127 Secretary's Environmental Assessment Requirements – The Northern Road Upgrade Stages 3 and 4</i>
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)	✓	Attachment E: <i>Western Sydney Infrastructure Plan - The Northern Road Upgrade Glenmore Parkway, Glenmore Park to Mersey Road, Bringelly – Amended State Significant Infrastructure Application report (Roads and Maritime, 2016)</i>
	copies of any flora and fauna investigations and surveys (section 3)		
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)		
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)		

9 Contacts, signatures and declarations

Project title:

9.1 Person proposing to take action

1. Name and Title:

Kevin Doherty, General manager, Western Sydney Program Office

2. Organisation NSW Roads and Maritime

3. EPBC Referral Number

4: ACN / ABN 76 236 371 088

5. Postal address PO Box 973, Parramatta, 2124

6. Telephone: 131 782

7. Email:

8. Name of proposed
proponent (if not the
same person at item 1
above :

not applicable.

9. ACN/ABN of proposed
proponent (if not the
same person named at
item 1 above):

not applicable.

I qualify for exemption
from fees under section
520(4C)(e)(v) of the
EPBC Act because I am:

not applicable.

If you are small business
entity you must provide
the Date/Income Year
that you became a small
business entity:

not applicable.

[Note: You must advise the Department within 10 business days if you cease to be a small business entity. Failure to notify the Secretary of this is an offence punishable on conviction by a fine \(regulation 5.23B\(3\) *Environment Protection and Biodiversity Conservation Regulations 2000* \(Cth\)\).](#)

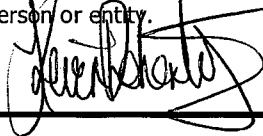
I would like to apply for a
waiver of full or partial
fees under Schedule 1,
5.21A of the [EPBC
Regulations](#). Under sub
regulation 5.21A(5), you
must include information
about the applicant (if
not you) the grounds on
which the waiver is
sought and the reasons
why it should be made:
Declaration

not applicable.

I declare that to the best of my knowledge the information I have given on, or attached

to this form is complete, current and correct.
I understand that giving false or misleading information is a serious offence.
I agree to be the proponent for this action.
I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.

Signature



Date 12-4-16

9.2 Person preparing the referral information (if different from 8.1)

Name Damian Williams
Title Associate Environmental Consultant
Organisation Jacobs Australia Pty Ltd
ACN / ABN (if applicable) 37001024095
Postal address 100 Christie Street, St Leonards NSW 2065
Telephone +61 (02) 9032 1300
Email Damian.williams@jacobs.com
Declaration I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct.
I understand that giving false or misleading information is a serious offence.

Signature



Date

11/04/2016

REFERRAL CHECKLIST

HAVE YOU:

- ✓ Completed all required sections of the referral form?
- ✓ Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- ✓ Provided a map showing the location and approximate boundaries of the project area?
- ✓ Provided a map/plan showing the location of the action in relation to any matters of NES?
- ✓ Provided a digital file (preferably ArcGIS shapefile, refer to guidelines at [Attachment A](#)) delineating the boundaries of the referral area?
- ✓ Provided complete contact details and signed the form?
- ✓ Provided copies of any documents referenced in the referral form?
- ✓ Ensured that all attachments are less than three megabytes (3mb)?
- ✓ Sent the referral to the Department (electronic and hard copy preferred)?

Attachment A

Geographic Information System (GIS) data supply guidelines

If the area is less than 5 hectares, provide the location as a point layer. If the area greater than 5 hectares, please provide as a polygon layer. If the proposed action is linear (eg. a road or pipeline) please provide a polyline layer.

GIS data needs to be provided to the Department in the following manner:

- Point, Line or Polygon data types: ESRI file geodatabase feature class (preferred) or as an ESRI shapefile (.shp) zipped and attached with appropriate title
- Raster data types: Raw satellite imagery should be supplied in the vendor specific format.
- Projection as GDA94 coordinate system.

Processed products should be provided as follows:

- For data, uncompressed or lossless compressed formats is required - GeoTIFF or Imagine IMG is the first preference, then JPEG2000 lossless and other simple binary+header formats (ERS, ENVI or BIL).
- For natural/false/pseudo colour RGB imagery:
 - If the imagery is already mosaiced and is ready for display then lossy compression is suitable (JPEG2000 lossy/ECW/MrSID). Prefer 10% compression, up to 20% is acceptable.
 - If the imagery requires any sort of processing prior to display (i.e. mosaicing/colour balancing/etc) then an uncompressed or lossless compressed format is required.

Metadata or 'information about data' will be produced for all spatial data and will be compliant with ANZLIC Metadata Profile. (http://www.anzlic.org.au/policies_guidelines#guidelines).

The Department's preferred method is using ANZMet Lite, however the Department's Service Provider may use any compliant system to generate metadata.

All data will be provide under a Creative Commons license (<http://creativecommons.org/licenses/by/3.0/au/>)