The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement

December 2017

Prepared for
Roads and Maritime Services
By Jacobs Australia
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Executive summary

The project

Roads and Maritime Services (Roads and Maritime) propose to upgrade 16 km of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park (the project). Key features of the project are summarised below:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Glenmore Park (two general traffic lanes and a kerbside bus lane in each direction). A wide central median would allow for an additional travel lane in each direction in the future, if required
- An eight-lane divided road between Bradley Street, Glenmore Park and just south of Glenmore Parkway, Glenmore Park (three general traffic lanes and a kerbside bus lane in each direction separated by a central median)
- About eight kilometres of new road between Mersey Road, Bringelly and just south of the existing Elizabeth Drive, Luddenham to realign the section of The Northern Road that currently runs through the Western Sydney Airport site
- About eight kilometres of upgraded and widened road between the existing Elizabeth Drive, Luddenham and just south of Glenmore Parkway, Glenmore Park
- Access to the Luddenham town centre from north of the realigned The Northern Road and the existing The Northern Road
- Twin bridges over Adams Road, Luddenham
- Four new traffic light intersections and new traffic lights at existing intersections
- Local road changes and upgrades to current access arrangements for businesses and private properties
- A new shared path for pedestrians and cyclists on the western side of The Northern Road and footpaths on the eastern side of The Northern Road where required.

To meet the requirements of both the Commonwealth and State planning approval processes for the proposed upgrade, Roads and Maritime prepared a single document acting as both the NSW Environmental Impact Statement and the Commonwealth Draft Environmental Impact Statement for the project.

Roads and Maritime, as the proponent of the project, has prepared this Final EIS to meet requirements under Part 8 of the EPBC Act and to respond to issues raised in submissions received during the exhibition of the draft EIS, as well as describe and assess proposed changes and design refinements to the project.

Draft environmental impact statement exhibition

With approval from the Commonwealth Department of the Environment and Energy (Commonwealth DoEE), the draft EIS was exhibited by the NSW Department of Planning and Environment (NSW DPE) from Wednesday 21 June 2017 until Wednesday 2 August 2017. The draft EIS was displayed at a number of locations during the exhibition period and also made available electronically.

Additionally, Roads and Maritime hosted three community information sessions during the exhibition period. A project information line was also available throughout the exhibition period to answer questions from the community relating to the project.

Further information about the draft EIS exhibition is provided in section 1.3.
Response to submissions

Roads and Maritime received a total of 39 submissions during exhibition of the draft EIS. Of these submissions 24 were received from community members including:

- Four from community special interest groups
- Nineteen from community members
- One from a private developer.

In addition to the 24 community submissions, a total of 15 government agency, local council and utility provider submissions were received in response to exhibition of the draft EIS.

The key issues raised included:

- **Traffic and transport issues relating to:**
  - maintaining access to utility corridors
  - construction impacts to local roads and the need to consult with residents
  - provision of bus shelters and shared path facilities
  - the model used for traffic forecasting and intersection capacity.

- **Noise and vibration issues primarily related to:**
  - construction noise and vibration impacts including the requirements for consultation with the community and utility providers
  - post construction noise verification requirements
  - the assessment of work carried out outside standard construction hours.

- **Biodiversity issues, primarily related to:**
  - the removal of existing, large remnant trees and the related fauna impacts
  - the removal Cumberland Plain Woodland
  - impacts to terrestrial and aquatic fauna including impacts from street lighting and impacts to fauna inhabiting farm dams
  - impacts to wildlife corridors and habitat connectivity including the provision of connectivity measures including underpasses and fencing in the design
  - the use of local native flora species for roadside plantings
  - ecosystem offset quantum and effectiveness.

- **Socio-economic and land use issues related to:**
  - property value and compensation concerns
  - property acquisition
  - construction related impacts including the proximity of construction compounds
  - operational impacts including economic impacts on non-registered businesses and agricultural land
  - signage and gateway treatments for the Local Government Areas.

- **Non-Aboriginal heritage issues related to:**
  - the existing Non-Aboriginal heritage of the project area including errors identified in the technical paper in relation to historical background information
  - potential construction impacts on local heritage items such as Miss Lawson's Guesthouse and Lawson's Inn site
  - the need for further historical research and archaeological assessment for some items.

- **Urban design and landscaping issues related to the impact of the project on the landscape character of the area and loss of rural aspect**

- **Effectiveness of mitigation measures to address the cumulative impacts of the project and other large infrastructure projects.**
Roads and Maritime responded to issues raised within this report by:

- Justifying the scope and location of elements of the proposal as well as confirming access arrangements, predicted traffic volumes and consultation requirements during construction and operation
- Including additional information on indicative worst case noise impacts, justification for out of hours work (OOHW) activities, background noise monitoring methodology and updated management measures
- Holding meetings with OEH and community members to discuss biodiversity issues including technical issues, offsets and connectivity measures. Sections of the biodiversity assessment report (BAR) for the Proposal were also updated to respond to submissions including clarification of the assessment methodology and updated management measures
- Clarifying that the acquisition and valuation for the Proposal would be in accordance with the provisions of the NSW Land Acquisition (Just Terms Compensation) Act 1991 as well as that negotiations would be ongoing through the detailed design for the project and that dedicated case manager has been allocated for property acquisition
- Carrying out further non-Aboriginal heritage assessment which included:
  - further historical research, land title searches and correction of errors
  - updated histories and significance assessments for known and potential heritage items
  - additional archaeological assessment
  - research designs and excavation methodologies.
- Clarifying consultation commitments with Councils for the urban design and landscape plan and with other proponents regarding other infrastructure projects in the area.

This Final EIS identifies the issues raised by the community (Chapter 2) and government agencies, local councils and utility providers (Chapter 3) during exhibition of the draft EIS and provides responses to those issues.

**Project changes and design refinements**

Roads and Maritime has refined aspects of the project as presented in the draft EIS in order to minimise impacts, where possible. The design refinements are a direct response to:

- Consultation with the community during the draft EIS exhibition period
- Submissions received during the draft EIS exhibition period
- Landowner discussions during property acquisition and adjustment
- Further review of the project concept design to address constructability and safety issues and to minimise the environmental impact of the project.

The design refinements include:

- Refinements to cuttings, embankments and the width of the median at various locations along the main alignment
- Changes to utilities and services
- Refinements to the horizontal and vertical alignment of The Northern Road
- Refinements to associated local road upgrades
- Refinements to various intersections including changes to turning movements, signal phasing and median lengths
• Removal of northbound heavy vehicle inspection bays and variable message signage (VMS)
• Refinements to drainage and water quality infrastructure
• Property adjustments including provision of new accesses at various locations
• Refinements to culvert designs at Surveyors and Badgerys Creek to provide dry fauna passage
• Changes to the delivery timing of the Littlefields Road to Glenmore Parkway stage of the project, the incident management facility and the mid-block sections of bus lanes. Other minor elements of the project may be staged due to funding availability and service requirements.

Overall, changes to the project have been assessed as being generally consistent with the outcomes of the draft EIS. The mitigation measures identified in the draft EIS would continue to apply, with a number of revised or new environmental management measures developed in response to the changes as summarised in Chapter 6 of this Final EIS.

Additional environmental assessment

Roads and Maritime has carried out additional desktop and field assessment as well as commissioned a number of supporting technical reports to respond to submissions received and to assess the impacts of design refinements outlined above. Additional assessments since exhibition of the draft EIS are outlined below.

Biodiversity

Further assessment of potential biodiversity impacts was carried out partly in response to submissions received from community members, Penrith City Council, OEH and DPI. Additionally, design refinements have been made to the proposed construction footprint for the project which has resulted in revised impacts and associated biodiversity offset requirements.

A revised assessment of the impacts under the Framework for Biodiversity Assessment (FBA) has been carried out including recalculation of landscape values, impacts to native vegetation (including threatened ecological communities), impacts to threatened species, and impacts to MNES, including impacts to the environment of Commonwealth land. An additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* was also carried out around the Vineyard Road extension on 7 August 2017.

Overall, impacts to biodiversity have decreased as a result of the refined design. Additional mitigation measures have also been developed in response to some of the submissions, and in response to design refinements. These measures have been incorporated into the revised environmental management measures for the project (refer to Chapter 6).

Water quality

Further assessment of potential water quality impacts was carried out partly in response to submissions received from Penrith and Liverpool City Councils. Additionally, through the design process, design refinements were made to the proposed road and pavement drainage design.

Water quality modelling using the MUSIC model was re-run for the revised drainage design which included vegetated swales and two detention basins. The results of the MUSIC model were compared against the result previously achieved for the road and pavement drainage proposed in the draft EIS. The results of the MUSIC modelling, which are measured in annual pollutant load reductions, indicate that the refined road and pavement drainage would generally result in an improvement in water quality compared to that which was previously achieved (and assessed within the draft EIS).
Non-Aboriginal heritage
Further non-Aboriginal heritage assessment has been carried out in response to submissions received from the community and agencies, as well as updated impacts and mitigation measures to account for design refinements (refer to Appendix D). The assessment included further historical research which informed updated histories and significance assessments for some of the known and potential heritage items identified in the draft EIS, including comparative analysis for Item 9: Miss Lawson’s Guesthouse site and Item 10: Lawson’s Inn site.

Although there were updates to the assessments and statements of heritage significance for some items, there was no change in relation to whether or not an item satisfied the criteria for local or State listing, with no State significant items identified within the project area.

The updated assessment in Appendix D also includes updated statements of heritage impact for the four potentially impacted heritage items assessed in the draft EIS. The additional historical research on Item 10: Lawson's Inn located the original site of the Inn outside of the project footprint, noting that design refinements associated with changes to batters at the tie in point to Eaton Road has resulted in avoiding areas of high archaeological potential, therefore decreasing the expected likelihood of impact to this item. Otherwise, there was minimal change to impacts and mitigation measures to reflect the refined design. Research designs and excavation methodologies have also been prepared for the impacted items as required, and are incorporated into the updated assessment. These are included in Appendix D.

Revised environmental management measures
The draft EIS identified a range of environmental outcomes and management measures proposed to avoid or reduce environmental impacts. After consideration of the issues raised in the public submissions and from project design refinements, Roads and Maritime has provided minor amendments to the environmental management measures for the project where appropriate.

The main amendments to the management measures provided in the draft EIS include:

- Preparation of a supplementary measures package as part of the Biodiversity Offsets Strategy for the Project
- Additional commitments for the preparation of revegetation plans and specifications that clearly identify the location of areas to be revegetated
- Additional detail regarding exclusion zones for threatened flora species
- The inclusion of a Vegetation Management Plan (VMP) to include specific management measures to mitigate impacts to riparian areas
- Additional revegetation measures including transplanting native species
- Additional noise and vibration management measures for construction compounds
- Further consultation commitments with utility providers and additional protection requirements for their assets
- Further consultation commitments with local Councils regarding street signage, revitalisation plans for Luddenham and the provision of heritage reports and photo archival recordings.

These environmental management measures, detailed in Chapter 6, will guide subsequent development and delivery phases of the project.
Next steps


A separate submissions and preferred infrastructure report has been made available to the public in accordance with section 115Z of the Environmental Planning and Assessment Act 1979. That report and all accompanying documents have been made available electronically at the NSW DPE’s website - www.majorprojects.planning.nsw.gov.au. All online documents have been made web accessible and can be accessed free of charge.

The NSW DPE and the Commonwealth DoEE will consider the responses to submissions, and additional assessment of design refinements as presented in this Final EIS and the Submissions and Preferred Infrastructure Report during its assessment of the project. The NSW Minister for Planning and the Commonwealth Minister for Environment and Energy will then decide whether or not to approve the project and identify any conditions of approval that would apply. If approved, Roads and Maritime will continue to consult with community members, government agencies and other stakeholders during the construction and operation phases of the project.
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Appendices

Appendix A – Noise and Vibration: additional information in response to submissions
Appendix B – Technical Memorandum: Noise and vibration
Appendix C – Technical Memorandum: Biodiversity
Appendix D – Technical Memorandum: Non-Aboriginal Heritage
Appendix E – The Northern Road upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park, draft Environmental Impact Statement (Draft EIS) (electronic version)
## Glossary of terms and abbreviations

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<tr>
<th>Term</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
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<tr>
<td>Abutment</td>
<td>The end support of a bridge or similar structure</td>
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<tr>
<td>Access</td>
<td>The driveway by which vehicles and/or pedestrians enter and/or leave property adjacent to a road</td>
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<tr>
<td>AEI</td>
<td>Areas of Environmental Interest</td>
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<tr>
<td>AEP</td>
<td>Annual Exceedance Probability</td>
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<tr>
<td>AHD</td>
<td>Australian Height Datum: The standard reference level used to express the relative height of various features. A height given in metres AHD is essentially the height above sea level. Mean sea level is set as zero elevation</td>
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<tr>
<td>AHIMS</td>
<td>Aboriginal Heritage Information Management System: register of NSW Aboriginal heritage information maintained by OEH</td>
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<tr>
<td>AHIP</td>
<td>Aboriginal Heritage Impact Permit: An Aboriginal Heritage Impact Permit is the statutory instrument that OEH issues under section 90 of the National Parks and Wildlife Act 1974 to manage harm or potential harm to Aboriginal objects and places</td>
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<tr>
<td>Alignment</td>
<td>The general route or layout (e.g. of a roadway) in plan (horizontal) and elevation (vertical)</td>
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<tr>
<td>ARI</td>
<td>Average reoccurrence interval: Used to describe the frequency or probability of floods occurring (e.g. a 100 year ARI flood is a flood that occurs or is exceeded on average once every 100 years)</td>
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<tr>
<td>Arterial</td>
<td>The main or trunk road of the State road network</td>
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<tr>
<td>B-double</td>
<td>A B-double is a class 2 heavy vehicle that consists of a prime mover towing two semitrailers, with the first semitrailer being attached directly to the prime mover by a fifth wheel coupling and the second semitrailer being mounted on the rear of the first semitrailer by a fifth wheel coupling on the first semitrailer</td>
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<tr>
<td>Backfill</td>
<td>Fill replaced in an excavation</td>
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<tr>
<td>BAR</td>
<td>Biodiversity assessment report</td>
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<tr>
<td>Base case / 'do nothing / do minimum</td>
<td>Used in evaluating projects to compare the cost and benefit of the do minimum (the base case) with another or a number of other projects or options</td>
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<tr>
<td>Batter</td>
<td>The side slope of embankments and cuttings which is usually expressed as a ratio of horizontal distance to vertical height value of one</td>
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<td>Term</td>
<td>Meaning</td>
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<tr>
<td>Blue Book</td>
<td><em>Soils and Construction, 2008 Volume 2D Main Road.</em> This document provides guidelines, principles and recommended design standards for managing erosion and sediment control during service installation</td>
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<tr>
<td>BOPMP</td>
<td>Biodiversity Offsets Policy for Major Projects</td>
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<tr>
<td>BOS</td>
<td>Biodiversity Offset Strategy</td>
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<tr>
<td>Bridge deck</td>
<td>The surface of the bridge including road and pedestrian/cyclist path</td>
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<tr>
<td>BSA</td>
<td>Bureau of Statistics and Analytics, Transport for NSW</td>
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<tr>
<td>Carriageway</td>
<td>The portion of roadway used by vehicles including shoulders and ancillary lanes</td>
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<tr>
<td>CASA</td>
<td>Civil Aviation Safety Authority</td>
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<tr>
<td>Catchment</td>
<td>The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location</td>
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<tr>
<td>CCS</td>
<td>Community Communications Strategy</td>
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<td>CEEC</td>
<td>Critically endangered ecological community</td>
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<tr>
<td>CEMP</td>
<td>Construction Environmental Management Plan</td>
<td></td>
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<tr>
<td>CIP</td>
<td>Community Involvement Plan</td>
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<tr>
<td>Chainage</td>
<td>Measurement at a particular point along a line as measured from a fixed starting point (in metres)</td>
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<tr>
<td>CHAR</td>
<td>Cultural heritage assessment report</td>
<td></td>
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<tr>
<td>CHL</td>
<td>Commonwealth Heritage List</td>
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<tr>
<td>CHMP</td>
<td>Cultural Heritage Management Plan</td>
<td></td>
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<tr>
<td>CMA</td>
<td>Catchment Management Area</td>
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<tr>
<td>CNVG</td>
<td>Roads and Maritime Construction Noise and Vibration Guideline</td>
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<tr>
<td>CNVMP</td>
<td>Construction Noise and Vibration Management Plan</td>
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<tr>
<td>CTMP</td>
<td>Construction Traffic Management Plan</td>
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<tr>
<td>Collector road</td>
<td>A local road that moves traffic to arterial roads</td>
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<tr>
<td>Commonwealth EIS Guidelines</td>
<td>Refers to the <em>Guidelines for the content of a draft environment impact statement: The Northern Road Upgrade: Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park</em> (Reference: EPBC 2016/7696), issued by the Commonwealth Department of Environment and Energy on 24 August 2016</td>
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<td>Term</td>
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<tr>
<td>Concrete</td>
<td>A mixture of fine and coarse aggregate, water, cement and admixtures</td>
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<tr>
<td>CPSWSGTF</td>
<td>Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Cumberland Plain Woodlands)</td>
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<td>CPTED</td>
<td>Crime prevention through environmental design</td>
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<tr>
<td>Cross-section</td>
<td>A vertical section, generally at right angles to the centreline showing the ground. On drawings it commonly shows the road to be constructed, or as constructed</td>
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<tr>
<td>Cut</td>
<td>The depth from the natural surface of the ground to the subgrade level</td>
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<tr>
<td>Cutting</td>
<td>The formation resulting from the construction of the road below existing ground level. The material is cut out or excavated</td>
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<tr>
<td>CWEMP</td>
<td>Construction Waste and Energy Management Sub-Plan</td>
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<tr>
<td>dB(A)</td>
<td>Decibels using the A-weighted scale measured according to the frequency to the human ear</td>
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<tr>
<td>DEHP</td>
<td>Defence Environment and Heritage Panel</td>
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<tr>
<td>DEOH</td>
<td>Defence Establishment Orchard Hills</td>
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<tr>
<td>Design standard</td>
<td>The particular standards used in the design, such as a standard lane width</td>
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<td>DIRD</td>
<td>Commonwealth Department of Infrastructure and Regional Development</td>
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<td>Discharge</td>
<td>The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m$^3$/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (e.g. metres per second (m/s))</td>
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<tr>
<td>DoD</td>
<td>Department of Defence</td>
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<td>DOEE</td>
<td>Commonwealth Department of Energy and Environment</td>
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<td>DPE</td>
<td>NSW Department of Planning and Environment</td>
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<td>DPI</td>
<td>NSW Department of Primary Industries, including DPI Fisheries and DPI Water</td>
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<td>DUXOP</td>
<td>Commonwealth Department of Defence UXO Panel</td>
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<tr>
<td>Earthworks</td>
<td>All operations involved in loosening, excavating, placing, shaping and compacting soil or rock</td>
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<td>EEC</td>
<td>Endangered ecological community: An ecological community identified as having endangered status under the NSW Threatened Species Conservation Act 1995</td>
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</table>
### Term | Meaning
--- | ---
EIS | Environmental impact statement: An environmental impact assessment document prepared for the purposes of Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW), and written generally to comply with the requirements issued by the Secretary of the NSW Department of Planning and Environment. The EIS was also prepared to meet the Commonwealth EIS Guidelines issued under the EPBC Act 1999.

Embarkment | An earthen structure where the road subgrade level is above the natural surface

EMP | Environmental Management Plan

EMS | Environmental management system: A quality system that enables an organisation to identify, monitor and control its environmental aspects. An EMS is part of an overall management system that includes organisational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, reviewing and maintaining its environmental policy and performance

EPA | NSW Environment Protection Authority

EP&A Act | *NSW Environmental Planning and Assessment Act 1979*

EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

EPL | Environmental protection license: The *Protection of the Environment Operations Act 1997* (POEO Act) establishes the NSW environmental regulatory framework and includes a licensing requirement for certain activities. Environment protection licences are a central means to control the localised, cumulative and acute impacts of pollution in NSW

ESD | Ecologically sustainable development: As defined by the *Protection of the Environment Administration Act 1991*

FBA | Framework for Biodiversity Assessment: The Framework for Biodiversity Assessment prepared by the NSW Office of Heritage and Environment underpins the Biodiversity Offset Policy for Major Projects. It contains the assessment methodology that is adopted by the policy to quantify and describe the impact assessment requirements and offset guidance that apply to Major Projects

FFMP | Flora and Fauna Management Plan

Fill | The material placed in an embankment

Flood affected area | Land susceptible to flooding by a PMF event

FM Act | *Fisheries Management Act 1994*

GDA | Geocentric Datum of Australia

GDE | Groundwater dependent ecosystems
<table>
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<tr>
<th>Term</th>
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<tbody>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>GHG</td>
<td>Greenhouse gases: Greenhouse gases are those gases that reduce the loss of heat in the earth’s atmosphere by absorbing infrared radiation. These gases include carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydrofluocarbons and perfluorocarbons</td>
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<tr>
<td>GPT</td>
<td>Gross Pollutant Trap</td>
</tr>
<tr>
<td>GSNSW</td>
<td>NSW Department of Planning and Environment, Division of Resources and Geoscience, Geological Survey of New South Wales</td>
</tr>
<tr>
<td>Ha</td>
<td>Hectare</td>
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<tr>
<td>Hydraulic</td>
<td>The term given to the study of water flow in waterways, in particular the evaluation of flow parameters such as water level and velocity</td>
</tr>
<tr>
<td>Hydrology/Hydrologic</td>
<td>The term given to the study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods</td>
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<tr>
<td>ICNG</td>
<td>NSW EPA Interim Construction Noise Guideline</td>
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<tr>
<td>Kerb</td>
<td>An edge stone or concrete shape used for bordering a road and defining the footway</td>
</tr>
<tr>
<td>KNC</td>
<td>Kelleher Nightingale Consulting</td>
</tr>
<tr>
<td>Landscape character</td>
<td>The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features</td>
</tr>
<tr>
<td>LCT</td>
<td>Local Traffic Committee</td>
</tr>
<tr>
<td>LCZ</td>
<td>Landscape Character Zones</td>
</tr>
<tr>
<td>LCVIA</td>
<td>Landscape Character and Visual Impact Assessment</td>
</tr>
<tr>
<td>LEP</td>
<td>Local environmental plan</td>
</tr>
<tr>
<td>LGA</td>
<td>Local government area</td>
</tr>
<tr>
<td>LoS</td>
<td>The ‘Level of Service: The standard measure used to assess the operational performance of these intersections. Level of service is ranked from LoS A to LoS F, with LoS A representing the best performance and LoS F the worst. The LoS is based on the average delay experienced by vehicles driving through the intersection (in seconds)</td>
</tr>
<tr>
<td>MCP</td>
<td>Management Control Plans</td>
</tr>
<tr>
<td>MDP</td>
<td>Metropolitan Development Plan</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MNES</td>
<td>Matters of national environmental significance: Matters listed under the EPBC Act</td>
</tr>
<tr>
<td>Median</td>
<td>The central reservation which separates carriageways from traffic travelling in the opposite direction</td>
</tr>
<tr>
<td>MP</td>
<td>Members of Parliament</td>
</tr>
<tr>
<td>MUSIC</td>
<td>Model for Urban Stormwater Improvement Conceptualisation</td>
</tr>
<tr>
<td>NCA</td>
<td>Noise catchment areas</td>
</tr>
<tr>
<td>NMG</td>
<td>Noise Management Guidelines</td>
</tr>
<tr>
<td>NML</td>
<td>Noise management levels</td>
</tr>
<tr>
<td>NSW RFS</td>
<td>New South Wales Rural Fire Service</td>
</tr>
<tr>
<td>Obstacle limitation surface (OLS)</td>
<td>The Obstacle Limitation Surfaces define the volume of airspace that should ideally be kept free from obstacles in order to minimise the danger to aircraft during an entirely visual approach</td>
</tr>
<tr>
<td>OEH</td>
<td>NSW Office of Environment and Heritage, includes OEH Heritage and OEH Biodiversity</td>
</tr>
<tr>
<td>OEMP</td>
<td>Operational Environmental Management Plan</td>
</tr>
<tr>
<td>OOHW</td>
<td>Out of Hours Works</td>
</tr>
<tr>
<td>Pavement</td>
<td>The portion of carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic</td>
</tr>
<tr>
<td>PCT</td>
<td>Plant community types</td>
</tr>
<tr>
<td>Peak discharge</td>
<td>The maximum discharge occurring during a flood event</td>
</tr>
<tr>
<td>Peak flow rate</td>
<td>The maximum flow rate occurring during a flood event</td>
</tr>
<tr>
<td>pH</td>
<td>A figure expressing the acidity or alkalinity of an aqueous solution on a logarithmic scale. 7 is neutral, lower values are more acid and higher values are more alkaline</td>
</tr>
<tr>
<td>PM2.5</td>
<td>Particulate matter less than 2.5 microns in diameter</td>
</tr>
<tr>
<td>PMF</td>
<td>Probable maximum flood: The largest flood that could conceivably occur at a particular location, usually estimated from the probably maximum precipitation. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain</td>
</tr>
<tr>
<td>Project footprint</td>
<td>The extent of impact that the project makes on the land</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>RAP</td>
<td>Remediation Action Plan</td>
</tr>
<tr>
<td>RBL</td>
<td>Rating background level: As defined by the NSW Industrial Noise Policy is it the overall single figure background level representing each assessment period (day/evening/night) over the whole monitoring period (as opposed to over each 24-h period used for the assessment background level)</td>
</tr>
<tr>
<td>RBS</td>
<td>Rapid Biodiversity Survey</td>
</tr>
<tr>
<td>Receiver</td>
<td>An environmental modelling term used to describe a map reference point where the impact is predicted. A sensitive receiver is a home, work place, school or other place where people spend some time</td>
</tr>
<tr>
<td>Retaining wall</td>
<td>A wall constructed to resist lateral pressure from the adjoining ground or to maintain in position a mass of earth</td>
</tr>
<tr>
<td>Riparian</td>
<td>Relating to the banks of a natural waterway</td>
</tr>
<tr>
<td>RMS</td>
<td>Roads and Maritime Services NSW (formerly Roads and Traffic Authority)</td>
</tr>
<tr>
<td>RNP</td>
<td>NSW Road Noise Policy</td>
</tr>
<tr>
<td>Roundabout</td>
<td>An intersection where all traffic travels in one direction around a central island</td>
</tr>
<tr>
<td>RTA</td>
<td>(former) Roads and Traffic Authority (now RMS)</td>
</tr>
<tr>
<td>Safety barrier</td>
<td>A physical barrier separating roadside hazards or opposing traffic and the travelled way, designed to resist penetration by an out-of-control vehicle and, as far as practicable, to stop or redirect colliding vehicles</td>
</tr>
<tr>
<td>SCA</td>
<td>Sydney Catchment Authority</td>
</tr>
<tr>
<td>Scour</td>
<td>The erosion of material by the action of flowing water</td>
</tr>
<tr>
<td>SEARs</td>
<td>Secretary’s environmental assessment requirements</td>
</tr>
<tr>
<td>Shared path</td>
<td>A path used by both cyclists and pedestrians, usually located on the side of the road</td>
</tr>
<tr>
<td>Shoulder</td>
<td>The portion of the carriageway beyond the traffic lanes adjacent to and flush with the surface of the pavement</td>
</tr>
<tr>
<td>SHR</td>
<td>NSW State Heritage Register</td>
</tr>
<tr>
<td>Site compound</td>
<td>Area enclosing construction machinery, stockpiles, site offices and other ancillary facilities</td>
</tr>
<tr>
<td>Span</td>
<td>The distance between centres of adjacent supports of a bridge</td>
</tr>
<tr>
<td>Spoil</td>
<td>Surplus excavated material</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SME</td>
<td>Small to medium enterprise</td>
</tr>
<tr>
<td>SSI</td>
<td>State Significant Infrastructure</td>
</tr>
<tr>
<td>STAM</td>
<td>RMS Strategic Traffic Assignment Model</td>
</tr>
<tr>
<td>Stockpile</td>
<td>Temporarily stored materials such as soil, sand, gravel and spoil/waste</td>
</tr>
<tr>
<td>Sub-arterial</td>
<td>A road that supports and links State roads</td>
</tr>
<tr>
<td>Subgrade</td>
<td>The trimmed or prepared portion of the formation on which the pavement is constructed</td>
</tr>
<tr>
<td>Substructure</td>
<td>In a bridge, the piers and abutments (including wing walls) which support the superstructure</td>
</tr>
<tr>
<td>Superstructure</td>
<td>That part of a bridge structure which is supported by the piers and abutments</td>
</tr>
<tr>
<td>SWMP</td>
<td>Soil and Water Management Plan</td>
</tr>
<tr>
<td>SWPGA</td>
<td>South West Priority Growth Area</td>
</tr>
<tr>
<td>TAMS</td>
<td>Total Asset Management System</td>
</tr>
<tr>
<td>TCP</td>
<td>Traffic Control Plan</td>
</tr>
<tr>
<td>TECs</td>
<td>Threatened Ecological Communities</td>
</tr>
<tr>
<td>TfNSW</td>
<td>Transport for New South Wales</td>
</tr>
<tr>
<td>TNR</td>
<td>The Northern Road</td>
</tr>
<tr>
<td>TSC Act</td>
<td>NSW Threatened Species Conservation Act, 1995</td>
</tr>
<tr>
<td>Total Suspended Solids (TSS)</td>
<td>Total suspended solids (TSS) are particles that are larger than 2 microns found in the water column</td>
</tr>
<tr>
<td>Underpass</td>
<td>A tunnel constructed for the use of pedestrians and cyclists under a carriageway</td>
</tr>
<tr>
<td>Urban design</td>
<td>The process and product of designing human settlements and their supporting infrastructure, in urban and rural environments</td>
</tr>
<tr>
<td>UDLP</td>
<td>Urban Design Landscaping Plan</td>
</tr>
<tr>
<td>UXO</td>
<td>Unexploded ordinance</td>
</tr>
<tr>
<td>Vertical alignment</td>
<td>The longitudinal profile along the design line of a road</td>
</tr>
<tr>
<td>View point</td>
<td>A point in the landscape chosen to measure impacts to visual amenity</td>
</tr>
<tr>
<td>VIS</td>
<td>Vegetation information system</td>
</tr>
<tr>
<td>VMP</td>
<td>Vegetation Management Plan</td>
</tr>
<tr>
<td>Term</td>
<td>Meaning</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>VMS</td>
<td>Variable Message Signs</td>
</tr>
<tr>
<td>Water quality basin</td>
<td>An area where stormwater is ponded to be treated before entering a waterway</td>
</tr>
<tr>
<td>WSA</td>
<td>Western Sydney Airport</td>
</tr>
<tr>
<td>WSIP</td>
<td>Western Sydney Infrastructure Plan</td>
</tr>
<tr>
<td>WSPGA</td>
<td>Western Sydney Priority Growth Area</td>
</tr>
</tbody>
</table>
1 Introduction and background

1.1 The project

The Australian and NSW governments are planning to upgrade The Northern Road as part of the $3.6 billion Western Sydney Infrastructure Plan (WSIP) to improve safety, increase road capacity and reduce travel times and congestion in the future.

Roads and Maritime Services (Roads and Maritime) propose to upgrade 16 km of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park (the proposed action, hereafter referred to as the project).

The project generally comprises the following key features:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Glenmore Park (two general traffic lanes and a kerbside bus lane in each direction). A wide central median would allow for an additional travel lane in each direction in the future, if required
- An eight-lane divided road between Bradley Street, Glenmore Park and just south of Glenmore Parkway, Glenmore Park (three general traffic lanes and a kerbside bus lane in each direction separated by a central median)
- About eight kilometres of new road between Mersey Road, Bringelly and just south of the existing Elizabeth Drive, Luddenham to realign the section of The Northern Road that currently runs through the Western Sydney Airport site
- About eight kilometres of upgraded and widened road between the existing Elizabeth Drive, Luddenham and just south of Glenmore Parkway, Glenmore Park
- Access to the Luddenham town centre from north of the realigned The Northern Road and the existing The Northern Road
- Twin bridges over Adams Road, Luddenham
- Four new traffic light intersections and new traffic lights at existing intersections
- Local road changes and upgrades to current access arrangements for businesses and private properties
- A new shared path for pedestrians and cyclists on the western side of The Northern Road and footpaths on the eastern side of The Northern Road where required.

A more detailed description of the project is found in Chapter 1 of The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park NSW Environmental Impact Statement/Commonwealth draft Environmental Impact Statement (herein identified as the draft EIS) prepared by Roads and Maritime in June 2017.

Figure 1-1 shows the regional context of the project. Key features of the project as outlined in the draft EIS are provided in Figure 1-2.

A revised project description and associated figures are provided in Chapter 4, outlining the key changes to the project since exhibition of the draft EIS.
The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement

Figure 1.2 | Overview of the project
The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement
1.2 Statutory context

1.2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

Under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) proposed ‘actions’ that have the potential to significantly impact on matters of national environmental significance (MNES), the environment of Commonwealth land or that are being carried out by a Commonwealth agency must be referred to the Australian Government. If the Australian Minister for the Environment and Energy determines that a referred project is a ‘controlled action’, the approval of that Minister would be required for the project in addition to the NSW Minister for Planning’s approval.

The project has the potential to significantly impact on MNES including EPBC listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. The project would also significantly impact upon areas of Commonwealth land associated with the Defence Establishment Orchard Hills (DEOH) and land purchased by the Australian Government for the Western Sydney Airport.

Accordingly, the project was referred to the then Australian Government Department of the Environment (now Department of the Environment and Energy) on 13 May, 2016. On 21 July, 2016, the Australian Minister for the Environment and Energy decided that the project has the potential to significantly impact on MNES and Commonwealth land and is therefore a ‘controlled action’ and it be assessed by an EIS. In making this determination the delegate for the Minister issued to Roads and Maritime, on 24 August 2016, Guidelines for the Content of a draft Environment Impact Statement (Commonwealth EIS Guidelines).

To streamline the environmental assessment requirements under Part 5.1 of the EP&A Act and Part 8 of the EPBC Act, one EIS has been prepared that addresses both the SEARs and the Commonwealth EIS Guidelines (see Appendix A and B of the Draft EIS). A copy of the SEARs and the Commonwealth EIS Guidelines are contained in Appendix B and Appendix C of the draft EIS respectively. For the purpose of this planning application for the project, Roads and Maritime is the proponent.

Roads and Maritime has prepared this Final EIS to meet requirements under Part 8 of the EPBC Act, specifically Division 6, Section 104 in relation to finalising the draft EIS. Accordingly, this Final EIS has been prepared to:

a) take account of any comments received within the period for comment; and

b) contain a summary of any such comments and how those comments have been addressed.

Figure 1-3 outlines how the EPBC Act approval process would work in conjunction with the EP&A Act approval process outlined in Section 1.1.1. Further information on the assessment process is available on the Department of the Environment and Energy website (https://www.environment.gov.au/epbc).

1.2.2 NSW Environmental Planning and Assessment Act 1979

Roads and Maritime is seeking project approval for the upgrade of The Northern Road between Mersey Road, Bringelly and about 100 m south of Glenmore Parkway, Glenmore Park under Part 5.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

Clause 94 of the State Environmental Planning Policy (Infrastructure) 2007 (the Infrastructure SEPP) applies to development for the purpose of a road or road infrastructure facilities and provides that these types of works are development which is permissible without consent (except land authorised under the National Parks and Wildlife Act 1974). As the project would not be carried out on land reserved under the National Parks and Wildlife Act 1974, the project is appropriately classified as being for the purpose of a ‘road’ and a ‘road infrastructure facility’ under the Infrastructure SEPP.
Clause 14 of the *State Environmental Planning Policy (State and Regional Development) 2011* declares development as State significant infrastructure if it is permissible without consent and specified in Schedule 3.

Clause 1 of Schedule 3 of the *State Environmental Planning Policy (State and Regional Development) 2011* specifies infrastructure or other development that would be an activity for which the proponent is also the determining authority and would, in the opinion of the proponent, require an EIS to be obtained under Part 5 of the EP&A Act.

Roads and Maritime formed the opinion that the project is likely to significantly affect the environment and would require an EIS to be obtained. Consequently the project is State significant infrastructure under Part 5.1.

Clause 16 of the *State Environmental Planning Policy (State and Regional Development) 2011* enables the Minister to declare a project to be critical State significant infrastructure. The project was declared to be critical State significant infrastructure (Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011*).

The SEARs for the project were issued on 28 July 2015 and amended SEARs were issued on 9 March 2016. The amended SEARs were in response to the decision by Roads and Maritime to assess and deliver the upgrade works between Glenmore Parkway, Glenmore Park and Jamison Road, Penrith as a separate, stand-alone activity to the project. A copy of the SEARs is provided in Appendix B of the exhibited EIS. That component of the program of works has been prepared under Part 5 of the EP&A Act.

Other than the EIS that went on exhibition, no other environmental assessment has been, or is being carried out for the project for the purpose of any local or state plan or policy.

In accordance with the Secretary’s requirements of section 115Z(6) of the EP&A Act, Roads and Maritime prepared a submissions and preferred infrastructure report to respond to issues raised in submissions received during the exhibition of the EIS, as well as to describe and assess proposed changes and design refinements to the project.

The approval process under Part 5.1 of the EP&A Act is illustrated in Figure 1-3.

Further information on the assessment process is available on the NSW Department of Planning and Environment (NSW DPE) website (www.planning.nsw.gov.au).
Figure 1-3 Approvals process under Part 5.1 of the EP&A Act and Part 8 of the EPBC Act
1.3 Community and stakeholder consultation

Prior to and during preparation of the draft EIS consultation was carried out with the community, Federal, State and local government agencies, special interest groups and relevant industry stakeholders that have specific interest in the project. Consultation would be ongoing throughout the construction and operation of the project.

1.3.1 Draft environmental impact statement exhibition

Following approval from the Commonwealth DOEE, the draft EIS was publicly exhibited by the NSW DPE for 43 days between 21 June and 2 August 2017. To meet statutory requirements, the exhibition was advertised in The Australian and the Sydney Morning Herald newspapers on 21 June 2017. The draft EIS was made available for information and comment on the NSW DPE website and at five public locations as listed in Table 1-1. Community information sessions were held to enable the public to meet project team members and find out more about the draft EIS and impacts.

Table 1-1 EIS exhibition locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penrith City Library</td>
<td>601 High Street, Penrith</td>
</tr>
<tr>
<td>Liverpool Library</td>
<td>170 George Street, Liverpool</td>
</tr>
<tr>
<td>Camden Council</td>
<td>70 Central Avenue, Oran Park</td>
</tr>
<tr>
<td>Narellan Library</td>
<td>Corner of Queen and Elyard Street, Narellan</td>
</tr>
<tr>
<td>Nature Conservation Council</td>
<td>14/338 Pitt Street, Sydney</td>
</tr>
</tbody>
</table>

In addition to the statutory advertisements, the exhibition of the draft EIS and the community information sessions were advertised in the following local and community language newspapers between 28 June and 30 June 2017 to raise awareness of the consultation and information sessions:

- Liverpool City Champion (Wednesday 28 June 2017)
- Liverpool Leader (Wednesday 28 June 2017)
- Penrith Press (Thursday 29 June 2017)
- Penrith City Gazette (Thursday 29 June 2017)
- Western Weekender (Friday 30 June 2017).

The purpose of the community consultation was to:

- Inform community members and stakeholders about the draft EIS and concept design for The Northern Road upgrade between Mersey Road and Glenmore Parkway
- Seek comments and submissions from the community and stakeholders
- Continue to build a database of community members and stakeholders for Roads and Maritime to engage with through the development and delivery of the project.

Table 1-2 provides a summary of these activities and their community reach.
Table 1-2 Consultation activities carried out during the exhibition period

<table>
<thead>
<tr>
<th>Tool / Activity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community update newsletter</td>
<td>A community update newsletter was produced including the key features of the proposal, details on the community information sessions and how to provide feedback on the draft EIS and concept design. The community update newsletters were distributed to about 4,000 properties. The newsletter was also made available on the Roads and Maritime website, WSIP portal and at community information sessions.</td>
</tr>
<tr>
<td>Media release</td>
<td>A media release was issued by Roads and Maritime on Wednesday 21 June 2017, titled ‘Environmental Impact Statement released for the Bringelly to Glenmore Park section of The Northern Road Upgrade’.</td>
</tr>
</tbody>
</table>
| Newspaper advertisement | Newspaper advertisements were placed in local papers between Wednesday 28 June and Friday 30 June 2017 to raise awareness of the consultation and information sessions. Publications included:  
  - Liverpool City Champion (Wednesday 28 June 2017)  
  - Liverpool Leader (Wednesday 28 June 2017)  
  - Penrith Press (Thursday 29 June 2017)  
  - Penrith City Gazette (Thursday 29 June 2017)  
  - Western Weekender (Friday 30 June 2017). |
| Email notifications     | Direct emails were sent from Roads and Maritime on Wednesday 21 June and Thursday 22 June 2017 to 1,500 stakeholders (community members and groups), local Members of Parliament (MPs) and other government stakeholders to announce the draft EIS and concept design as well as to raise awareness of the commencement of the consultation period, how to make a submission and details of the information sessions. |
| Webpage                 | The project webpage was updated on Wednesday 21 June with project information including the community update newsletter, links to the draft EIS and how to make a submission as well as information about the community information sessions. A total of 13,654 page views were recorded during the consultation period for www.rms.nsw.gov.au/thenorthernroad and 2,553 page views recorded for http://www.rms.nsw.gov.au/projects/sydney-west/the-northern-road/stage-4/index.html. |
| WSIP Portal             | The WSIP portal was used during the consultation period with a new animation video providing a visual of the features and future look of the project. There were a total of 2,154 page views unique to the project during the consultation period. |
| Social Media (Facebook) | A Facebook advertisement was live between Thursday 22 June and Thursday 20 August 2017. The post targeted The Northern Road area and was published to target a broader geographic area and featured the project animation video. The advertisement included a link to information on how to make a formal submission on the project to the NSW DPE. The Facebook advertisement reached 288,728 individual Facebook users. |
### Community information sessions

Three community information sessions were held with around 125 people attending at the following locations:
- Holy Family Primary School, Luddenham – Saturday 1 July, 10am to 1pm
- Holy Family Primary School, Luddenham – Wednesday 19 July, 3pm to 1pm
- Orchard Hills Masonic Centre – Saturday 22 July, 10am to 1pm.

### Variable message signs (VMS)

Six variable message signs were displayed across The Northern Road and Elizabeth Drive during the consultation period to notify the community about the upcoming information sessions.

### Stakeholder briefings

The project team briefed the following stakeholders:
- Liverpool City Council – Thursday 22 June
- Penrith City Council – Thursday 15 June.

#### 1.3.2 Future consultation

As the project progresses and during construction, the project team would continue to work with the community to ensure they are informed about the project and have opportunities to provide feedback to the project team.

Key involvement activities and tools would include:
- Development and implementation of a detailed Community Involvement Plan
- Appointment of a dedicated Community Relations Manager for the project
- Regular notification of works and particularly night work (including targeted letterbox drops)
- 24-hour project information phone line
- Complaints management process
- Regular updates to the Roads and Maritime website
- Newsletters, information brochures and fact sheets
- Clear signage at construction sites
- Media releases and project advertisements in local and metropolitan papers
- Construction updates (including for councils, emergency services and bus operators)
- Email communication, and in some cases phone calls, to key stakeholders and those who have registered on the project database
- Ongoing liaison with, and support for, community members affected by property acquisition.

A detailed description of the consultation activities and other consultation processes (such as complaints management) that would be carried out during construction can be found in the Draft Community Consultation Framework in Appendix R of the draft EIS.
1.4 Purpose and structure of the Final EIS

During the exhibition of the draft EIS, a total of 39 submissions were made. The Secretary of the NSW DPE provided copies of the submissions to Roads and Maritime and the Department of Environment and Energy.

Roads and Maritime have prepared this Final EIS to meet requirements under Part 8 of the EPBC Act, specifically Division 6, Section 104 in relation to finalising the draft EIS. Accordingly, this Final EIS has been prepared to:

a) take account of any comments received within the period for comment; and
b) contain a summary of any such comments and how those comments have been addressed.

Since the exhibition of the draft EIS, Roads and Maritime have made a number of design refinements to address the issues raised during the exhibition, to minimise its environmental impact and to address other issues raised during further review of the concept design.

This Final EIS includes information regarding additional studies carried out since the exhibition of the draft EIS and a description of changes to the project. Revised environmental management measures for the project are also included.

The following is an outline of the structure of the Final EIS:

- Chapter 1 – provides an overview of the project, its statutory context, outlines the consultation process prior to, during and post exhibition of the draft EIS, and outlines the purpose of this Final EIS
- Chapter 2 – sets out the issues raised in community submissions on the draft EIS and presents responses to those issues
- Chapter 3 - sets out the issues raised in government agency and utility provider submissions on the draft EIS and presents responses to those issues
- Chapter 4 - describes the changes to the project as a result of design refinements since exhibition of the draft EIS
- Chapter 5 – provides a summary of the ‘key’ and ‘other’ issues as assessed in the draft EIS and outlines the additional assessments carried out since exhibition of the draft EIS in response to submissions and/or design refinements
- Chapter 6 – presents the safeguards and mitigation measures for the project, which have been revised to address issues raised during public exhibition of the draft EIS or as a result of additional assessment in response to design refinements.
2 Response to community issues

2.1 Respondents
The NSW DPE received a total of 39 submissions during exhibition of the draft EIS between 21 June and 2 August 2017.

Of these submissions 24 were received from community members including:

- Four from community special interest groups
- Nineteen from community members
- One from a private developer.

The community issues raised and Roads and Maritime’s response to these issues forms the basis of this chapter. Chapter 3 addresses the remaining 15 submissions received from government agencies and utility providers which are assessed and responded to separately.

A list of submissions received from community members is provided in Table 2-1, including where in this Final EIS the issue has been addressed. Each community submission was assigned an individual number by the NSW DPE. These numbers are referred to in the Table 2-1 and throughout this chapter.

Table 2-1 List of respondents (community)

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Submission Number</th>
<th>Section where issues are addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community group (Turtle Rescues NSW)</td>
<td>1</td>
<td>2.7.4</td>
</tr>
<tr>
<td>Individual</td>
<td>3</td>
<td>2.7.4</td>
</tr>
<tr>
<td>Individual</td>
<td>4</td>
<td>2.7.4</td>
</tr>
<tr>
<td>Individual</td>
<td>5</td>
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The issues raised in each submission have been extracted and collated, and corresponding responses to the issues have been provided. Where similar issues have been raised in different submissions, only one response has been provided.

The most common issues raised by the community related to:

- Consultation, including the timing of community sessions and the amount of consultation carried out for property acquisition
- Traffic and transport, including alternate design suggestions, safety issues and the maintenance of access during construction
- Noise and vibration impacts associated with construction and operation of the project
- Biodiversity issues, including:
  - the removal of existing, large remnant trees and the related fauna impacts
  - the removal Cumberland Plain Woodland
  - impacts to terrestrial and aquatic fauna including impacts from street lighting and impacts to fauna inhabiting farm dams
  - the impact of the project on wildlife corridors and habitat connectivity and suggested additional fauna crossings, underpasses, fencing and other connectivity measures be included in the design
- the use of local native flora species for roadside plantings
- offsetting concerns, including the effectiveness of BioBanking to offset the losses of critically endangered vegetation communities in Western Sydney.

- Socio economic issues, including:
  - property value and compensation concerns
  - acquisition related to the design of the project
  - construction related impacts including the proximity of construction compounds
  - operational impacts including economic impacts on non-registered businesses and agricultural land.

- Non-Aboriginal heritage including comments that historical information has been incorrectly reflected in the non-Aboriginal heritage technical working paper

- Urban design and landscaping issues related to the impact of the project on the landscape character of the area and loss of rural aspect.

Figure 2-1 provides a summary of the issues raised.

![Figure 2-1 Summary of the types of issues raised by the community](image-url)
2.3 General objections

2.3.1 Adequacy and independence of the draft EIS

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<th>Submission number(s)</th>
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**Issue description**
A respondent raised concerns that the draft EIS documents are written to provide support for Roads and Maritime carrying out the project.

**Response**
The draft EIS was prepared by a team of qualified professionals and presents a balanced, merit-based EIS in accordance with the EP&A Act, the Secretary’s Environmental Assessment SEARs, the Commonwealth EIS Guidelines and applicable NSW and Commonwealth assessment policies.

The draft EIS was supported by a range of comprehensive technical studies (contained in Appendices G to Q of the draft EIS). These technical studies were prepared in accordance with the key issues identified in the SEARs and the Commonwealth EIS Guidelines, which included requirements issued by key Government regulatory agencies as well as industry standards and guidelines. The draft EIS, including all detailed technical studies, was reviewed by the NSW DPE and the Commonwealth DoEE to confirm that it adequately addressed all requirements prior to being placed on public exhibition.

Consultants were engaged to prepare the draft EIS for the project via a competitive Request for Tender process. The preparation of the draft EIS also involved separate consultants outside of the lead EIS consultant including:

- Lyall and Associates (Appendix K – Flood Risk Assessment)
- Kelleher Nightingale Consulting (Appendix M - Aboriginal Cultural Heritage Assessment Report)
- Spackman Mossop and Michaels (Appendix O - Urban design, landscape character and visual impact assessment).

The engagement of specialist consultants to prepare the draft EIS is consistent with other major transport infrastructure projects of this size and scale.

2.4 Consultation

2.4.1 Level and quality of consultation

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<th>Submission number(s)</th>
<th>7</th>
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**Issue description**
The following issues were raised:

- Concern that insufficient consultation has been carried out for the project
- Unsatisfied that some exhibition information sessions were held during school holidays and on a Saturday.

**Response**
As outlined in Chapter 6 of the draft EIS, the community and stakeholder consultation effort for the project has included activities before and during the exhibition of the draft EIS. Additionally, Roads
and Maritime has carried out an extensive community consultation program for other WSIP projects.

Consultation for the project began in July, 2015 when Roads and Maritime released a preliminary design and access strategy for The Northern Road Upgrade between Littlefields Road, Luddenham and Jamison Road, South Penrith. The consultation effort used a variety of communication and engagement methods including community information sessions, face-to-face meetings with individual property owners, businesses and residents that may be directly affected by the project, letterbox drops and mail outs and advertisements in various forms of media. Section 6.2.5 of the draft EIS provides a detailed account of the consultation effort carried out before preparation of the draft EIS.

Further consultation was carried out during the preparation of the draft EIS as outlined in section 6.2.6 of the draft EIS. This consultation included further community update newsletters (November 2015, February 2016 and July 2016), door knocks, media releases and four more community information sessions.

Roads and Maritime have endeavoured to consider all consultation comments throughout the development of the project. Section 6.3 of the draft EIS outlines the key issues raised by the community, community groups (including pedestrian and bicycle user groups), businesses and adjoining and affected landowners. It consolidates the issues raised for the purpose of the draft EIS and indicates where the issue is addressed in the draft EIS. The outcomes of this consultation process have informed the project’s design and development of the project to date.

A project information line was also available throughout the exhibition period to answer questions from the community relating to the project.

Consultation throughout exhibition of the draft EIS (is outlined in section 1.2.1). Community information sessions were held at:

- Holy Family Primary School
  Willowdene Avenue, Luddenham
  Saturday 1 July 2017, 10am to 1pm
  Wednesday 19 July 2017, 3pm to 7pm

- Orchard Hills Masonic Centre
  290 Homestead Road, Orchard Hills
  Saturday 22 July 2017, 10am to 1pm

While the session held on Saturday 1 July was within school holidays, the other sessions were held outside of school holidays, one on the weekend and one mid-week. As described in Section 2.4.3, the exhibition period was also extended beyond the minimum 30-day requirement in the EP&A Act.

### 2.4.2 Property acquisition consultation

| Submission number(s) | 23, 24 |
| Issue description | The respondents were concerned that consultation between directly affected properties (ie those to be acquired) and Roads and Maritime has been inadequate and inconsistent. |
Response

Roads and Maritime would acquire properties for the project in accordance with the provisions of the NSW Land Acquisition (Just Terms Compensation) Act 1991. The acquisition process includes the appointment of a dedicated case manager (Property Manager Acquisition) to help landowners understand their rights and provide a single point of contact throughout the acquisition process. The case manager helps affected landowners who have their home acquired with finding new homes, new schools for children and other services to ease the experience of moving. The case managers have also been involved in the partial acquisition on this project.

With regards to the respondents’ property, there is more than one person who owns the property referred to in these submissions. The separate parties have different value and legal representation. Given the complexity of the property ownership Roads and Maritime has been in regular contact with the valuers and legal representatives of the property owners rather than individual owners during the acquisition phase work carried out to date.

Further meetings with the owners will occur during the negotiation phase which is expected to be scheduled once the owners’ claims have been finalised.

2.4.3 Exhibition period

Submission number(s)
23, 24

Issue description
The respondents raised the following issues:
- Considered that the period of time allowed for comments on the draft EIS has been inadequate
- Concerned that the exhibition period did not cater for people that do not have the internet.

Response

Under the EP&A Act, the minimum duration for public exhibition of an Environmental Impact Statement is 30 days. For this project, the public exhibition period was extended from the statutory minimum of 30 days to a total of 43 days. All online documents were made web accessible and were able to be accessed free of charge.

The draft EIS was available in hard copy at a number of exhibition locations (refer to Table 1-1) and electronically available during the exhibition period between Wednesday 21 June 2017 and Wednesday 2 August 2017. This period allowed for additional time due to the public school holiday period which was taken into consideration.

As well as the community information sessions and hard copy exhibition locations, a project information line was also available throughout the exhibition period to answer questions from the community relating to the project.

2.5 Traffic and transport

2.5.1 Alternate design

Submission number(s)
37

Issue description
The respondent SmartWest.Sydney, raised the following issues:
- An objection to the exhibition design and location of The Northern Road with regard to delivering a western access intersection near the Western Sydney Airport
Proposed an alternative design, constructed in two stages, that they believe would future proof The Northern Road and provide access to the Western Precinct.

Response

The location of the intersection within the Western Sydney Airport was specified by the federal Department of Infrastructure and Regional Development. The location of the intersection was then reviewed by Roads and Maritime to assess its suitability for the project. The proposed design provides scope for modification to a four-way intersection format, to support future development west of The Northern Road and Western Sydney Airport.

Roads and Maritime and Transport for NSW's Freight, Strategy and Planning Division reviewed the submission provided by SmartWest.Sydney in detail and the project team have carried out further consultation with the organisation since exhibition of the draft EIS. Following this review and consultation Roads and Maritime and Transport for NSW have found no compelling reason to modify the location proposed for the intersection.

2.5.2 Construction access and haulage

Submission number(s)
20

Issue description
The respondent was concerned that Willowdene Avenue would be used for construction haulage and that the road is not suitable for those activities.

Response

As outlined in section 5.4.13 of the draft EIS, designated access and haulage routes for construction vehicles entering and exiting construction areas and temporary ancillary facilities would be along The Northern Road and surrounding arterial network. The use of local roads by heavy vehicles to access temporary ancillary facilities would be limited as far as is reasonably practicable. This has been incorporated into the revised environmental management measures for the project (refer to Chapter 6).

Construction traffic on Willowdene Avenue would be limited to light vehicles needing to access The Northern Road construction corridor for the period where that section is under construction.

2.5.3 Safety

Submission number(s)
13, 15, 33

Issue description
The respondents raised the following issues:

- Concern regarding access to and from The Northern Road to their property via the proposed 100 metre merge across the bus lane. Respondent is also concerned that the bus lane may inhibit safe access to their property
- Concern regarding the safety of Longview Road as a result of increased traffic including access to existing driveways
- Concern regarding the potential for the eastern Elizabeth Drive u-turn facility to impact the safety and amenity of nearby residents. Request that security/crime prevention measures be installed at the eastern Elizabeth Drive u-turn facility.

Response

The 100 m merge distance across bus lanes is set by the Road Rules 2014 Part 11 Division 6 Rule 158. The 100 m distance is consistent with operation of bus lanes across Sydney. This rule has
been set for more than 20 years and the operational performance and monitoring of crash rates across the State Road network has not prompted Roads and Maritime to review the 100 m designation.

The project does not include the upgrade of Longview Road beyond the tie-in points with The Northern Road and the Vineyard Road extension.

As outlined in Chapter 7-1 of the draft EIS (Traffic and Transport), the existing traffic numbers on Longview Road are low during both AM and PM peak periods.

Forecast traffic volumes on Longview Road are not expected to increase substantially above existing volumes (less than 30 vehicles an hour in the peak periods) or as a result of changes to access at Kings Hill Road.

The construction of a new link between Longview Road and Kings Hill Road (Vineyard Road extension) is proposed to facilitate existing right turn demand that would not be possible at Longview Road once the construction of a median along The Northern Road is completed as part of the project. Minimal additional traffic would be expected to use Longview Road as a result of the Vineyard Road extension, as some existing traffic that currently uses Longview Road to access Vineyard Road would be likely to use Kings Hill Road instead.

During construction of the project, access would be generally maintained at Kings Hill Road. Should traffic need to be redirected along Longview Road, this would be temporary and managed in accordance with the traffic management plan developed for the project.

Street lighting would be provided where required for the project to light the alignment. Signage, preventing the stopping of vehicles at the u-turn facilities, including the one on Elizabeth Drive, would also be provided.

Roads and Maritime would review the operation of the road once construction is completed in accordance with standard operational requirements.

2.6 Noise and vibration

2.6.1 Assessment methodology

Submission number(s)
13

Issue description
The respondent raised the following issues:

- Concern that current noise measurements have not been taken at the respondent’s property in order to assess the direct effects of the increase in traffic noise at the property
- The respondent requests that a peer review of the noise assessment be carried out as a result.

Response
Long-term unattended noise monitoring was carried out at various locations within the noise and vibration study area for the draft EIS to identify the existing background noise levels to be applied for each noise catchment area (NCA). Receivers are grouped into NCAs to enable a logical grouping of receivers affected by the same works to assist with the assessment, consultation or notification regarding potential noise impacts during construction of the project. As identified in the draft EIS, NCA boundaries for the project were determined by considering:

- Factors affecting how construction noise would propagate into a given area (eg, topography and screening by buildings)
- The level of background noise in that area
The type(s) of receivers within that area, eg, whether residences (for which noise goals are a function of emergence above the level of background noise) or commercial or industrial premises (for which fixed noise goals not dependent on the level of background noise apply)

The grouping of receivers into bands of similar construction noise impact.

Background noise levels within each NCA were used to inform the identification of construction noise management levels (NMLs) to be applied at residential receivers within that NCA. It is noted that the results of background noise monitoring do not inform or influence the assessment of operational (traffic) noise from the project. The predicted increase in traffic noise levels at each residence is determined through noise modelling. Further response in relation to operational noise impacts is discussed in section 2.6.3.

A peer review of the noise and vibration technical working paper is not considered necessary. The draft EIS, including the noise and vibration technical working paper, has been sufficiently reviewed by the various specialists involved, Roads and Maritime technical experts and through the various government agencies during adequacy review of the draft EIS prior to exhibition. A response is also provided in section 2.3.1 regarding the adequacy and independence of the draft EIS.

2.6.2 Construction noise impacts

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Issue description

In summary, the respondent raised the following issues:

- Concern regarding the lack of adequate noise mitigation for some properties near the project which have not been included for mitigation
- Concern regarding the management of intrusive noise impacts at properties during construction
- Concern regarding the determination and application of reasonable and feasible measures
- Concern regarding the staging of works and associated management and justification of noise impacts for both day time and out of hours works (OOHW)
- Concern regarding the management of noise complaints and how they will be dealt with to reduce the impacts of construction.

Response

As is typical of a road construction project, construction noise mitigation measures would be applied to the source of the noise to benefit all potentially impacted receivers rather than being applied at individual properties. As such there are no permanent construction noise mitigation measures proposed to be applied at or to an individual property as part of the project. Various types of at-property building insulation treatments are proposed to mitigate potential operational noise impacts for the project. Further detail and response to community submissions in relation to operational noise impacts and mitigation measures is provided in section 2.6.3.

The assessment of construction noise levels at each receiver is detailed in the noise and vibration technical working paper for the project (Appendix H of the draft EIS) and summarised in section 7.2.5 of the draft EIS. This includes the predicted noise levels during all standard hours (daytime) and out of hours works (OOHW) (Saturday afternoons, Sundays, evenings and nights), assessed against the relevant NMLs identified for each receiver. NMLs apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. Where the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels was at the most noise-affected point within 30 m of that residence.
The assessment predicted noise levels at each receiver was presented in the draft EIS and was based on indicative timeframes and staging of construction works as presented in Chapter 5 of the draft EIS, including indicative durations for each activity. However, the assessment did not specify the indicative duration of the most noise intensive plant use during each activity and what the worst case noise impact would be to any one receiver, including from ancillary facilities. Further information regarding the indicative duration of worst case noise impacts has been provided in Appendix A (refer to Attachment 1). This information is indicative only and is subject to change upon engagement of a construction contractor(s) dependant on the final staging and scheduling of works.

Additional detail regarding indicative OOHW activities and justifications is also provided in Appendix A (refer to Attachment 2). As outlined in the draft EIS, OOHW activities would be associated with paving and bridge construction works as well as the use of ancillary facilities associated with those activities. OOHW for bridge construction works at Adams Road would likely utilise ancillary facilities C8, C9 and C10. Use of ancillary facilities for paving works during out of hours would be dependent on the location of works at the time. Further detail regarding out of hours work activities, locations and justification would be identified in the CEMP to be developed by the contractor once engaged.

All noise predictions in the draft EIS are based on the assumption that the standard and project-specific noise mitigation measures as outlined in Section 7.2.8 of the draft EIS are applied. In instances where after the application of standard and project-specific noise mitigation measures there still remain receivers at which NMLs are exceeded, the Roads and Maritime Construction Noise and Vibration Guideline (CNVG) (August 2016) directs that additional mitigation measures detailed in Appendix C of the CNVG should be considered where feasible and reasonable. These have been summarised in the noise and vibration technical working paper (Appendix H of the draft EIS, section 10.13 and Table 10-9). Further information is provided in Appendix A for reference, including triggers for the application of additional mitigation measures (refer to Attachment 3) and further explanation of each ‘additional’ mitigation measure as per the CNVG (refer to Attachment 4).

An indicative assessment of the application of standard, project-specific and additional mitigation measures during each proposed construction activity for the project is presented in Appendix A (refer to Attachment 5). This includes the assessment of daytime and OOHW, assessed for two key OOHW periods as follows:

- **OOHW period 1**: Monday - Friday (6pm-10pm), Saturday (7am-8am & 1pm-10pm), Sunday / Public Holidays (8am-6pm)
- **OOHW period 2**: Monday - Friday (10pm-7am), Saturday (10pm-8am), Sunday / Public Holiday (6pm-7am).

This assessment acknowledged the increased sensitivity of late night works / early morning works during which time most people are likely to be sleeping (ie OOHW period 2) and the more stringent mitigation measures required during this time.

The NSW Interim Construction Noise Guideline (ICNG) requires the application of feasible and reasonable measures to mitigate construction noise and vibration impacts from a project. Further to this, the Roads and Maritime CNG provides guidance regarding the identification of feasible and reasonable noise mitigation measures for construction works as outlined below.

Feasibility relates to engineering considerations (what can be practically built). These engineering considerations may include:

- The inherent limitations of different techniques to reduce noise emissions from road traffic noise sources
- Safety issues such as restrictions on road vision
- Road corridor site constraints such as space limitations
- Floodway and stormwater flow obstruction
Access requirements
Maintenance requirements
The suitability of building conditions for at receiver treatments.

Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits provide significant social, economic or environmental benefits. The factors to be considered are:

- The noise reduction provided and the overall number of people that benefit from the mitigation
- Existing and future noise levels, including changes in noise levels in the build and design year and the extent of any exceedance of the noise criteria
- Potential for a mitigation measure to reduce noise during construction as well as from road traffic after the project is complete
- The cost of mitigation, including the cost of noise mitigation measures as a percentage of the total project cost and the ongoing maintenance and operational costs.
- Community views and preferences (typically gathered during the community consultation process following the noise assessment)
- Visual impacts for the community surrounding the road project and for road users. These are typically identified in the Environmental Assessment
- The wider community benefits arising from noise mitigation of the proposed road or road redevelopment
- Relative weighting of treatments with respect to protection of outdoor areas or only internal living spaces.

The ICNG and CNVG would be referred to in the preparation of the CNVMP with regards the mitigation measures to be applied during construction of the project.

The final construction noise management measures would be determined once the construction program and staging of works is confirmed upon engagement of the construction contractor(s). The contractor would document the relevant mitigation measures in the construction noise and vibration management plan (CNVMP) to be developed for the project.

The community would be informed and kept up to date regarding the staging and duration of works throughout the construction stage of the project through regular community consultation as detailed in the draft EIS and further summarised in section 1.2.

As detailed in the draft Community Involvement Plan (Appendix R of the draft EIS), a complaints management procedure for recording, responding and reporting of complaints would be adopted for the project. In accordance with this plan, complaints must be acknowledged within one working day. Where a complaint cannot be responded to immediately, a follow-up verbal response on what action is proposed must be provided to the complainant or enquirer within three working days. A written response to the person raising a complaint would be provided within 10 working days. Follow-up monitoring would be carried out to ensure any issues/complaints have been resolved satisfactorily and any corrective actions implemented.

### 2.6.3 Operational noise impacts

**Submission number(s)**

13, 15, 22, 23, 24

**Issue description**

In summary, the respondents raised the following issues:
Concerns regarding the impact of increased traffic noise at their property, including consideration of the topography of their land and the potential implications in terms of increased noise impacts

Concern regarding the lack of adequate noise mitigation for properties, limited to at-property treatment as opposed to noise walls or low noise pavement, or where a property has not been identified as being eligible for treatment

Concern regarding operational noise impacts for properties around the Luddenham bypass, with no mitigation or compensation for these properties.

Response

Predicted traffic noise levels were modelled for future year scenarios to assess the potential increase in traffic noise at individual receivers generated as a result of the project (i.e. the "Build" scenario as referred to in the draft EIS). These predictions are based on a detailed noise model which includes detailed topographical information.

In accordance with section 6 of the Roads and Maritime Noise Mitigation Guideline (NMG), when evaluating if a receiver qualifies for consideration of noise mitigation, Roads and Maritime considers how far above the criterion the noise level is and also how much the noise level has increased by. These two considerations were applied for the project in the assessment and identification of receivers qualifying for the consideration of mitigation. Therefore, although some residences were assessed as being impacted by increased traffic noise levels as a result of the project, where the increase did not satisfy the NMG criteria, these residences did not qualify for consideration of noise mitigation.

As outlined in Section 7.2.6 of the draft EIS, the method for determining a receiver’s eligibility for mitigation as outlined in the NMG was applied in the assessment of operational noise mitigation for the project. This included the consideration of the following mitigation measures in order of preference of application as per the NSW Road Noise Policy (RNP):

- Low noise pavement surfaces
- Noise mounds
- Noise walls
- At-property treatments.

As outlined in the draft EIS, noise mitigation in the form of at-property acoustic treatment was determined to be the most reasonable form of noise mitigation at eligible receivers for the project.

As indicated in the draft EIS noise and vibration technical working paper, operational (traffic) noise levels at receivers located on The Old Northern Road are predicted to be lower in the future if the project is built compared to if the project is not built. By way of example, the future daytime operational (traffic) noise level to the residence at 3057 The Old Northern Road, Luddenham is predicted to be 66dB(A) if the project is not built, and 64dB(A) if the project is built. This reduction in noise level is consistent for most receivers in Luddenham.

It is noted that due to a number of design refinements the vertical alignment has changed at some locations. A technical assessment of revised noise predictions has been carried out to identify further properties that qualify for the consideration of mitigation based on the design refinements as summarised in Table 4-1. This assessment identified one additional property for consideration of mitigation. Roads and Maritime carried out additional consultation with this property owner in December 2017 to inform them of the outcomes of the assessment. All properties identified in the draft EIS as being eligible for the consideration of at-property treatment remains unchanged, with the predictions to be verified and associated effectiveness of mitigation to be confirmed post-construction.
2.7 Biodiversity

2.7.1 Removal of native vegetation

**Submission number(s)**
7, 11, 12, 16, 17, 18, 21, 25, 27

**Issue description**
The respondents raised the following issues:

- Concern regarding impacts to large remnant trees, including hollow-bearing trees
- Concern regarding impacts to important trees, particularly *Eucalyptus molacanna* (sic) and two old-growth remnant trees recommended to be retained in the median where possible
- Concern regarding impacts to fauna during the tree removal process.

**Response**
The NSW Biodiversity Offsets Policy for Major Projects (BOPMP) provides a standard method for assessing impacts of major projects on biodiversity and determines offsetting requirements. In the State Significant Infrastructure (SSI) application process, the EIS must address the SEARs requested by the NSW DPE and apply the Framework for Biodiversity Assessment (FBA). The FBA adopts the BOPMP and provides an assessment methodology to identify terrestrial biodiversity values, assess impacts and quantify and describe biodiversity offsets required for unavoidable impacts.

The Biodiversity Assessment Report (BAR) was completed in accordance with the requirements specified by the SEARs issued on 28 July 2015, the amended SEARs issued on 9 March 2016 and Commonwealth EIS Guidelines issued on 24 August 2016. Additional assessment (refer to Appendix C – Technical memo, Biodiversity) has also been carried out in accordance with these requirements to assess some of the changes to biodiversity values and impacts as a result of design refinements as outlined in Chapter 4.

Despite avoidance and mitigation, residual impacts from the clearing of native vegetation and fauna habitat features is acknowledged in the draft EIS. These impacts have been quantified using the BioBanking Credit Calculator, and form the basis of offsets for the project. There would be impacts to the following matters which need to be offset via biodiversity credits:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (including derived native grasslands)
- *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion
- *Pultenaea parviflora*
- *Marsdenia viridiflora* subsp. *viridiflora* - endangered population
- Cumberland Plain Land Snail
- Regent Honeyeater.

Cumberland Plain Woodland is listed as a critically endangered ecological community (CEEC) under the NSW Threatened Species Conservation Act, 1995 (TSC Act). The project may significantly reduce the viability of this CEEC within the locality and therefore it was considered a matter for further consideration under the FBA. While not recorded during the surveys, there would
also likely be impacts to potential habitat for the critically endangered Regent Honeyeater. This species was also considered a matter for further consideration.

The project would be likely to result in a range of impacts to biodiversity which are not covered under the FBA including impacts to the aquatic environment (including as a result of changes to hydrology), habitat fragmentation, edge effects, injury and mortality of fauna (including indirect impacts associated with vehicle strike), invasion and establishment of weeds, potential for invasion and spread of pathogens and disease, noise, vibration, dust, light and contaminant pollution, and a range of cumulative impacts to vegetation and associated species within the Cumberland Plain region.

Some of the higher quality patches of Cumberland Plain Woodland meet the description of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPSWSGTF) CEEC listed under the EPBC Act. The plant species *Pultenaea parviflora* is also listed as vulnerable under the EPBC Act. Other Matters of National Environmental Significance that may be impacted by the project include habitat for the listed Regent Honeyeater, Swift Parrot, Grey-headed Flying-fox and Large-eared Pied Bat. The project has therefore been identified as a controlled action under the EPBC Act due to predicted significant impacts to listed threatened species and ecological communities and Commonwealth land. The controlled action is considered by the Commonwealth DoEE, likely to have a significant impact on the following EPBC Act listed threatened species and ecological communities:

- Critically endangered – Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Cumberland Plain Woodlands)
- Critically endangered – *Lathamus discolor* (Swift Parrot)
- Critically endangered – *Anthochaera phrygia* (Regent Honeyeater)
- Vulnerable – *Pultenaea parviflora*
- Vulnerable – *Pteropus poliocephalus* (Grey-headed Flying-fox).

A Biodiversity Offset Strategy (BOS) has been prepared for the project (refer to Appendix I of the draft EIS). The project offsets will aim to provide ‘like for like’ offsets for all biodiversity values, with this being the minimum requirement for those matters listed under the EPBC Act. The final offset requirement for the project would be determined during development of the offset package.

The draft EIS recognises the loss of hollow-bearing trees as a long term-impact that would affect local fauna populations. The number of hollow-bearing trees was counted at each plot/transect location within the study area and this data forms a component of the assessment of ecosystem composition and function under the FBA. The impact to hollow-bearing trees is offset as part of the ecosystem credit requirement for the project.

Some large remnant hollow-bearing trees, including the trees located near the truck inspection bay at Orchard Hills would be removed by the project. The safe retention of these trees within the median is not a viable option due to road safety, line of sight and other engineering purposes. Additionally, the wide central median has been included in the design to allow for future road capacity upgrades, therefore these trees would likely be subject to removal in the future, regardless of whether or not they could be retained in the current design.

The draft EIS includes a mitigation measure for a two staged clearing process (EIS mitigation measure B-3), which the contractor would be required to incorporate into the flora and fauna management plan (FFMP) to be developed for the project and implemented during construction. This mitigation measure has been expanded on in the biodiversity technical assessment undertaken as part of this Final EIS (refer to Appendix C) and summarised below.

A staged habitat removal process is to be used when hollow-bearing trees are to be removed as follows:

- Make contact with vets and wildlife carers before works start to ensure they are willing to assist treating injured animals if necessary
- An experienced and licensed wildlife carer and/or ecologist will be present on site during all habitat removal activities to capture and relocate fauna that may be encountered.
- Progressive habitat removal will take place around habitat identified and marked during the pre-clearing process. Remove non-hollow-bearing trees, undergrowth, feed-trees, regrowth and grass. Do not fell trees towards exclusion zones.
- Identified habitat (e.g. hollow-bearing trees) will be left for at least 24 hours after removing non-habitat vegetation to allow fauna to escape. A licensed wildlife carer and/or ecologist will check hollow-bearing trees are not being used by fauna before felling. If necessary, fauna may need to be trapped and relocated to pre-determined habitat identified for fauna release.
- Fell habitat trees as carefully as possible to avoid injury to any fauna still remaining in trees. Use equipment that would allow the habitat trees to be lowered to the ground with minimal impact (e.g. claw extension). Do not fell trees towards exclusion zones.
- An experienced and licensed wildlife carer and/or ecologist will inspect habitat once it is removed e.g. after a tree is felled. Animals that emerge should be captured, inspected for injury then relocated to pre-determined habitat identified for fauna release.
- All hollows have the potential to support fauna and will be placed in adjacent habitat until the following day for further inspection by a licensed wildlife carer and/or ecologist to verify no fauna is present. If possible, the hollows could be permanently relocated in adjacent areas. Inspect woody debris for fauna immediately before chipping to avoid injury or death to fauna that may be present.
- The project manager and/or environment manager should ensure that the outcomes of the clearing process are recorded. Reporting is usually the responsibility of an ecologist or environment officer. Reports are to be submitted to relevant personnel e.g. environment manager or Roads and Maritime regional environmental staff.
- Consider the seasonal impact of clearing on species identified in the environmental assessment or pre-clearing process or that are known to occur in the area.

### 2.7.2 Removal of threatened ecological communities

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**Issue description**

The respondents raised the following issues:

- Concern regarding the impacts of the project on Cumberland Plain Woodland
- Concern regarding the impacts of the project on Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest.

**Response**

The draft EIS identified the potential impacts to Cumberland Plain Woodland and this community is identified as a Matter for Further Consideration in the BAR as the project is considered likely to significantly reduce the viability of Cumberland Plain Woodland.

Based on the original construction footprint for the draft EIS design, the project would result in the direct clearing of about 33.83 ha of the TSC Act listed critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community. Following design refinements, this impact has reduced by 2.96 ha to about 30.87 ha. It is noted that although the TSC Act has now been replaced by the *Biodiversity Conservation Act 2016*, the project commenced assessment under the old FBA prior to the TSC Act being repealed, and therefore continues to be assessed and referenced in relation to the TSC Act.
Based on the draft EIS construction footprint, the project would result in the direct clearing of about 16.37 ha of the EPBC Act listed critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. Following design refinements, this impact has been reduced by 1.29 ha to 15.08 ha.

### 2.7.3 Removal of threatened flora

**Submission number(s)**

27

**Issue description**

The respondent raised the following issues:

- Concern regarding the impact of the Vineyard Road extension on an east-west terrestrial corridor, which has been identified to contain threatened plants including *Pultenaea parviflora* and *Marsdenia viridiflora*
- Request that further detail on the timing of ‘ground truthing’ in the area is provided
- Loss of identified threatened plants must be offset by the permanent conservation of a nearby population.

**Response**

An additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* was carried out in an expanded study area around the Vineyard Road extension on 7 August 2017. This area was not able to be accessed during the fieldwork carried out for the original assessment due to the property owners consent not being available at the time of survey. An area of habitat of about 4.7 ha was surveyed by an experienced botanist following the methods described in the NSW Guide to Surveying Threatened Plants (OEH, 2016). Traverses of this habitat were carried out over a three-hour period for a distance of 3.13 km (3,131 m) (refer to Appendix C). The survey located a further six *Pultenaea parviflora* plants (two of which were in the construction footprint, and four outside of the footprint). No additional *Marsdenia viridiflora* subsp. *viridiflora* plants were recorded during the survey.

This data has been used in the amended assessment of impacts and calculation of offset requirements for the project (refer to Appendix C).

Impacts to habitat corridors are further addressed in Section 2.7.5, fragmentation of biodiversity links and habitat corridors. Offsetting is also discussed further in section 2.7.8.

### 2.7.4 Impacts to aquatic biodiversity

**Submission number(s)**

1, 3, 4, 5, 16, 19

**Issue description**

The respondents raised the following issues:

- Concern regarding impacts to aquatic species, such as turtles, near the project due to the dewatering and backfilling of farm dams
- Request that the project include measures to protect and manage fauna, including capture and relocation of fauna by an appropriately qualified person prior to the dewatering of farm dams.

**Response**

The construction and operation of the project has the potential to impact aquatic ecosystems due to changes in water quality, hydrology, habitat loss and instream barriers. Many of the watercourses in the study area are artificial dams, located in minor gullies which are either first or second order streams, and are not considered key fish habitat. Threatened species would be
unlikely to be present within these dams, however there would potentially be native and invasive fish species colonising these dams as well as freshwater turtles and eels. If dams or creeks are to be dewatered during the construction of the project, then any native fish or aquatic fauna (including turtles) would need to be relocated into a similar aquatic environment to which it was found by trained aquatic ecologists under a Fisheries Permit issued by NSW Department of Primary Industries (DPI).

The dewatering of streams and farm dams would be carried out in accordance with the relevant procedures to be outlined in the construction environmental management plan (CEMP) and relevant sub plans (e.g. the FFMP and soil and water management plan (SWMP)). This would include the management and re-location of Eastern long neck turtles and other aquatic species. All fish and aquatic fauna works would require a Fisheries Permit issued by the DPI under Section 37 of the Fisheries Management Act 1994 (FM Act).

The selection of relocation sites would be conducted in consultation with DPI Fisheries upon permit application, and would consider permanence of water, any upstream disturbances, habitat, water quality conditions. Fish and other aquatic fauna would be relocated into a waterway with similar water quality and habitat characteristics to minimise stress. Where possible the relocation site would be within the same sub-catchment to avoid the inadvertent dispersal of fauna into unsuitable habitat.

During relocation, fish would be relocated into aerated transportation tubs. Tubs would be located in the shade during capture and transportation to avoid sudden changes in temperature. Frogs, turtles, fish and eels would be treated in a similar manner, however different fauna would not be transported within the same tub to prevent injury or consumption of smaller fauna. Turtles and frogs would be damp, but not submerged in water. Fish and other aquatic fauna would be transported to the recipient site as quickly as practical. Any invasive species would be euthanised in accordance with animal care and ethics permits requirements. Accurate records of species released or euthanised (in the case of exotic species) would be recorded and provided to DPI upon completion.

The draft EIS includes an existing mitigation measure for the development of a farm dam dewatering plan (EIS mitigation measure SWC-1), this measure would be revised as follows and incorporated into the revised environmental management measures for the project (refer to Chapter 6):

- A stream and farm dam dewatering plan would be prepared which includes:
  - a map showing locations of streams and farm dams to be dewatered and the selected relocation sites
  - fisheries Permit and Animal Care and Ethics requirements.
- Methodology for dewatering streams and dams with consideration to aquatic ecology including the capture, storage, relocation, release of fish and other aquatic fauna
- Euthanisation procedure (as required)
- Location of any offsite discharge points
- Requirements to manage encounters of poor water quality.

2.7.5 Fragmentation of biodiversity links and habitat corridors

Submission number(s)
7, 11, 12, 17, 18, 21, 25, 27

Issue description
The respondents also raised the following issues:
A number of respondents raised concern regarding the impact of the project on wildlife corridors and habitat connectivity and suggested additional fauna crossings, underpasses, fencing and other connectivity measures be included in the design.

The draft EIS does not accurately assess existing wildlife permeability along The Northern Road.

Concern that the draft EIS lacks detail and credible solutions that manage the loss of Critically Endangered vegetation communities and fragmentation of landscapes in Western Sydney.

Construction of the bike track to Mulgoa Nature Reserve would impact wildlife connectivity.

Bike trails should not be installed through or across the Surveyors Creek Corridor.

Concern regarding impacts of the project on the Flame Robin, Rose Robin and Eastern Grey Kangaroos.

Specific assessment should be made of potential barriers to the annual migration of the Flame Robin and Scarlet Robin over The Northern Road, especially to known habitat in DEOH.

The height of the proposed fauna underpass (1.5 metres) is not suitable for Eastern Grey Kangaroos.

Services should be routed to avoid interfering with Surveyors Creek Corridor and its future restoration on both eastern and western (DEOH) sides.

Physical barriers more than two metres high should not be located along the DEOH boundary.

There has been insufficient consultation regarding a suitable solution for the safe movement of fauna in the vicinity of the DEOH site.

Response

Due to the linear nature of the project, it will result in fragmentation of habitats. Habitat fragmentation is considered an important impact of the project and fragmentation impacts and the impact of barriers are discussed in 7.3 of the draft EIS. The draft EIS acknowledges fully that there would be localised fragmentation of local wildlife corridors between the existing Northern Road and Willowden Avenue where some intact habitat patches would be broken apart. The hard barrier introduced by the project would restrict fauna movement. Additionally, the widening of the existing Northern Road in the north of the study area would further exacerbate the existing barrier effects of this roadway where it bisects Regional Corridor 17 as identified in the NSW Office of Environment and Heritage (OEH) Biodiversity Investment Opportunities Map (BIO Map).

As identified in Section 7.3 of the draft EIS, the BIO Map identifies areas for biodiversity investment funding within the Cumberland sub-region, termed priority investment areas, including core areas and biodiversity corridors of state and regional significance. This includes Regional Corridor 17 which connects the Mulgoa Nature Reserve to the vegetation on the DEOH site. This is shown in Figure 7-7 of the draft EIS. As noted in the draft EIS, the BIO Map has not been approved by the Chief Executive of OEH and therefore these biodiversity links have not been included in the FBA calculations. However, connectivity measures have been identified as discussed below and are included as part of the revised environmental management measures for the project (refer to Chapter 6).

The draft EIS acknowledges the existing habitat connectivity within the landscape. Connectivity value has been assessed in accordance with Appendix 5 of the FBA. The connecting links have been identified and a connectivity value score assigned. The draft EIS details that the project would impact on local area biodiversity links (as defined under the FBA). Several local area biodiversity links have been identified (refer to Figure 2.3 of the BAR). The draft EIS acknowledges that the existing Northern Road is a single carriage (two lanes) road and considered a barrier of a size that would sever a connecting link. As such, the connecting links identified in the draft EIS cross the existing Northern Road. The existing Northern Road does however contribute to a considerable reduction in local connectivity when compared to areas without existing roadways (the links are not severed but are highly modified). The Northern Road is a heavily used roadway.
and significant barrier effects are currently present. The fence along the edge of the DEOH site does increase the barrier effect provided by the existing The Northern Road in this area. In this location, dispersal of fauna is currently limited but is not entirely prevented.

The draft EIS acknowledges that habitat connectivity would be altered during and after construction. There may be declines in population density and/or species richness within the remaining vegetation patches as a result of the project. There may also be an alteration to community composition, altered species interactions, and altered or ecosystem functioning in the locality as a result of the project. Due to the importance of connectivity, dispersal opportunities and habitat quality, for species at a local scale the project is considered likely to be detrimental to the dispersal of relatively sedentary species such as mammals, frogs, and reptiles. Local division of some wildlife populations, isolation of key habitat resources, loss of genetic interchange, and loss of population viability may result from the fragmentation caused by the project.

The impacts of altered connectivity on fauna species, including Eastern Grey Kangaroos and east-west obligatory migrant species such as the Flame Robin and Scarlet Robin, have been assessed according to the assessment process outlined in the FBA. The Flame Robin and Scarlet Robin are ecosystem credit species and direct impacts to these species, along with common species including the Eastern Grey Kangaroo, have been assessed in conjunction with general biodiversity values and they have been assessed as being at least moderately likely to be present in the habitats that would be impacted. Suitable habitat for these species is present and this is identified in the BAR. As with other fauna species, east-west obligatory migrant species such as the Flame Robin and Scarlet Robin would be detrimentally impacted by habitat fragmentation, as would macropods such as the Eastern Grey Kangaroo.

It is noted that the scope of the project does not include any separated bike trails that would impact on the corridor, the proposed shared path is immediately adjacent to the road corridor along the length of the upgrade. There are no plans for bike paths beyond this shared path.

Utilities would be relocated within the allocated easement available on either side of the road as assessed as part of the refined design footprint. This would include service relocations at the proposed Surveyors Creek crossing. The footprint within the DEOH site has been reduced where possible to minimise environmental impacts associated with the revised design. Mitigation measures including restoration of disturbed areas would be implemented as summarised in the revised environmental management measures for the project (refer to Chapter 6). This includes an update to existing environmental management measure SWC-3 which has been updated to in relation to rehabilitation of the realigned tributary of Surveyors Creek.

Connectivity measures are being considered during detailed design in accordance with the Wildlife Connectivity Guidelines for Road Projects (currently in preparation). In particular, maintenance of current connectivity and potential future connectivity has been considered in culvert design, lighting and fencing. Consultation with community members and the Penrith City Council was undertaken during the exhibition of the draft EIS to discuss proposed connectivity measures.

Connectivity between the Mulgoa Nature Reserve and the DEOH via Regional Corridor 17 (Surveyors Creek corridor) would be planned for in the future with construction of a fauna crossing to allow for future connectivity to the DEOH land. The proposed fauna crossing is currently a 2.4 m high dry passage underpass (refer to Figure 2-2). This is considered suitable for larger species such as the Eastern Grey Kangaroo based on monitoring results from Pacific Highway projects. However, the potential to increase the height of this underpass would be investigated during detailed design of project where reasonable and feasible. The culvert would lead from the Surveyors Creek corridor under the road and would exit at the new DEOH fencing within the road reserve. There is a second culvert that leads from this road reserve into the DEOH site. For DEOH security reasons, this second culvert would be blocked via bars at about 180mm spacing onto DEOH land. This is to prevent the public from gaining unauthorised access to the DEOH land through the underpass and to prevent animals from exiting the culvert onto the roadway. The bars would remain in place until a change in potential future land use would allow the removal of the DEOH fencing. While this would preclude larger animals crossing into the DEOH in the short term, it would still allow for connectivity for smaller animals. Appropriate control of the crossing in interim
period before the development on the east occurs will be considered further during detailed design. Fauna exclusion fencing would be provided either side of the crossing in accordance with Roads and Maritime standards.

Fauna passage would also be provided at Badgerys Creek with the construction of a fauna friendly drainage culvert of similar internal dimensions to the Surveyors Creek / DEOH culvert (refer to Figure 2-3).

The requirement for fauna passage at Surveyors and Badgerys Creek crossings have been incorporated into the revised environmental management measures for the project (refer to Chapter 6).

Figure 2-2 Cross section of the proposed culvert at the unnamed tributary of Surveyors Creek

Figure 2-3 Cross section of the proposed culvert at Badgerys Creek
There is a particular fencing specification required for the DEOH boundary. A Class 2 chain link perimeter fence is required to be installed to delineate the base boundary, as it is adjacent to a public road. This fence would be a galvanised, rail-less chain wire security fence with gates 2.4 m high (unless increased during detailed design), topped with at least three strands of barbed (or similar) wire to a total height of three metres. The mesh size of the fence would be about 50 mm x 50 mm. The fence would be kept clear of trees and other vegetation to a distance of five metres. This fence would continue the current level of fragmentation in the landscape until it is removed in the future due to any proposed changes in land use.

2.7.6 Impacts due to lighting

Submission number(s)
11, 17, 18, 27

Issue description
The respondents raised the following issues:

- Concern regarding the impacts of light pollution on fauna
- Reduced street lighting would minimise impacts to native fauna
- Request for lighting to be limited to larger traffic intersections to reduce impacts to fauna, such as threatened bat and owl populations, as well as other nocturnal species
- Lighting should be excluded from the width of the Surveyors Creek Corridor on both eastern and western sides, and along the length of Cumberland Plain Woodland on the DEOH site.

Response
The draft EIS acknowledges that night works would be required during construction which would involve the use of temporary lighting. Additionally, street lighting would be provided as required to support the safe operation of the project. Street lighting would be designed to ensure relevant guidelines are adhered to, including on light spill. The immediate area surrounding the project construction activities, and the roadside during operation, would be subject to artificial lighting. This would essentially create permanent ‘daylight’ conditions in the area around the lights. Ecological light pollution may potentially affect nocturnal fauna by temporarily interrupting their life cycle. Due to the frequency and sustained nature of the lighting, it would be unlikely that animals would habituate to the light disturbance and a long-term impact in the area of lighting would be likely. Despite efforts to minimise the impacts of lighting, localised impacts from light spill would remain and this has been identified and assessed as a residual impact in the BAR for the project.

2.7.7 Impacts due to landscaping

Submission number(s)
11, 17, 18

Issue description
The respondents raised the following issues:

- The Orchard Hills stretch of road should be kept rural in character. Landscaping should be avoided along the DEOH boundary and Cumberland Plain Woodland verges should be retained
- The use of local native flora species for roadside plantings will create habitat, help retain local character, and reduce roadside maintenance
- The width of the existing Surveyors Creek Corridor on both western and eastern sides should be capped with suitable Cumberland Plain Woodland substrate via soil translocation following earthworks
The Surveyors Creek Corridor and median strip and verges for chains adjoining the DEOH bushland should not be landscaped. The sites should be restored to BAM/FBA-criteria functional Cumberland Plain Woodland.

Response

An urban design and landscape concept has been developed for the project as documented in Section 8.5.3 the draft EIS, based on the project objectives and principles, to achieve an integrated design for the project. It incorporates the urban and landscape design concept plans for the project and a landscape planting concept including recommended species. As identified in the draft EIS, this would be adopted and further developed during detailed design and implemented as part of the Urban Design Landscape Plan (UDLP) for the project which is currently ongoing. This plan would be developed in consultation with Council, noting that there is a particular interest from the Community on the frontage of the DEOH site. Planting selection would be in keeping with the rural character of the area, and in accordance with DEOH security measures and road safety requirements.

The draft EIS includes a mitigation measure for the re-establishment of native vegetation (EIS mitigation measure B-6), which the contractor would be required to incorporate into the FFMP to be developed for the project and implemented during construction. This has been updated to include additional detail and would be included as part of the revised environmental management measures for the project (refer to Chapter 6).

Native vegetation would be re-established in disturbed areas and along the roadway using the following procedure:

- Ecologists and landscape architects will work together on the preparation of revegetation plans and specifications that clearly identify the locations of areas to be revegetated
- Allocate sufficient time for the collection of seed to be used in revegetation
- Carry out all seed collection in accordance with RTA Seed Collection QA Specification R176 and the Florabank Guidelines and Model Code of Practice
- Use experienced and licensed seed collectors to carry out seed collection
- Where possible, procured plants should be grown from local provenance seed where available
- Consideration should be given to a range of characteristics such as species, height and drought tolerance when procuring native plants
- Planting operations should be in accordance with RTA Landscape Planting QA Specification R179
- Use only plants that have been certified disease free for revegetation works
- Collect local native topsoils and leaf litter and store for use in revegetation works
- Soils in areas to be revegetated should match surrounding soil conditions as closely as possible unless adjacent areas are weedy or contaminated
- Ensure areas to be revegetated have an appropriate level of natural drainage
- Avoid compaction of soils in areas identified for revegetation. Where compaction has occurred, the soil should be loosened
- When planting consider seasonal risks of frost, drought, flooding and sun exposure to avoid damaging plants and to encourage growth
- Ensure plant spacing and diversity follows the landscaping plan for the project, reflects local conditions and is dense enough to ensure plants achieve a timely coverage of the ground
• Consider appropriate shade and drainage conditions when planting. Provide mulching around plants for dry or potentially weedy sites to help retain moisture and suppress weeds.

• Inspection, monitoring and maintenance of revegetated areas should be conducted in accordance with the landscape management plan. Outline the roles and responsibilities in landscape management and revegetation plans including the schedule for monitoring and maintenance activities.

2.7.8 Offsetting

Submission number(s)
27

Issue description
The respondents raised the following issues:

• The draft EIS does not appear to find value in all of the mature canopy species being removed
• All habitat loss in a Critically Endangered vegetation system must be compensated
• The draft EIS underestimates the offsetting required to compensate for direct losses and for the flow-on effects associated with the project
• Concern regarding the offsetting of Conservation Lands located on the DEOH site
• Requests that Roads and Maritime provide the respondent transparency of the offset process
• Concern regarding the ineffectiveness of BioBanking to offset the losses of critically endangered vegetation communities in Western Sydney
• There are insufficient offsets available to supply the offset needs for current development
• Requests that Roads and Maritime procure land to be managed for conservation.

Response
The BOS outlines the offsets required for unavoidable (residual) biodiversity impacts associated with the project and demonstrates that appropriate offsets are available and can be delivered for the project. Roads and Maritime are currently working in consultation with OEH to determine the quantum of offsets or supplementary measures that would be required for the project. The preferred approach to securing offsets for the project is to purchase credits from the market. Where credits are unavailable for purchase on the market, Roads and Maritime would work with public and private landholders to enter a BioBanking and/or Stewardship Agreement on their land and then buy the credits issued.

Supplementary measures at a landscape scale are also being investigated in conjunction with the OEH. The final offset requirement for the project would be determined during development of the offset package in consultation with the OEH. Following discussions with Roads and Maritime, the Commonwealth DoEE and OEH, it was decided that an additional supplementary measures package would be developed in consultation with OEH and the Commonwealth DoEE with a focus on landscape scale measures within the local area. The package may include measures such as weed eradication programs within Cumberland Plain Woodland. This requirement has been incorporated into the revised environmental management measures for the project (refer to Chapter 6).

Detail regarding additional offsets for impact to Cumberland Plain Woodland and measures to secure offsets is provided in section 5.1.3.
2.8 Socio-economic and land use

2.8.1 General issues/errors

Submission number(s)
23

Issue description
The respondent raised the following issues:

- Table 4-18 Social Infrastructure on page 54 of the socio-economic technical working paper (Appendix J of the draft EIS) omits Luddenham Progress Hall, next to the Uniting Church, from the list of Cultural facilities.

Response
The respondent’s advice is noted. The draft EIS (Table 4-18 - Social Infrastructure in the broader study area) should have included The Luddenham Progress Hall (Roots Avenue, Luddenham). The project would not have a direct impact on the Luddenham Progress Hall. Indirect impacts to the hall from construction activities would be unlikely due to the distance of the hall from the construction area of the project.

2.8.2 Assessment methodology

Submission number(s)
23

Issue description
The respondent raised the following issues:

- While there is a broad brush quantitative discussion of grouped communities from the 2011 Census data (eg Luddenham-Mulgoa-Orchard Hills; or Greendale-Bringelly), there is little qualitative information especially regarding the difference between villages, as each have different histories and community make-up.

Response
The socio-economic technical working paper (Appendix J of the draft EIS), as summarised in Section 7.4 of the draft EIS, involved a process of analysing, monitoring and managing the intended and unintended social and economic impacts, both positive and negative, of the project. It involved identifying, assessing and evaluating changes to or impacts on, communities, business and industry that would be likely to occur as a result of the project, in order to mitigate or manage impacts and maximise benefits. This assessment was developed in accordance with the Roads and Maritime Environmental Impact Assessment Practice Note N05 – Socio-economic assessment and to address socio-economic matters outlined in the SEARs and the economic and social matters identified in the Commonwealth EIS Guidelines.

Information presented in the socio-economic technical working paper from the 2011 Census is based on the Statistical Area Level 2 (SA2) geographies defined by the ABS. They include:

- Glenmore Park-Regentville
- Mulgoa-Luddenham-Orchard Hills
- Badgerys Creek-Greendale
- The use of these ABS SA2 geographies is consistent with other Roads and Maritime socio-economic impact assessments.
The socio-economic technical working paper (Appendix J of the draft EIS) recognises the difference in social and demographic profiles of more recently developed areas (e.g. Glenmore Park) and more established rural localities (e.g. section 4.3.1, section 4.3.2 and section 4.3.5 of the technical working paper). The different community values associated with the villages and more recently developed urban areas are also recognised in section 4.5 of the technical working paper. This includes connections to the area of long-term residents.

The socio-economic technical working paper was also informed by the outcomes of consultation. This includes consultation with property owners and residents from across the study area.

The socio-economic technical working paper also recognises the different effects of the project on various communities. For example, section 6.1.2 of the working paper recognises the effects on social networks and community relationships associated with property acquisition, particularly for long-term residents, and older populations. Potential impacts on families that have had the same property for several generations are also recognised.

### 2.8.3 Property value and compensation

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**Issue description**

The respondents raised the following issues:

- Concern regarding the impacts of the project on property values and request to be compensated for property devaluation
- Concern regarding changed access to private property, and the potential impact on property values, safety and compensation
- Compensation for partial or total acquisition does not account for the loss of heritage, family history, connection to the property and community, future use of the property, or increased traffic noise and loss of amenity
- The impacts on “registered” businesses are acknowledged as important within the report, however the compensation for property owners who also use their land for income-producing primary production (without operating a business open to the public) has not been considered.

**Response**

As outlined in section 7.4.4 of the draft EIS, property values are driven by a range of factors. It would be likely that external factors, such as the Western Sydney Airport and future urban development, may influence property values.

Roads and Maritime would acquire properties for the project in accordance with the provisions of the NSW *Land Acquisition (Just Terms Compensation) Act 1991*. Among other things, this Act provides the basis for assessing compensation.

Compensation is based on the assessment of the market value, unaffected by the road project, however as stated in the draft EIS, Roads and Maritime does not pay compensation to properties that are not materially impacted (i.e. property or buildings physically or structurally affected).

The owner may also choose to engage its own registered valuer to carry out a valuation of the property. The valuations on behalf of both Roads and Maritime and the property owner are discussed between the parties, including the respective valuers.

The total purchase price may where relevant, also include, in addition to the market value, reasonable costs arising from any need to relocate, such as:

- Legal costs including conveyancing fees
- Valuation fees
- Removalist costs
- Pest and building inspection costs
- Stamp duty costs in connection with the purchase of another property of equal value • Mortgage re-establishment costs and other payments
- Solatium (an amount of money to compensate an owner for the inconvenience of having to move their primary residence).

Under the NSW Land Acquisition (Just Terms Compensation) Act 1991, where property compensation offers are in dispute, Roads and Maritime attempts to resolve the dispute by negotiation. The Valuer General provides independent valuations for all properties that are unable to be agreed between Roads and Maritime and the owner and as a resultant must be compulsorily acquired, in accordance with the NSW Land Acquisition (Just Terms Compensation) Act 1991.

The socio-economic assessment recognises that some properties impacted by property acquisition are used for home based businesses. As indicated in section 6.5 (working paper), where business properties are impacted by property acquisition, compensation for reasonable disturbance costs likely to arise would be considered by Roads and Maritime (Roads and Maritime, 2014). This would include compensation for any temporary disruption to business operations. The use of the term ‘registered businesses’ relates to ABS data on Counts of Australian Businesses.

The socio-economic assessment considered potential impacts on all businesses near the project that were identifiable through either a visual survey or desk-top research (e.g. internet searches). Direct impacts on land used for primary production, that were not clearly identified as a business, were considered as part of the assessment of agricultural uses (refer to section 6.6.2 of the working paper). This recognised that acquisition would impact on land used for primary production (e.g. dairy farming, cropping, grazing, horticultural production), with potential impacts related to such things as loss of productive land, impact on farm infrastructure, severance of agricultural properties, changes to the movement of farm equipment and changes to farm access.

Potential impacts on property owners and residents of property acquisition are addressed in section 6.1.2 of the socio-economic technical working paper (Appendix J of the draft EIS).

Management measures outlined in section 7.4.6 of the draft EIS involve effective and ongoing communications with the community and affected land owners and reflect Roads and Maritime’s commitment to consultation and negotiation with affected landowners in relation to land acquisition. This process is ongoing.

### 2.8.4 Acquisition

**Submission number(s)**

13, 14, 23, 24, 31

**Issue description**

The respondents raised the following issues:

- Questioning why partial property acquisition is occurring on private property instead of government land on the opposite side of the Northern Road
- There has been no assessment made of the environmental effects should government land be used rather than private land.
- Comment that the draft EIS does not adequately assess the impacts of stress related to property acquisition
- Concerns regarding the design of Gates Link Road and the related property impacts and acquisition.
Response

Chapter 4 of the draft EIS outlines the route options development process that was carried out during development of the project. In particular, a key component of the route options development was the consideration of minimising impacts to private property.

The selection of the preferred corridor was based on the preference to utilise the existing road reserve as much as possible to accommodate the road upgrade rather than investigate realignment options that would result in larger property acquisitions or property severance. Upgrading the road within the existing road corridor and widening to the east (Commonwealth land side) was chosen as the preferred option as it would result in substantially less private property acquisition and because this has a lower project cost and higher overall performance against WSIP and project objectives.

The existing road reserve between Littlefield Road, Luddenham and Glenmore Parkway, Glenmore Park is generally about 40 m wide. Early in the project’s design it was identified that an additional 20 m of corridor may be required to provide for the proposed upgrade of The Northern Road. While partial acquisition is occurring on both sides of the road, with more property impacted within the DEOH than private property on the western side of the road corridor.

Property Acquisition for the project will be conducted in accordance with the provisions of the NSW Land Acquisition (Just Terms Compensation) Act 1991. Among other things, the Act provides the basis for assessing compensation.

The acquisition process includes the appointment of a dedicated case manager (Property Manager Acquisition) to help landowners understand their rights and provide a single point of contact right through the acquisition process. The case managers have also been involved in the partial acquisition on this project.

The project has the potential to significantly impact on MNES including EPBC listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. The project would also significantly impact upon areas of Commonwealth land associated with the DEOH and land purchased by the Australian Government for the Western Sydney Airport. The draft EIS fully assesses the potential impacts to Commonwealth land located within the DEOH site and the Western Sydney Airport site. All assessments within the draft EIS have been prepared that addresses both the SEARs and the Commonwealth EIS Guidelines.

The impacts of property acquisition are considered within the socio-economic technical working paper carried out for the project (Appendix J and section 7.4.4 of the draft EIS). The draft EIS outlined that disruption caused by changes due to property acquisition can result in a number of impacts including:

- Anxiety and stress about changes as well as uncertainty regarding the acquisition process. Consequential effects on health and well-being
- Disruption to community cohesion, social networks and community relationships, particularly if people need to move away from the local area and from existing social and support networks
- These impacts are likely to have the greatest effect on groups such as the elderly, people with disability, longer term residents and people on lower incomes who are often more reliant on personal and community networks.

It is acknowledged that stress is difficult to quantify. Management measures outlined in the draft EIS (refer section 7.4.6) involve effective and ongoing communications with the community and affected landowners and reflect Roads and Maritime’s commitment to consultation and negotiation with affected landowners in relation to land acquisition. This process is ongoing.

Affected land owners were initially consulted with project’s designs that were preliminary in nature and still subject to further survey and consultation. There were no formal agreements entered into between Roads and Maritime and landowners based on these plans.
Following further survey and discussions with all affected landowners, design refinements were made to the proposal at Gates Link Road. Matters that were considered during the consultation and design process included:

- Further survey and optimal design considering the topography of the landscape
- Presence of dam infrastructure and access to water resources
- Maintenance of a constant width between The Northern Road and Gates Link Road to not preclude future land use
- Distance to properties and loss of land due to acquisition.

These are discussed below in more detail.

Roads and Maritime met with Penrith City Council on 29 June 2016 to discuss the proposal. One of the outcomes of these discussions was their request to ensure the design of Gates Link Road would not preclude future development of the land between The Northern Road (as upgraded) and the proposed Gates Link Road. The concept design was developed with this in mind and consultation was carried out based on the concept design.

A response during this early consultation phase was received from one of the potentially impacted property owners who raised concerns regarding their property being segmented and cut off from a dam on the property, being a primary water source for the property. Subsequent to this the alignment was redesigned as per the draft EIS design.

Another local resident potentially impacted by the design did not receive the initial community update in July 2016 and was subsequently consulted in August 2016 based on an advanced version of the draft EIS design. This resident expressed concerns regarding the loss of land at their property and the proposed road being located so close to their house.

A letter was also received from a third potentially impacted property owner in September 2016. This submission identified that the alignment of Gates Link Road was segmenting a large area of their land and making it unviable for future development. They requested a 200 m width between The Northern Road and Gates Link Road.

Considering all consultation outcomes and taking into consideration the topography and environmental constraints in and around this location of the project, including the presence of Cumberland Plain Woodland threatened ecological community and associated habitat for threatened fauna species, the design of Gates Link Road was amended post exhibition of the draft EIS as per the refined design presented in this document.

This design provides a width ranging between 100 m and 140 m between the proposed alignments of The Northern Road and Gates Link Road. This refined design was presented to impacted property owners during property adjustment discussions in August 2017.

While the refined design has moved further to the east since the draft EIS was exhibited, Roads and Maritime has reduced the amount of land required for acquisition in the area. This has resulted in some land being temporarily leased during construction instead of acquired for the operation of the project.

All affected property owners have been consulted regarding the following issues:

- Property adjustments would involve reinstating affected property access and driveways
- Offers of plant screening to reduce the visual and amenity impacts and improve privacy.

Further consultation has been carried out since the draft EIS exhibition, including consultation regarding the refined design, and will continue to be undertaken with landowners in the future.
2.8.5 Construction impacts

Submission number(s)
23, 24

Issue description
The respondents raised the following issues:

- There is little discussion of the effects of compounds on adjacent properties, especially pollution, from construction activities on grazing and other land, as well as noise
- Concern that impact of the construction and use of the new road on affected residents have been completely ignored because their number is considered low.

Response
A detailed socio-economic impact assessment has been carried out for the project and is provided in Appendix J of the draft EIS (socio-economic technical working paper) and section 7.4.4 of the draft EIS. The assessment was carried out in accordance with the SEARs and requirements of the Commonwealth EIS Guidelines.

The assessment included the consideration of impacts related to all construction activities and the temporary ancillary facilities (construction compounds). The assessment considered impacts to the surrounding socio-economic environment such as communities, commercial and residential considerations and also included a business impact assessment which identified potential impacts to businesses, including direct impacts and impacts from changed trade. Land use impacts during construction were also assessed as discussed in section 7.4.3 of the draft EIS. The use of land affected by temporary leases during construction would be temporarily disrupted or suspended for the duration of the lease.

Any structures, facilities or infrastructure located on the affected lands would likely be demolished and/or relocated, in consultation with the landowner. On completion of construction, any land not required for the project’s long-term operation would be reinstated to its former condition.

The assessment of residual, construction related impacts (ie impacts after the application of environmental management measures) identified that the overall social impact of construction would likely be minor and that:

- Short-term changes to traffic and access, including reduced travel speeds, increased delays near construction works and temporary changes to accessibility for pedestrians and cyclists. This may require some motorists, pedestrians or cyclists to travel further to reach their destination. This would be necessary to ensure construction work is carried out safely. This impact would be minor and is not considered to be significant
- Short-term changes in local amenity for some residents, businesses and visitors near the project, associated with increased noise, dust and visual impacts. Overall, these impacts would be temporary and will be managed to an acceptable level. It is acknowledged that some people may experience ongoing amenity impacts that affect the use and enjoyment of their property during construction. This impact is not considered to be significant.

Management measures specific to construction noise are outlined in section 7.3.8 of the draft EIS. A CNVMP would be prepared and applied to all construction processes throughout the project. The CNVMP would include the requirement to monitor the effectiveness of construction mitigation measures at sensitive receivers. The frequency of monitoring would be outlined in the plan but would include the requirement for additional monitoring if complaints are received. The monitoring would be carried out to determine if construction methods or techniques need to be refined to minimise noise.

Since exhibition of the draft EIS, further detail has also been provided regarding the proposed out of hours works for the project. Appendix A also provides further detail regarding the application of mitigation measures for activities during standard and out of hours construction periods.
As outlined in section 7.4.6 of the draft EIS, a Community Involvement Plan will be prepared to ensure effective communication with affected community members and minimise impacts during the construction of the project. The Community Involvement Plan would be in addition to a range of additional and specific mitigation measures that would be used to minimise the impacts from issues such as noise and air emissions, temporary changes to traffic conditions and changes to amenity.

2.8.6 Operational impacts

Submission number(s)
23, 24

Issue description
The respondents raised the following issues:

- The working paper and relevant chapter in Volume One give more weight to the economic impacts on affected businesses than the impacts on property owners and residents who are not registered businesses.
- Each section in this working paper indicates there is little “significant” impact in terms of the project as a whole for all aspects of the analysis. However, there is no definition of what is significant or how this is measured or how many people have to be affected or the extent of the impact for it to be considered “significant”
- The measure of “significance” of each of the project impacts is not defined in this working paper nor Volume 1.

Response
Appendix J (Socio-economic assessment) of the draft EIS assesses directly affected agricultural uses (section 6.6.2). Some rural properties impacted by property acquisition comprise agricultural businesses. These include businesses that sell produce direct from the property.

Further information about broader impacts of construction and operation on agricultural uses and businesses in the study area is provided in section 6.6.3 of draft EIS Appendix J. In both cases, direct and indirect impacts on agricultural also assumes that impacts to those uses include registered and unregistered agricultural businesses. The assessment identifies that acquisition for the project would impact on land used for dairy farming, honey production, grazing, cropping and horticulture production. Potential impacts on directly affected agricultural businesses would generally be associated with:

- Loss of productive land, including land used for pasture, feed crop and horticulture production
- Direct impact on farm infrastructure such as dams, irrigation, fencing, sheds and storage areas, and other facilities, resulting in the loss of this infrastructure or the requirement for this infrastructure to be relocated
- Severance or fragmentation of larger agricultural properties, potentially isolating some parts of agricultural properties and impacting on the efficiency of farm management, and farming operations associated with the movement of livestock and/or farm machinery and equipment
- Changes to the movement of farm equipment and livestock, including between different areas of farming properties
- Changes to farm access, including for vehicles transporting produce or delivering farming equipment and supplies.
The level of significance is dependent on a range of factors such as the extent of the impact (i.e. individuals, local or regional areas), whether the impact is temporary or permanent, and the magnitude or severity of the impact. In evaluating significance, consideration is given to such things as the nature of the impacts (e.g. are they negative or positive), ability or capacity of communities to tolerate or respond to changes and whether the area affected is limited to people for whom individual arrangements can be made or extends to an area which requires more detailed strategies to be implemented.

The severity of impacts would depend on such things as the proportion of the socio-economic value lost or impacted and whether the impact would diminish over time. For example, impacts that have a lower level of significance would generally relate to those that result in minor changes to the social environment, quality of life or social conditions, and that would be easily reversible over time. Impacts with a high level of significance may include those that have a large, but temporary impact on quality of life or social conditions, and/or that are likely to have serious social issues, temporary ceasing of social functions, while impacts that are considered to have a very high level of significance may be those that impact a large proportion of the population, or on quality of life or social conditions, or that cause irreparable damage to items of high community value or great social significance.

While the report recognises that some impacts are not expected to be significant in the context of the project as a whole (i.e. due to such things as duration, the extent of population affected, impact would be reversible over time), it also recognises that some impacts are likely to be a concern (or substantial) for some affected individuals (e.g. those affected by property acquisition).

Other potential socio-economic impacts on property owners and residents who are not registered businesses is assessed in Appendix J of the EIS and summarised below.

Potential socio-economic impacts during construction would include:

- Direct land use impacts associated with the location of construction compounds, temporarily disrupting use and access to land including rural or vacant land, residential and commercial uses
- Temporary decrease in local amenity for residents, community and business facilities and natural areas near to construction worksites and work areas, due to increased noise and dust from construction activities
- Increased construction traffic and temporary changes in local access and connectivity, including for motorists, public transport users, pedestrians and cyclists during construction resulting in delays and disruptions
- Temporary decrease in visual amenity due to the presence of construction works including light spill from any night-time construction works
- Removal and/or relocation of farm infrastructure near to the construction footprint, such as farm dams, fencing and internal roads
- Increased movement of construction vehicles within the construction footprint, potentially increasing the likelihood of the spread of weeds and pests between rural properties.

Overall, potential impacts would be short-term in nature. While these impacts may be a concern for some individuals, overall they are not expected to be significant, given the implementation of proposed environmental management measures.

The project would also impact positively with the creation of direct and indirect employment opportunities throughout the construction phase. The potential positive impacts of the project are expected to outweigh the negative impacts during construction of the project.

As identified in section 7.4.4 of the EIS, the main impact during operation of the project would be the required acquisition of properties including privately owned land, as well as land owned by Roads and Maritime, other NSW Government agencies and the Commonwealth Government. The
majority of land to be partially, or fully acquired for the project comprises residential uses. A revised property acquisition table is provided in Table 5-12 of this document based on the revised design. The acquisition of land required for the operation of the project would be permanent and would result in long-term impacts to property as a result of the project. Roads and Maritime would continue to consult with property owners to effectively mitigate potential land use and access impacts where possible through detailed design.

Roads and Maritime would acquire properties for the project in accordance with the provisions of the NSW Property Acquisition (Just Terms Compensation) Act 1991. Among other things, the Act provides the basis for assessing compensation.

The draft EIS identified some potential adverse impacts to local amenity at those properties where The Northern Road moves closer to homes, businesses or community facilities due to the realignment or widening of the road corridor.

Overall, the operation of the project would contribute to improved access and connectivity to community services and facilities at the regional, State and national level, within or near to the study area, through improved travel time savings and improved travel time reliability. Additionally, the project would provide improved access not only to the planned airport site, but also to the Western Sydney Priority Growth Area and the South West Priority Growth Area. Through improved access and connectivity, the project would help to stimulate economic development that would eventually benefit local communities in terms of improved social infrastructure in the project area.

2.9 Hydrology and flooding

2.9.1 Stormwater runoff

Submission number(s)

13

Issue description

Further information required regarding the impact of insufficient stormwater retention, and associated stormwater run-off, on the respondent’s property.

Response

Roads and Maritime have conducted specific, further consultation with the landowner including providing relevant flood mapping from the draft EIS.

As demonstrated in Appendix K1 of the draft EIS (Table D.1 Summary table peak flow) the project would result in a decrease in the cross sectional area of the pipes upstream of the affected property. This decrease in the size of the culverts crossing The Northern Road upstream results in a decrease in the peak flow rates reaching the property (as is shown in Appendix K1 of the draft EIS, Table D.1).

The landowner was also provided the relevant drainage design plans and a suite of figures showing the relevant modelled results for:

- Change in flood levels for 1:2, 1:10, 1:50 and 1:100 between pre and post project
- Pre and post project predicted flood levels for 1:2, 1:10, 1:50, 1:100 and probable maximum flood (PMF).
2.10 Soils, water and contamination

2.10.1 Contamination

Submission number(s)
22

Issue description
Concern regarding the potential for the project to result in reduced water quality at dams on private property.

Response
Roads and Maritime proposes to implement water quality management measures to manage the suspended solids and associated contaminants from the road pavement runoff. The project would include grass swales as part of the drainage system conveying road pavement runoff. Grass swales provide water quality improvement because of the interaction between the flow and the vegetation along the length of the swale. The vegetation acts to spread and slow water velocities, which in turn aids the deposition of sediments. The proposed swales are highly efficient at providing suspended solid capture and reasonably efficient at reducing nutrients. The pollutant load reduction results vary depending on the swale length and slopes and from one pollutant to another. Modelling indicates the swales achieve reduction in Total Suspended Solids (TSS) of 78 per cent to 93 per cent, for Total Phosphorus a reduction 43 per cent to 64 per cent and for Total Nitrogen a reduction 11 per cent to 45 per cent).

Water quality would also be managed during the construction phase of the project. Prior to construction, baseline water quality monitoring would be carried out to identify parameters for monitoring during construction and to determine indicative existing water quality. The potential impact on receiving waterways during construction would generally be mitigated through erosion and sediment controls including appropriately sized temporary sediment basins. A SWMP would be prepared as part of the CEMP prior to the commencement of construction.

2.11 Non-Aboriginal heritage

2.11.1 General issues / errors

Submission number(s)
23, 24

Issue description
The respondents raised the following issues:

- Historical information has been incorrectly reflected in the non-Aboriginal heritage technical working paper (Appendix N of the draft EIS), and as a result there are errors which have been carried through into the published documents.

- In relation to Item 3: Warragamba Dam to Prospect Reservoir Pipeline, the focus in the report solely on the use of Chinese workers for a year on the pipeline fails to acknowledge the major engineering and historical impact of these large infrastructure projects on the wider community, growth of new settlements and the contribution to the multicultural community that developed in the area.

- In relation to Item 6: Weatherboard House and Sheds, Luddenham, the location of the original slaughterhouse is noted as being on the same site as the current slaughterhouse, and confirmation is provided that the Roots family lived there for a number of years.
• In relation to Item 7: “Pleasantview” House 1, Luddenham, it is suggested the authors clarify the statement with the owner (Mr Ken Hughes) as to who brought the building to the property as it is understood it may have been his father or grandfather that did so.

• In relation to Item 8: ‘Luddenham Village’ area: Chapel and School Site and Adams Road House, it is noted that Mrs Roots stated to Mrs Sales, that when she was a girl she attended the Primitive Methodist Chapel and school on the site. It is also noted that land was procured further along the Northern Road for the Methodist Church, in its current position. Subsequently the location of the original Primitive Methodist chapel and school was sited on land later owned by Mr HL Sales approximately between 14 – 18 Eaton Road. The only use of the land from the time of his purchase (around 1920) was sheep grazing. It was sold on his death in the early 1970’s.

• In relation to Item 8: ‘Luddenham Village’ area: Chapel and School Site and Adams Road House, it is noted that this was developed although not as extensively as early plans suggest and with larger lots in some cases.

• In relation to Item 9: Miss Lawson’s Guesthouse, it is noted that Miss Lawson’s name was Carrie not Cassie. The guesthouse had a slab kitchen. The guesthouse was still standing when Mr HCJ Sales was a boy in the 1920’s. Mr Jack Vicary and Mr Dan Lawson lived in the guesthouse in its final years. When they died the land was auctioned and was bought by Mr HL Sales who used it for sheep grazing. Following his death in 1970, the land has been used solely for grazing. The land was consolidated with a further purchase of what is now 7, 15 and 25 Adams Road from Mr John Adams.

• In relation to Item 9: Miss Lawson’s Guesthouse, it is noted that the location of wells, stone gatepost and road cutting as documented for survey area 4-13 are predominantly located further to the south.

• Noted that Figure 5-8 on page 52 of the non-Aboriginal heritage technical working paper actually shows the eastern view not the western view of Eaton Road.

Response

Additional assessment since exhibition of the draft EIS has been carried out as documented in the non-Aboriginal heritage technical memorandum prepared as part of this assessment (refer to Appendix D). The memorandum has been prepared in response to community and agency submissions received during exhibition, including those summarised above.

The assessment incorporates the results of further historical research and information gathered from local oral histories to update the histories and significance assessments for some of the heritage items assessed in the draft EIS as follows:

- Item 3: Warragamba Dam to Prospect Reservoir pipeline
- Item 5: Weatherboard house, slab hut and old dairy, Luddenham
- Item 6: Weatherboard house and sheds, Luddenham
- Item 7: “Pleasantview” House 1, Luddenham
- Item 8: ‘Luddenham Village’ area
- Item 9: Miss Lawson’s Guesthouse site
- Item 10: Lawson’s Inn site.

The additional assessment also included a comparative analysis for Item 9: Miss Lawson’s Guesthouse site and Item 10: Lawson’s Inn site to aid the assessment of heritage significance for these sites. A comparative analysis provides a review of comparable sites to assist in the understanding of factors such as rarity and representativeness which inform the assessment of a place’s significance. A comparative analysis can also be valuable in predicting the layout of the establishment by comparing a site to like sites as it could be easily assumed that what made one place successful would be replicated by other places.
The assessment of individual heritage items in Appendix D replaces those presented in section 5 of the non-Aboriginal heritage technical working paper and corresponding details in Section 8.3 of the draft EIS. This includes the documented histories and statements of heritage significance for these items. Although the significance assessments and associated statements of heritage significance have been updated for these items, there was no change in relation to whether or not these items satisfied the criteria for local or State listing, with no State significant heritage items identified for the project.

Further to this, research designs and excavation methodologies have been prepared for the following:

- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (in relation to Chaffey Brothers Irrigation Scheme Canal)
- Item 9: Miss Lawson’s Guesthouse site
- Item 10: Lawson’s Inn site.

The potential archaeological significance of these sites and expected impacts has been reflected in the updated assessment in Appendix D to reflect further knowledge of the sites.

In addition to the further historical research undertaken for the items above, it is acknowledged that in relation to Item 1: Remnants of The Northern Road, Figure 5-8 on page 52 of the non-Aboriginal heritage technical working paper for the draft EIS was incorrectly referenced, with this image facing east along Eaton Road not west as stated. The figure title is to be read as follows:

Figure 5-8: Eaton Road, facing east. Photo taken by Jennifer Chandler on 25 February 2016.

2.11.2 Construction impacts

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<th>Submission number(s)</th>
<th>23</th>
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**Issue description**

The respondents raised the following issues:

- In relation to Item 9: Miss Lawson’s Guesthouse, a respondent expressed concern that the access to ancillary facility C8 as shown in the draft EIS will destroy the site, and that this is not captured in the assessment of ancillary facilities against the relevant SSI criteria as per Table 5-16 of the draft EIS.

**Response**

As outlined in the non-Aboriginal heritage technical memorandum (Appendix D), in relation to Item 9: Miss Lawson’s Guesthouse site, it is noted that although the location of the proposed ancillary facility C8 overlaps with this item, construction and operation of the ancillary facility would not result in any additional impact to the site that would not already be impacted by construction of the road at this location (refer to Figure 5-8).
2.12 Urban design and visual impact

2.12.1 Lighting

Submission number(s)
22

Issue description
Concern regarding street lighting impacts on the respondent’s property.

Response
The introduction of street lighting is required to support the safe functioning of the road. Street lighting would be designed to avoid unnecessary light spill on adjacent residents or sensitive receivers in accordance with AS 1158.1-1986 – The lighting of urban roads and other public thoroughfares, performance and installation design requirements. Street lighting in proximity to the airport has been specifically designed in accordance with aviation requirements.

2.12.2 Impacts to existing landscape character

Submission number(s)
21, 22

Issue description
Concern regarding the impact of the project on the landscape of the area and loss of rural aspect and privacy to private property.

Response
The draft EIS and Appendix O – Urban design, landscape character and visual impact assessment provides a detailed assessment of the urban design and visual amenity implications of the project and consideration of impacts on views and vistas.

The approach to the assessment follows the Roads and Maritime Services Guideline for Landscape Character and Visual Impact Assessment EIA-N04 (RMS, 2013) and includes an evaluation of the project’s visual impact by comparing the sensitivity of viewpoints and the magnitude of the impact of the upgrade upon them. A total of five Landscape Character Zones (LCZ) were identified for the project. The draft EIS details that the LCZ are generally rural in nature and have a high sensitivity to impacts.

The assessment identifies that the project would fundamentally alter the character of the existing road north of Elizabeth Drive, and introduce a new road alignment into greenfield areas south of Elizabeth Drive. The change in road character, in particular the width of the road, combined with extensive earthworks and removal of vegetation and farm dams would have a considerable impact on the existing rural landscape along the route. The project would impact on all LCZs, due to the scale of the proposed works and the high sensitivity of surrounding areas, with some private properties significantly affected.

The draft EIS also notes that substantial land use changes are planned for areas along the project south of Elizabeth Drive and east of the new road alignment. They include the development of employment lands within the Western Sydney Priority Growth Area (WSPGA), the Western Sydney Airport and the development of urban centres and residential areas within the South West Priority Growth Area (SWPGA). The upgrade of The Northern Road would support these planned changes.

While landscape and mitigation measures may assist the integration of the project with surrounding areas and people may adjust to the landscape character and visual changes, the impacts themselves are not likely to significantly reduce over time, especially in those areas retaining a large rural component or situated at the interface with rural lands.
Project specific environmental management measures identified in the draft EIS (Table 8-35) have been developed with the aim of minimising or mitigating, as far as practical, the potential impacts of the project and support a range of urban design outcomes incorporated into the project's design.

The mitigation measures seek to integrate the proposed upgrade with the existing landscape while taking into account the planned changes to maximise the long-term fit of the project within its natural and built setting.

In the context of an urbanising landscape, it has been anticipated that the long-term landscape character changes brought about by the project would be consistent with the future planned character and use of the area.

Roads and Maritime is consulting with affected property owners to mitigate the impacts of the project.

2.13 Air quality

2.13.1 Impacts to health

Submission number(s)

13

Issue description

Concern regarding increased particulate pollution associated with traffic near the respondent’s property and the impact this may have on human health, building elements and flora and fauna.

Response

Potential air quality impacts for the operational phase of the project as well as for a ‘do minimum’ scenario were modelled and compared against background levels (refer to section 8.6.6 of the draft EIS).

Air quality impacts were predicted to be minor, and the project was not predicted to result in air quality concentrations exceeding relevant criteria at surrounding receivers (excepting PM2.5 which is already exceeded as a result of elevated background levels). No specific environmental management measures have been recommended beyond traffic flow and composition verification monitoring once the road is in operation.

Though the project is not expected to result in unacceptable air quality concentrations at surrounding receivers during operations, concentrations were predicted to marginally increase relative to the ‘Do minimum’ option. Relative concentrations would also increase markedly along the portion of the project which takes a new route from the existing road around Luddenham, which was previously mostly unaffected by road-related emissions.

Regarding operation of the project, noting the low level of impacts generally predicted at a local scale, it is not expected that the project would result in any significant changes to regional air quality. Even in the instance of PM2.5, though the project may further elevate concentrations above the annually averaged criterion of 8 µg/m³ locally, this effect becomes comparable to the ‘do minimum’ option at around 200 m from the alignment and as such would not result in any material changes at a regional scale.
2.14 Cumulative impacts

2.14.1 Mitigation measures

Submission number(s)
23

Issue description
Concern that mitigation measures may not be adequate and coordinated between Roads and Maritime and other large infrastructure projects in the area to address the cumulative impacts of the project and other large infrastructure projects.

Response
Chapter 9 of the draft EIS provides a cumulative impact assessment for the project and other proposed developments within the region. Mitigation measures outlined in the draft EIS stipulate that consultation would be carried out with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts in order to minimise them. These engagement activities would be monitored, assessed and reported regularly to ensure they are effective.

2.14.2 Impacts on property owners

Submission number(s)
23

Issue description
Concern regarding the acknowledgment and extent of discussion of cumulative impacts on individual property owners in the socio-economic impact assessment in the draft EIS.

Response
The socio-economic assessment does recognise potential impacts associated with long-term residents and family connections to land and that the area has experienced a loss of agricultural land associated with increasing urban development and the proposed Western Sydney Airport.

Potential impacts relating to stress and anxiety associated with property acquisition and disruption to social networks are described in section 6.1.2. Potential impacts associated with changes in local amenity are described in the urban design, landscape character and visual impact, and noise and vibration and air quality technical working papers as well as in section 6.8.2 of the socio-economic assessment.

Roads and Maritime acknowledge that substantial land use changes are planned for areas along the project south of Elizabeth Drive and east of the new road alignment. They include the development of employment lands within the WSPGA, the Western Sydney Airport and the development of urban centres and residential areas within the SWPGA. The upgrade of The Northern Road would support these planned changes.

Roads and Maritime has carried out consultation with directly affected property owners. Management measures outlined in Chapter 12 of the draft EIS involve effective and ongoing communications with the community and affected land owners and reflect Roads and Maritime’s commitment to consultation and negotiation with affected landowners in relation to land acquisition and related impacts. This process is ongoing.
3 Response to government agency, local councils and utility provider issues and advice

3.1 Respondents

In addition to the 24 community submissions addressed in Chapter 2, the NSW DPE received a total of 15 government agency, local council and utility provider submissions in response to exhibition of the draft EIS. This included submissions received up until 7 August 2017 in accordance with an extension granted by NSW DPE to some government agencies.

The issues raised in each submission have been extracted and collated, and corresponding responses to the issues have been provided. Where similar issues have been raised in different submissions, only one response has been provided.

The most common issues raised by government agencies, local councils and utility providers are listed in Table 3-1.

This chapter addresses each government agency, local council and utility provider submission and associated response provided by Roads and Maritime. Each submission is outlined verbatim and individual responses have been provided specific to each submission.

3.2 Overview of the issues raised and advice provided

Responses to government agencies, local councils and utility providers are outlined within this chapter and summarised in Table 3-1.

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<thead>
<tr>
<th>Respondent</th>
<th>Submission number</th>
<th>Section addressed</th>
<th>Issues raised</th>
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<td>3.3</td>
<td>• Requirements</td>
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<td>Civil Aviation Safety Authority (CASA)</td>
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<td>Federal Member for Macarthur, Dr Mike Freelander MP</td>
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### 3.3 NSW Rural Fire Service

#### 3.3.1 Requirements

**Issue description**

The New South Wales Rural Fire Service (NSW RFS) has reviewed the information provided and advises it has no objections to the proposed upgrade. Subject to the following requirements:

- Public road access shall comply with section 4.1.3 (1) of *Planning for Bush Fire Protection 2006*.
- Landscaping shall comply with the principles as outlined within Appendix 5 of *Planning for Bush Fire Protection 2006* and the NSW RFS document Standards for Asset Protection Zone.

**Response**

Chapter 8.9 of the draft EIS identified that a search of the Penrith City Council LGA – Bushfire Prone Land Map (2014) and Liverpool City Council – Bushfire Prone Land Map (2014) was conducted to confirm that the project would be partly located within and near bushfire prone land.

With regards to construction of the project, measures to mitigate and manage bushfire would be developed and included as part of site-specific hazard and risk management measures within the project CEMP.

In addition, Roads and Maritime would further consider the requirements of *Planning for Bush Fire Protection 2006* during the detailed design of the project.

### 3.4 Civil Aviation Safety Authority

#### 3.4.1 General support

**Issue description**

CASA has reviewed the Environmental Impact Statement and has no comment to make.

**Response**

Roads and Maritime acknowledges the support for the project by Civil Aviation Safety Authority.
3.5 Federal Member for Macarthur, Dr Mike Freelander MP

3.5.1 Traffic and transport

**Issue description**

The respondent raised concerns on behalf of constituents regarding congestion on local roads and transport corridors, and that this would be exacerbated by recent growth and development in the area including the Western Sydney Airport. The airport would add to traffic along The Northern Road and contribute to increased congestion where this links to Narellan Road.

The respondent calls for a new rail line, to link Leppington, Campbelltown and surrounding suburbs to the new airport and strongly believes that the provision of adequate public transport, and associated infrastructure is necessary to address the current problems facing our transport network, and in catering for future demand.

Additionally, the respondent believes that current upgrades to The Northern Road are inadequate, and believes the upgrade requires at least three to four lanes each way, rather than two.

**Response**

The project has been proposed to cater for expected growth as part of the $3.6 billion WSIP to improve safety, increase road capacity and reduce travel times and congestion in the future.

Major land use changes associated with the SWPGA and development of Western Sydney Airport and associated WSPGA, together with forecast growth in the regional centres of Penrith and Campbelltown, will drive a dramatic increase in traffic demand in the region which has been considered by the project.

Testing of the performance of The Northern Road under future year scenarios (2021 and 2031) with a no build option shows that there would be insufficient capacity along The Northern Road under existing two-lane road network conditions. Delays on The Northern Road at most of the intersections would be unacceptable (generally Level of Service E to F) and no further growth in traffic would be possible during peak periods.

Traffic modelling of the intersection performance along The Northern Road with the project shows that most of the intersections within the study area would have sufficient capacity to operate satisfactorily under the 2021 and 2031 future year traffic forecasts at Level of Service D or better.

Once complete, the project would cater for the substantial forecast traffic growth and provide connectivity to and from the Western Sydney Airport – connecting the M4 Western Motorway and the proposed M12 Motorway. The project would also improve road safety and public and active transport facilities, promoting more sustainable and efficient journeys.

Additionally, the project has incorporated a wide central median to allow for future growth with the addition of a travel lane in each direction in the future, if required.

3.6 WaterNSW

3.6.1 Utilities

**Issue description**

WaterNSW notes Section 5.4.10 (Vol.1) of the EIS discusses utilities and services, but does not identify the 11kV power supply crossing The Northern Road to supply the operation of WaterNSW’s critical Cross Connection 2 (CC2). CC2 must be able to be operated during any water quality or quantity incidents, or where an issue with the integrity of one of the Pipelines arises requiring isolation of one or the other Pipelines. The power supply is also required to operate a sump pump for the pit containing the connecting valve and electrical controls. WaterNSW would require a 415 Volt generator to be hard-wired into the CC2 electrical switch room if the power were to be interrupted for a long period.
There is also a safety issue arising from the road being raised 1.5 metres closer to the power supply at this point. Depending on timing of works, this issue may be able to be addressed through the proposal by Cardno, acting for the Sydney Science Park development, to upgrade the power supply and underground it. Preliminary advice has been provided to Cardno on the basis the feeder will be accommodated in the widened Northern Road, i.e. that it is not located on land that will remain under the ownership of WaterNSW after acquisitions by RMS and subsequent boundary adjustments.

Table 5-14 in the EIS (Vol.1; s5.4.10; p.136) states "The water main crossing would need to have sufficient protection, otherwise there would be a need to relocate or replace the crossing so that connection to water mains are maintained." The proposal may result in Sydney Water temporarily not being able to pump water up to the Blue Mountains if the 450 mm and 900 mm rising mains are relocated. Depending upon the timing, an interruption to supply from the Orchard Hills Water Treatment Plant to the Blue Mountains storages may result in the depletion of available supplies. Close consultation with WaterNSW and Sydney Water is required regarding this aspect of the proposal.

Response

As stated in section 5.4.10 of the draft EIS, the extent of impact to utilities and services cannot be confirmed until the detailed design is finalised. A list of utilities that may require relocation is provided in Table 5.14 of the draft EIS. The 11kV power supply crossing The Northern Road to supply the operation of WaterNSW's critical Cross Connection 2 (CC2) was missing from Table 4-15. Since exhibition of the draft EIS, further identification of utilities has occurred and this includes the 11kV power supply line which is now shown on all current design drawings for the project.

Strategies to address impacts to the power supply crossing would be developed in close consultation with WaterNSW during the detailed design and construction of the project. Strategies may include protection or relocation of the utility, or adjustments to the project design to avoid any impacts.

The locations of water main crossings have been identified as detailed in Table 5-14 of the draft EIS. The project would be designed to minimise impacts on utility services within and adjacent to the project. Roads and Maritime is committed to carrying out ongoing consultation with WaterNSW regarding all of their assets. A solution which would not involve significant depletion or interruption of water supplies will be sought.

Changes to utilities outside of the project construction footprint would be subject to separate environmental assessment and approval processes.

3.6.2 Consultation

Issue description

WaterNSW requests that if there are any amendments to the project arising from further assessment, and if these amendments have potential implications for WaterNSW, that the RMS consult with us on these amendments prior to making decisions.

WaterNSW would appreciate being provided with a copy of the submissions report.

Response

The items raised by WaterNSW are noted. Consultation has commenced with WaterNSW and would be ongoing during the final design and construction phases of the project, as required.

Chapter 4 outlines the design refinements for the project. Table 4-1 outlines the design refinements and provides a brief justification as to the need for each of these refinements. Assessment of the potential impacts of the changes to the project is also provided in Chapter 4 where applicable for consistency against the outcomes of the assessments provided in the draft EIS.
3.6.3 Traffic and transport - Access

Issue description
WaterNSW owns and manages the Warragamba to Prospect Water Supply Pipelines corridor as a Controlled Area declared under the Water NSW Act 2014. Access is prohibited unless a written access consent has been obtained from WaterNSW. More information regarding access consents is available on WaterNSW's website at http://www.waternsw.com.au/water-quality/catchment/manage/special-areas/access.

WaterNSW access to the Pipelines corridor must be maintained at all times during construction for security and maintenance purposes. As previously specified, WaterNSW requires an 8.8 metre design turn path for service vehicles, and a 12.5 metre turn path for a truck.

WaterNSW requires security fencing to be installed to WaterNSW standards along the new boundaries. Any existing security fencing along boundaries that are not proposed to change must be maintained. Should the fencing be damaged, any repairs or replacement must occur to WaterNSW's standards and at RMS's expense. Any existing fencing proposed to be replaced must be removed and disposed of at a facility licenced to accept such waste.

Response
WaterNSW’s comments regarding access to the Controlled Area associated with the Warragamba to Prospect Water Supply Pipelines corridor are noted. Roads and Maritime will consult further with WaterNSW on the required access and consents for the pipeline corridor during detailed design.

In accordance with the management measures outlined in the draft EIS, access to properties would be maintained at all time, unless otherwise agreed (in writing) with the property owner.

As requested by WaterNSW, the turn path for service vehicles has been designed to accommodate the vehicle sizes specified.

As with all aspects of construction near the pipeline corridor, fencing requirements would be developed in close consultation with WaterNSW during the remainder of the design and during construction of the project.

3.6.4 Noise and vibration

Issue description
WaterNSW notes the proposal includes adding an extra 1.5 metres of fill to form the road above the Warragamba Pipelines. The acceptability of this method - as opposed to installing an 'at-grade' bridge - should be verified with geotechnical sampling, and reviewed by WaterNSW's engineers.

Section 7.2.3 of the EIS (Vol.1; p.234) discusses vibration criteria, including for structural damage, and the German DIN Standard 4150-3 is proposed only for use where heritage structures are impacted. It should be noted the Pipelines are concrete lined and the potential for vibration from construction to impact the lining should not be underestimated. A precondition survey, including of the drainage works beside the pipeline stockpile site on the eastern side of the corridor, and vibration monitoring during construction is considered necessary, with the German Standard being applied. Mitigation measures should be incorporated in the CNVMP, with the use of rock-breaking machinery excluded in close proximity to the Pipelines.

Response
Further discussions with WaterNSW to justify the current proposal would be undertaken once geotechnical information is available.
Table 7-33 of the draft EIS provides the safe working distances for vibration intensive plant to be adopted during construction of the project, including distances required to prevent cosmetic damage (eg surface cracks) to conventional buildings in close proximity to the works. Where structures are more sensitive such as heritage items, the draft EIS states that more stringent conditions would be applicable and should be considered individually in accordance with the German Standard DIN 4150: Part 3-1999. This would be the case for the heritage listed WaterNSW pipelines in the vicinity of the proposed construction works.

This would be assessed and appropriate management measures incorporated into the CNVMP to be developed for the project once the final construction methodology is confirmed. The construction methodology would be developed in consultation with WaterNSW following the completion of geotechnical investigations and a pre-condition survey of the pipelines. The CNVMP would identify the safe working (buffer) distances for any vibration-intensive processes (eg rockbreaking or vibratory rolling) specifically proposed by the construction contractor. Where required, the CNVMP would investigate the use of alternative processes (eg ripping instead of rockbreaking) should it identify potential unacceptable vibration impacts to the pipeline from conventional work methods.

Additionally, where required, vibration monitoring would be carried out at the commencement of vibration-generating activities near the WaterNSW pipeline to confirm that vibration levels are within the acceptable range to prevent damage to the pipeline. These measures would be included into the CNVMP as required. This requirement has been incorporated into the revised environmental management measures for the project (refer to Chapter 6).

### 3.6.5 Property acquisition and temporary leases

**Issue description**

In Section 5.2.14 (Vol.1; Table 5-9) it is noted that the RMS proposes to acquire parts of lots currently owned and managed by WaterNSW as part of the Warragamba Pipelines corridor:

- land parcel 70 (RMS ID) is known as Lot A DP 341893
- land parcel 71 Lot A DP 341629 is incorrectly identified as Crown Land (road reserve). This lot is under the ownership of WaterNSW, and should be identified as such
- WaterNSW lots subject to acquisition and temporary leases have not been identified in Tables 5-9 or 5-10, but include Lot 1 DP 226972 and others according to previous correspondence between RMS and WaterNSW
- the Project Area on various figures (eg Figure 7-1 p.195 EIS Vol.1) identifies further WaterNSW lots will be impacted (Lot A DP 347475 and/ or Lot A DP 359606), however these lots are not listed in the EIS for either acquisition or lease.
- proposed lease areas must not interfere with WaterNSW access to and operation of the pipeline stockpile compound located on Lot 1 DP 226972.

WaterNSW's preference is for the acquisition to occur post-construction to allow accurate survey and acquisition to the new boundaries, with an access, works and services lease in place during the construction period to protect WaterNSW's interests.

**Response**

Table 5-9 of the draft EIS has been updated to reflect revised property acquisition requirements in response to design refinements for the project (refer to Table 4-1 in Chapter 4). The errors identified by WaterNSW have been corrected in the updated table with Lot A DP 341629 (RMS ID 71) identified as being under WaterNSW ownership. Additionally, Lot 1 DP226972 (RMS ID 72) under WaterNSW ownership would also be subject to partial acquisition.

Temporary leases for construction access and to facilitate construction works around the pipelines would be negotiated with WaterNSW. It is noted that the proposed areas for lease within
WaterNSW land has been reduced through the design refinement process (refer to details of the revised construction footprint in Chapter 4).

In summary, land currently owned and managed by WaterNSW would be subject to the following:

- Lot A DP341893 (RMS ID 70) – partial acquisition
- Lot A DP341629 (RMS ID 71) – partial acquisition and lease
- Lot 1 DP226972 (RMS ID 72) – partial acquisition, lease and easement.

Access to these lands would be carried out in accordance with the requirements of a site access schedule to be developed with each construction contractor and in consultation with affected land holders, including WaterNSW. In accordance with the draft EIS, access to properties would be maintained during construction wherever possible. Any alternative and/or temporary access arrangements would be agreed with WaterNSW prior to works commencing.

Post completion surveys would be carried out for all lease areas and any residual land identified would be transferred back to WaterNSW.

Property Acquisition for the project will be conducted in accordance with the provisions of the NSW Land Acquisition (Just Terms Compensation) Act 1991. Roads and Maritime would negotiate acquisition of land prior to the commencement of construction to allow for greater project certainty in advance of procuring construction contractors.

### 3.6.6 Hydrology and flooding – Stormwater

**Issue description**

Table 5.1 of Appendix K notes the potential project related impacts include an increase in the rate and volume of runoff discharging to the open trenches of the Warragamba Pipelines, which could increase the likelihood of bank instability and also cause added wetting of the ground around the concrete support plinths.

WaterNSW requires that there is no increase in stormwater flows into the Pipelines corridor over the pre-development state. While it is WaterNSW’s preference that any additional runoff or increase in peak flow hydrographs (for any storm) due to the increase in impervious area due to road widening be drained away from the WaterNSW corridor, WaterNSW supports the proposal for the provision of a new pipes trunk drainage line conveying the runoff to discharge to drainage line BLC DL06 via and armoured spreader on DEOH land, as identified on Figure 6.2 Sheet 2 of Appendix K, and in Vol.1 of the EIS (s5.2.7; Table 5-5; p.107). The headwall is to be located on DEOH land, and not within the WaterNSW boundary.

Additional discharge to rural dams in the area surrounding the project resulting in increased flows into the Pipelines corridor must also be addressed, for example:

- into drainage line BLC DL03 from the works in the vicinity of Gates Road on Lot 23 DP 207317 (Appendix K; Figure 6.2; Sheet 2)
- the diversion of flow from a section of the new six-lane road west along Littlefields Road where it would discharge to an existing dam located on the southern side of the road adjacent to the limit of works, which flows into the Pipeline corridor further west (Appendix K; Figure 6.1; Sheet 1).

The EIS (Vol.1; s8.2.6; Figure 8-7; p.488) identifies that a sediment basin is proposed for near the intersection of Gates Road and The Northern Road. The overflow drainage path for this basin has not been identified. Any spill or overflow from this basin must be directed away from the Warragamba Pipelines corridor to avoid the possibility of sediment laden water entering the corridor.

All areas of WaterNSW land impacted by the proposal should be stabilised and restored after construction is concluded.
Response

Roads and Maritime can confirm that the project would not result in an increase in either the rate or volume of runoff discharging to drainage line BLC DL03 (refer peak flow rates set out in Table C1 in Appendix C of Appendix K of the draft EIS).

Flood modelling provided in the draft EIS shows that the project would result in less than a 10 per cent increase in peak flows in drainage line MC DL09 at a location a short distance downstream of the road corridor (refer Peak Flow Location Identifier MC Q09 on Figure 6.1 in Appendix K of the draft EIS).

The impact of the project on peak flows in Mulgoa Creek where it crosses the pipeline corridor would be negligible given the project would also result in a reduction in peak flows discharging to Mulgoa Creek via several of its tributary arms (for example, drainage lines MC DL01, MC DL02, MC DL03, MC DL04, MC DL05, MC DL06, MC DL07 and MC DL08).

Further discussions with WaterNSW about drainage infrastructure, including the headwall, would be carried out during the detailed design. Infrastructure associated with drainage would not be located on DEOH land due to the environmental sensitivity of the site being an area of natural heritage significance associated with the Commonwealth heritage listed Orchard Hills Cumberland Plain Woodland.

Since exhibition of the draft EIS, refinements have been made to the proposed road and pavement drainage design and the strategy for construction drainage management. This has resulted in the change to some sediment basin locations. There is no longer a sediment basin proposed near the intersection of Gates Road and The Northern Road.

All areas subject to disturbance would be stabilised and restored to its pre-works condition or similar in consultation with landowners. This is reflected in the mitigation measures committed to in the draft EIS including SWC-6 (soil and water), SE-2 (socio-economic) and AQ-3 (air quality), as well as the sustainability objectives for the project as outlined in Chapter 10 of the draft EIS.

3.6.7 Hazard and risk

Issue description

WaterNSW requests that all refuelling, oil changes and vehicle wash-downs are conducted within the construction compounds and appropriate mitigation measures are adopted to prevent spills and leaks at all other operational locations.

A tested emergency response plan must be in place in the event of damage/breakage of the Pipeline during bulk earthworks and road construction works.

WaterNSW requires notification of any incident such as a vehicle accident, discovery of any heritage items, spill or fire that affects or could affect the Warragamba Pipelines including the corridor. Any such incident should be reported to Water NSW on the Incident Notification Number 1800 061 069 (24-hour service) as a matter of urgency.

Response

Chapter 8.7 of the draft EIS (Resources and Waste Management) and Chapter 8.9 of the draft EIS (Hazard and Risk) both assess the potential for accidental spill and leaks associated with construction and operation of the project.

The potential for such incidents to occur is considered to be low and the environmental management measures such as those identified in section 8.9.3 would reduce the likelihood of impact to the environment, construction personnel and the public.

The draft EIS mitigation measures have been developed with the aim of minimising or mitigating, as far as practical, hazards and risks associated with construction and operation of the project. Hazard and risk management planning would be incorporated throughout the CEMP, which may include items such as:
Details of the hazards and risks associated with construction activities
Risk management measures, including those identified in Chapters 7 and 8 of this draft EIS
Procedures to comply with all legislative and industry standard requirements
Contingency and emergency response plans, as required
Site-specific Work, Health and Safety plans and activity specific Safe Work Method Statements
Training for all personnel (including subcontractors) in site inductions, including the recognition and awareness of site hazards and the locations of relevant equipment to protect themselves and manage any spills.

As requested, Roads and Maritime would also notify WaterNSW of any incident such as a vehicle accident, discovery of any heritage items, spill or fire that affects or could affect the Warragamba Pipelines including the corridor.

3.7 NSW Department of Planning and Environment, Division of Resources and Geoscience (GSNSW)

3.7.1 General support for the project

Issue description
The New South Wales Department of Planning & Environment, Division of Resources and Geoscience, Geological Survey of New South Wales (GSNSW) has reviewed the subject area in conjunction with advice previously supplied relating to the Draft EIS (our ref: OUT16/47611). GSNSW has no further comments at this stage. The proposal is unlikely to restrict exploration activities in the vicinity of the Northern Road Upgrade.

Response
Roads and Maritime acknowledges the support for the project by NSW DPE Division of Resources and Geoscience, GSNSW.

3.8 Liverpool City Council

3.8.1 General support for the project

Issue description
Council supports the project and delivery plan as part of the Western Sydney Airport ground transport improvement works.

Response
Roads and Maritime acknowledges the support for the project by Liverpool City Council.

3.8.2 Traffic and transport

Issue description
Council appreciates that the project includes two traffic lanes and a bus lane in each direction. It is noted that traffic assessment has been undertaken for 2031 traffic conditions. Stage 1 of the Western Sydney Airport is scheduled for completion by 2030, with further stages to follow. As The Northern Road is a significant north-south road corridor adjacent to the airport, it is important to ensure that the project is designed to cater for long-term growth.
The traffic assessment should cater for 20-30-year growth to ensure that adequate road reservation is identified at major intersection points as part of the project. To this end, it is suggested that Transport for New South Wales (TfNSW) Land Use Forecasts for 2051 are used for additional traffic modelling.

Council also notes that the section of the project in the Liverpool LGA includes two proposed signalised intersections with an access road to the Western Sydney Airport, and a realigned Elizabeth Drive. The intersection layouts are based on forecast 2031 traffic conditions.

To accommodate future traffic conditions, Council suggests that provision (i.e., road reservation) should be made for full or partial grade separation at these intersections. In addition, the intersection with the proposed M12 Motorway should be considered as a grade separate intersection.

**Response**

Assessment of intersection capacity and performance has been carried out for traffic forecasts up to and including 2041 and include assumptions relating to the likely traffic generation of the Western Sydney Airport at this time. Intersections within the proposal have been designed with sufficient capacity to perform satisfactorily under 2041 forecast peak period traffic volumes. We note that for operational modelling and road design, forecasting of traffic flows further than 20 years is generally not reliable.

The grade separation of the intersections of The Northern Road with Elizabeth Drive and the southern access to Western Sydney Airport site is not warranted under the forecast 2041 traffic volumes. Forecast traffic volumes for M12 show that the interchange with M12 and The Northern Road would operate satisfactorily as a standard single-point signalised interchange.

**Issue description**

The Northern Road is a significant north-south freight route and the Airport will be expected to generate significant freight movements. Therefore, consideration should be given to the provision of heavy vehicle facilities including parking bays.

**Response**

The Transport Planning Branch in Transport for NSW and the Roads and Maritime Freight Branch administer the freight policy for NSW which includes identifying areas for the provision of heavy vehicle rest areas, de-coupling facilities and parking areas. The Northern Road corridor, being primarily metropolitan in nature, is not currently a priority under the freight policy.

The Northern Road Upgrade has no provision in the design for a heavy vehicle inspection area, de-coupling facility or parking area for northbound traffic. However, between Littlefields Road, Luddenham and Glenmore Parkway, Glenmore Park, the project does include a southbound heavy vehicle inspection bay.

**Issue description**

Council suggests that for uniformity, the project should include appropriate bus shelters with real-time bus service information along its entire length.

**Response**

The predominant land use along the project corridor is rural residential as opposed to the highly urbanised environments referred to by Council where bus shelters have previously been provided. Roads and Maritime has formed the view that the existing passenger demand in the short-term does not warrant the implementation of bus shelters.
Issue description
Council notes that the project currently includes a shared path along the western side and a provision of a footpath along the eastern side of the road. The Northern Road is a major north-south regional bicycle route, and it is suggested that in addition to the shared path on the western side, a shared path should be provided along the eastern side.

Response
The current shared path provision is consistent with the shared path being provided along the rest of The Northern Road (north of Bradley Street) which is being provided on the western side.

Given the location of existing development adjacent to The Northern Road (primarily on the western side), lack of development opportunities on the eastern side, due to DEOH and Western Sydney Airport and the provision of pedestrian crossings at all signalised intersections along the proposal, the provision of a shared path on both side of The Northern Road is not warranted.

Issue description
Council requests that where local roads will be affected during construction, Council and local communities are to be appropriately informed. Appropriate road occupancy permits are to be obtained prior to commencement of construction works. Copies of construction traffic management plans and associated traffic control plans during different construction stages are to be submitted to Council.

Response
The draft EIS mitigation measures identified in Table 7.14 of the draft EIS have been developed with the aim of effectively minimising or mitigating, as far as practical, traffic and transport impacts from construction of the project. Specific outcomes that would be achieved through the implementation of effective environmental management measures include:

- Carry out works in accordance with the relevant Traffic Management Plans and associated traffic control plans
- Ensure safe and continuous traffic movement for construction workers and the general public
- Maintain the capacity of existing roads where possible during construction in order to minimise road user delays
- Maintain continuity of access to local roads and properties
- Appropriate consultation with impacted residents and businesses and stakeholders
- Compliance with the relevant legislative requirements and project conditions of approval.
- Roads and Maritime would consult with Council and local communities where local roads will be affected during construction.

Appropriate road occupancy permits would be obtained prior to commencement of construction works. Copies of construction traffic management plans and associated traffic control plans would be provided to Council for the various construction stages.

Issue description
It is noted that a number of major construction works, including the following, will occur at the same time within the local region and result in increased construction vehicles:

- The Northern Road upgrade between Glenmore Parkway and Jamison Road;
- Earth work on the Western Sydney Airport site; and
- Bringelly Road upgrade (Stage 1 and 2).
Due to the increase in volume of construction vehicles along Elizabeth Drive, it is suggested that interim treatments such as traffic control signals be provided at the following intersections:

- Elizabeth Drive/Western Road intersection
- Elizabeth Drive/Devonshire Rd intersection

Council also suggests that the existing applicable 80 km/hr speed limit along Elizabeth Drive, near Western Road, is to be relocated further west of the Kemps Creek Village.

**Response**

Section 7.1.3 of the draft EIS provides an assessment of potential construction traffic generation impacts associated with the project. Based on arrivals to and departures from site at peak periods each working day, traffic generation would likely be in the order of 230 additional light vehicle movements per day (115 in the morning and 115 in the afternoon).

The majority of this traffic would likely travel along The Northern Road from the north, with a small proportion travelling along Elizabeth Drive from the east. This volume of traffic would be well within the capacity that these roads have been designed for and within the daily fluctuation of observed traffic volumes along The Northern Road and Elizabeth Drive. As such, the installation of traffic signals at the stated locations along Elizabeth Drive are not required.

This additional construction traffic, combined with general impacts to traffic related to construction activities would be likely to impact traffic operation and require a range of traffic management activities including:

- Reduced speed limits at traffic switches
- Reduced speed limits and active traffic control would be required wherever construction activities would be taking place near live traffic.

Potential cumulative traffic impacts may occur as a result of construction works occurring at the same time in relation to the different stages of the project or other nearby projects.

Cumulative construction traffic impacts would be managed through the implementation of suitable mitigation measures (refer to Chapter 6). This includes the requirement for staging plans to be prepared in consultation with adjoining contractors and for each stage of the project (management measure T-2). Additionally, construction traffic management plans for this project would be developed in consultation with plans for other projects to assist in spreading the traffic load over the network and to minimise construction traffic being concentrated on any one particular route (management measure CI-3).

The TMP, to be developed with other concurrent projects, would identify interim traffic controls, including appropriate speed limits, required on Elizabeth Drive and would be developed in consultation with Council.

**Issue description**

The proposed bridge across Adams Road is to include appropriate provision for future four lane road widening and safety barriers.

**Response**

Design of the Adams Road Bridge includes appropriate provision for future four lane road widening and safety barriers.

**Issue description**

The bypass may change the road classification and maintenance responsibilities of the road section through the Luddenham Village. In this regard, Council requests that the RMS and Council enter into a Memorandum of Understanding on future road classification, maintenance responsibilities, and financial implications on the road section through the Luddenham Village.
Response
At the end of construction, a completion survey will be undertaken by Roads and Maritime and a dedicated gazettal plan will be developed along with public road classification. At this time, Roads and Maritime would also discuss future maintenance responsibilities with Council.

Issue description
Council has been making representations for a rail link to be provided to the airport and considers that while the project includes bus lanes, the ground transport plan should include an extension of the South West Link from Leppington to the Airport.

Response
While Council’s support for an extension of the South West Link from Leppington to the Western Sydney Airport is acknowledged it is beyond the scope of this project and no further consideration to this issue is provided.

Issue description
The Northern Road links Camden, Liverpool and Penrith LGA’s. The three Councils have various forms of entry statements to their respective LGA’s. It is requested that gateway treatment is to be provided in consultation with the relevant Councils. Appropriate location and road spaces should also be identified in consultation with the relevant Councils.

Response
The provision of gateway signage is beyond the project scope. Roads and Maritime would work with Council to identify suitable locations for Council gateway signage or other features.

3.8.3 Noise and vibration

Issue description
The project is to ensure that existing properties that would be exposed to increased traffic noise are assessed and if required, attenuation measures are implemented.

Response
The draft EIS and associated noise and vibration technical working paper (Appendix H of the draft EIS) included a detailed, qualitative assessment of the project’s potential operational traffic noise impacts to existing properties. The assessment identified 77 receivers that qualify for consideration of noise mitigation, which is proposed in the form of at-property acoustic treatments.

It is noted that due to a number of design refinements including changes to the vertical alignment at some locations, a technical assessment of revised noise predictions has been carried out to identify further properties that qualify for the consideration of mitigation based on the design refinements as summarised in Table 4-1. This assessment identified one additional property for consideration of mitigation. Roads and Maritime carried out additional consultation with this property owner in December 2017 to inform them of the outcomes of the assessment. All properties identified in the draft EIS as being eligible for the consideration of at-property treatment remain unchanged, with the predictions to be verified and associated mitigation to be confirmed post-construction.

Issue description
It is noted that night-time construction activities would be supported by out-of-hours operation. Noise mitigation measures should be provided in accordance with EPA requirement.

Response
Refer to response in section 2.6.
### 3.8.4 Socio-economic and land use

**Issue description**

Handover of the existing road section through Luddenham Town Centre.

Council notes that as part of the project, The Northern Road is being realigned to bypass Luddenham Town Centre. Council agrees with this arrangement as it will preserve the residential amenity of the Luddenham Town Centre; however, the bypass could have significant impacts on the existing businesses in the town centre that rely upon passing traffic.

Council requests that funding be provided for appropriate signage and consultation with the business in the town centre to ensure the impact of the bypass can be minimised and for the centre to attract some passing trade.

**Response**

Management measures that would be put in place to minimise the impact of the bypass of Luddenham Town Centre and attract passing trade include:

- Appropriate road signage will be provided in accordance with the *Roads and Maritime Services Guidelines Tourist Signposting* (2012) to provide guidance to passing patrons on access to shops and services, including within Luddenham Town Centre.

- Roads and Maritime, in consultation with Council will provide monetary support for preparation of plans to revitalise Luddenham town Centre for the purpose of encouraging motorists to continue to pass through or visit the town.

**Issue description**

Council appreciates that this project could generate significant employment opportunities for local residents during construction and requests that local businesses be given the opportunity to tender for works and be part of this major project.

Council suggests that procurement workshop(s) be held inviting local businesses and interested contractors to attend. The ICN Gateway, or similar a platform, could also be a useful tool to engage with local business to ensure local content and opportunity is maximised on the project. In addition, consideration should be given to apprentices from the local TAFE colleges.

**Response**

Roads and Maritime proposes to hold an industry event for the project in the last quarter of 2017. Procurement for the staged delivery of the project would be via competitive tender processes. Engagement of any local apprentices, suppliers and sub-contractors would be at the discretion of the successful construction contractor. As part of the tender process, the contractor would also be required to prepare a Small to Medium Enterprise (SME) Participation Plan in line with the NSW Government SME Policy Framework to show how their tender will support local industry, including jobs, skills and capability development.

### 3.8.5 Hydrology and flooding

**Issue description**

The project includes crossings at Badgerys Creek, Cosgrove Creek and Duncans Creek, and a number of minor drainage systems.

Mainstream and Overland Flooding - The proposed road upgrade works will involve filling a number of existing farm dams, removal of earth dams and upgrade of spillways of existing dams.

Council notes that the road works may increase the frequency and/or depth of overtopping the earth embankment and result in an increase in both the rate and volume of runoff discharging to a number of receiving waterways.
The project is expected to increase peak flows with associated increase in scouring. Impacts and comments on the three creeks to be impacted are as follows:

- **Cosgrove Creek** - Peak flows at the project boundary will increase by up to 100%. While a number of flood mitigation measures have been proposed, there would be residual impacts including an increase in peak flood levels by up to 300mm.

- **Duncans Creek** - Peak flows will increase by more than 100%. While mitigation works have been proposed, there will also be residual impacts of flooding and flood levels by up to 50mm. Upstream of Duncans Creek, the project would result in an increase of flood levels up to 500mm in a 100-year flood event.

- **Badgerys Creek** - Two (2) existing properties located upstream of Badgerys Creek crossing would be adversely affected by flooding.

**Response**

Roads and Maritime considers that the impact of the project on flooding and drainage patterns in presently undeveloped pastoral land would be within acceptable limits. These minor impacts would be accounted for as the area is developed over time and further drainage infrastructure is implemented.

The flooding and drainage strategy that has been developed for the project is aimed at preventing adverse flooding conditions from being experienced in existing development that is located on both the upstream and downstream sides of the road corridor for events with annual exceedance probabilities (AEP’s) up to 1 per cent.

The strategy allows for minor impacts in presently undeveloped pastoral land during storms with AEP up to 1 per cent in preference to providing a large number of detention basins along the project which would have impacts to biodiversity and property acquisition.

Roads and Maritime has lowered the vertical alignment of the road to mitigate the impact the project would otherwise have on flooding behaviour in the vicinity of the existing dwellings upstream of Badgerys Creek.

Further consultation has been carried out with Liverpool City Council to discuss modelling work and assessment carried out since exhibition of the draft EIS.

**Issue description**

It is noted that flood modelling has been undertaken for 2, 10, 100-year Average Recurrence Intervals (ARI) and the Probable Maximum Flood (PMF) events. Council considers that additional flood modelling shall be undertaken for 20-year event and a flood impact assessment shall be undertaken for all the design events.

**Response**

Roads and Maritime considers that the assessment of storms with ARI’s of 2, 10 and 100 years, as well as the PMF provides a sufficient level of understanding of the impact the project would have on flooding and drainage patterns over the full range of potential storm events.

Further consultation has been carried out with Liverpool Council to discuss modelling work and assessment carried out since exhibition of the draft EIS.

**Issue description**

The project involves significant catchment modification, which will adversely impact on flooding, drainage and environmental health of the waterways. The project would significantly increase impervious areas, resulting in increased peak flows and volume of runoff from the road surface.

Council requests that any potential flooding, drainage and environmental health impacts should be assessed and addressed to ensure that the pre-road construction flooding regime is maintained or improved.
Flood impact assessment for all the design flood events including the 1% AEP and the PMF shall be submitted for Council’s review and endorsement. The flood maps should include the following:

- Flood level contours and depths;
- Velocity vectors for both pre and post development conditions;
- Flood depth difference; and
- Velocity difference maps.

The flood maps shall ensure that no private property is adversely affected by flooding due to proposed road works.

Appropriate and adequate flood mitigation works including detention basins shall be incorporated to ensure flood levels, peak flows and velocities across the catchment area are controlled to existing conditions or improved.

Response

The flooding and drainage strategy that has been developed for the project is aimed at preventing adverse flooding conditions from being experienced in existing development that is located on both the upstream and downstream sides of the road corridor for events with AEP’s up to 1 per cent.

The strategy allows for minor impacts in presently undeveloped pastoral land during storms with AEP up to 1 per cent in preference to providing a large number of detention basins along the road corridor. Roads and Maritime considers that the impact the project will have on flooding and drainage patterns in presently undeveloped pastoral land would be within acceptable limits, noting that most of the land which lies adjacent to the road corridor will undergo development in coming years, when the minor impacts of the project can be taken into account.

The approval process for the project is under Part 5.1 of the EP&A Act is illustrated in Figure 1-3.

The project has been declared State significant infrastructure under the State Environmental Planning Policy (State and Regional Development) 2011. As such, the project is permissible without consent. The flood impact assessment provided in the draft EIS will be determined by the NSW DPE and the Commonwealth DoEE respectively. While Roads and Maritime will consult with and seek input from Council throughout all stages of the project there is no legislative requirement to have flooding assessments formally endorsed by Council.

3.8.6 Soils, water and contamination

Issue description

The proposed road upgrade would generate substantial amounts of solid and liquid pollutants. If appropriate mitigation measures are not implemented, it would significantly impact on water quality of the adjoining waterways.

It is noted that 50 temporary sediment basins will be constructed to control water quality during the construction phase. A number of roadside swales will also be constructed at locations where sensitive receiving waterways have been identified, to control water quality to an acceptable level during operation.

Council has met with RMS representatives and discussed the need for the following additional assessments:

- A detailed water quality modelling using MUSIC model should be undertaken to assess impact of the proposed road upgrade and to determine provision of water quality treatments, including gross pollutant traps (GPT), bio-swales and bio-retention basin. The design of water quality treatment should be designed to ensure pollution reduction targets are achieved in accordance with Liverpool City Council’s Development Control Plan.
• Comprehensive on-site stormwater treatment facilities should be designed and constructed to ensure all gross pollutants, nutrients and liquid contaminants (including spill of fuels, oils, lubricants) are captured and removed from the stormwater runoff before entering into the natural waterways.
• A fail-safe emergency water quality management system shall be in place at all times.
• The maintenance of GPTs should be the responsibility of RMS.

Response

Roads and Maritime has held a technical workshop with Council representatives (19th September, 2017) to discuss the above stormwater and drainage issues raised be Council.

The soils, water and contamination technical working paper (Appendix L of the draft EIS) incorporated the results of the MUSIC model developed for the project. This provided an estimate of the annual average pollutant load reductions achieved through the proposed water quality treatment controls. These controls consisted of a number of vegetated swales proposed upstream of sensitive receiving waterways as a priority, with additional swales provided elsewhere, where possible.

During the design process, refinements were made to the proposed road and pavement drainage design. The amended design proposes 23 operational water quality swales (a reduction from the 24 proposed in the draft EIS).

Pollutant removal is facilitated by the interaction between the flow and the vegetation along the length of the swale. Rock check dams have also been proposed to provide additional treatment by slowing down the runoff and allowing it to temporarily pond during storm events. The location and size of each swale has been optimised to maximise filtering out of suspended materials and pollutants, including those proposed upstream of identified sensitive receiving waterways (i.e. Key Fish Habitat). GPTs and water quality basins have been considered as part of the water quality treatment type selection process.

Since the generation of gross pollutant loads from the upgraded road would be significantly lower than those generated from an urbanised catchment of residential or commercial landuse, it was decided that any gross pollutants from the upgraded road would be removed at the swales as part of a road maintenance program.

Space constraints along a narrow road corridor was the main reason for not adopting specific water quality basins. These constraints included private and commonwealth properties, utilities, topographical constraints and clearing of trees and valuable vegetation.

The details of the revised water quality control strategy for the project is provided in section 5.2.2. Additionally, revised MUSIC Modelling has been carried out for the project based on the refined design. The result of the MUSIC modelling for the refined design, including a comparative assessment against the results of the draft EIS model, are also provided in section 5.2.2 and indicates that pollutant load reductions can be achieved as follows:

• Total suspended solids (ranged from 31 per cent to 93 per cent)
• Total phosphorous ranged from (17.2 per cent to 75 per cent)
• Total nitrogen (range from 5.3 per cent to 49 per cent).

The results of the MUSIC modelling, which are measured in annual pollutant load reductions, indicate that the refined road and pavement drainage would generally result in an improvement in water quality compared to that which was previously achieved (and assessed within the draft EIS).

The Water Management Policy of Liverpool City Council (section 4.1j) refers to pollutant load reductions for suspended solids, total phosphorus and total nitrogen. General policy pollutant load reductions are not available in the latest Council General Development Control Plans (DCP), however a previous DCP 2008, Part 1, General Controls for all Development (section 6.4) indicates
that post development water quality shall be reduced by 45 per cent for Total Phosphorus and Total Nitrogen and by 80 per cent for Total Suspended Solids.

Due to the limited space available along the road corridor to provide additional water quality controls, these targets were not always achieved.

Additionally, the option to include at least one dry biofiltration basin, as well as a limited number of traditional wet permanent basins is also being considered.

As above, a comprehensive suite of on-site stormwater treatment controls is proposed as part of the refined design. There are still no GPTs or spill containment basins being proposed, however the gross pollutant loads generated from the road catchment are considered small and less that those generated from an urban catchment. The improvement of the road geometry for both horizontal and vertical alignments means that the current risk of accidental spills is likely to have been reduced and therefore the risk of accidental spills has not increased when compared to existing conditions.

The current arrangement of proposed water quality controls has been coordinated between the design teams and Roads and Maritime. Any recommended changes or additions requested by Council that can be justified can be considered in coordination with Roads and Maritime.

3.8.7 Aboriginal heritage

Issue description
Council notes that the project would have the following heritage impacts and appropriate treatments are to be implemented:

Aboriginal Cultural Heritage - Reports and photo archival has been undertaken for an Aboriginal Heritage Impact Permit (AHIP) and associated excavation salvage. Council requests a copy of this report for its records.

Response
As identified in section 2.2.1 of the draft EIS, no AHIP is required for any project approved under Part 5.1 of the EP&A Act, which applies to this project. Table 8.23 of the draft EIS outlines environmental management measures that have been developed to specifically manage potential impacts which have been predicted as a result of the project. Further detail regarding the management outcomes to be implemented in accordance with the management procedures for the project is provided in the draft EIS Appendix M - Aboriginal Cultural Heritage Assessment Report – including archaeological salvage excavation.

Council would be provided copies of heritage reports and photo archival results. Release of sensitive information would be carried out in accordance with the wishes of Aboriginal stakeholders. This requirement has been incorporated into the revised environmental management measure for the project (refer to Chapter 6).

3.8.8 Non-Aboriginal heritage

Issue description
Non-Indigenous Heritage Assessment

Council is concerned that the report may not have addressed all the requirements of the NSW Heritage Division Guidelines, in particular, the assessment conditions and options analysis. In addition, the project will affect the following four sites:

Lawson’s Inn site - This site is identified as a heritage site under the Liverpool Local Environmental Plan (LLEP) 2008. The project would impact on the curtilage and not affect the archaeology. Council considers that the artefacts should remain in-situ with the proposal designed around it.
Miss Lawson’s Guesthouse - This site is not listed as a heritage item under the Liverpool Local Environmental Plan 2008. Council requests that prior to demolition, further detailed investigations should be undertaken to determine the extent of the remains.

Lot 502 DP 580982 and Lot A, DP 160890 - The Environmental Impact Statement does not provide an appropriate assessment of these heritage sites nor substantiative evidence that the archaeological relics cannot be preserved. Council requests that all buildings, objects or items to be removed or demolished are to be photographically archived in accordance with NSW Heritage Division guidelines and copies provided to Council.

Response

Chapter 4 of the draft EIS outlines the process that was undertaken in the selection of the preferred project route assessed in the draft EIS, and the alternatives considered. This included consideration of impacts to non-Aboriginal heritage items and place. The merits of the project were considered in the context of other alternatives and a detailed route options development process was carried out early in project planning to avoid or minimise potential environmental impacts from the project where possible. The preferred option outlined in this draft EIS was deemed to be in the public interest as it would provide the best outcome of supporting the Western Sydney Airport and catering for the growth in travel demand as a result of the planned land use changes in the region.

Additional assessment since exhibition of the draft EIS has been carried out as documented in the non-Aboriginal heritage technical memorandum prepared as part of this assessment (refer to Appendix D). The memorandum has been prepared in response to community and agency submissions received during exhibition. A summary of the findings is presented in the response in section 2.11.1.

It is noted that Item 10: Lawson’s Inn site is currently listed on the Liverpool LEP but as identified in the draft EIS and subsequent assessment presented in Appendix D, previous heritage assessments (Artefact Heritage 2015; Australian Museum Consulting 2014) have determined the location of the listing on the LEP (Lots 1 & 2 DP851626) is not the actual location of the Lawson’s Inn site. A search of the NSW Deeds Registration Branch by RD Williamson (Legal Searcher), on behalf of Jacobs, in July 2016 revealed details of the land titles information, up to Primary Application No. 56452 for Lot 2 DP623457, the land on which the Lawson’s Inn site is situated. Lot 2 DP623457 has been identified as the correct location of Lawson’s Inn, and is situated on the opposite side of The Northern Road, to the north of the LEP listed location. The correct location was assessed in the draft EIS and the additional assessment in Appendix D.

The non-Aboriginal heritage technical memorandum in Appendix D includes a copy of and incorporates the findings of a research design and excavation methodology which has been prepared for each of the following sites:

- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (in relation to Chaffey Brothers Irrigation Scheme Canal)
- Item 9: Miss Lawson’s Guesthouse site
- Item 10: Lawson’s Inn site.

It is noted that further historical research has identified that Item 10: Lawson’s Inn site is located outside of the project boundary, noting that design refinements associated with changes to batters at the tie in point to Eaton Road has resulted in avoiding areas of high archaeological potential, and therefore impact to any remnants of the Inn building are not expected. An excavation methodology has been prepared for areas around the Inn site within the project boundary that may potentially contain relics and artefacts associated with the Inn site. If during testing significant archaeological resources are identified within these areas of low archaeological potential to be impacted by the project, then the design would be reviewed and where reasonable and feasible adjusted to avoid where possible or minimise these impacts.

The research design and methodology for each item listed above includes the proposed management of artefacts if identified. In general, artefacts recovered from the site would be managed by a dedicated artefact manager and in accordance with the process outlined below:
• All artefacts that are retained will be catalogued by using a system that identifies and allows easy retrieval of the item
• The specialists’ cataloguers will produce reports on the artefacts outlining issues of importance
• Important artefacts will be assessed for materials conservation treatment which would include the gluing of pottery or the conservation of important metal or leather materials
• Artefacts which are the subject of materials conservation may be used in artefact displays in interpretation of the stations.

The subsequent excavation report to be developed would contain an analysis of artefacts and their deposits and contexts in the final report.

Artefacts would be categorised into three groups; special finds, reference collection and discard collection. This latter category would be used for those materials whose archaeological research potential has been realised and retention is no longer required. The final repository for special finds and reference collection would be determined in consultation with Roads and Maritime and may include donation to a local museum.

In relation to the canal as part of Item 2, an archival photographic recording would be made of the extent of the canal to be impacted by the works, in accordance with the Heritage Division of the OEH guidelines (Heritage Council of NSW 2006) prior to its excavation. Photographic records of archaeological deposits at Item 9 Miss Lawson’s Guesthouse and Item 10 Lawson’s Inn would also be recorded in excavation reports in accordance with the Heritage Division of the OEH guidelines (Heritage Council of NSW 2006).

No other identified in tact heritage buildings, objects or items are proposed to be demolished by the project, therefore photographic archival recording is not proposed in relation to any other heritage item.

3.8.9 Urban design and visual impact

**Issue description**

RMS should develop a landscaping plan for road verge areas in consultation with Council. Council will provide a list of approved plant species and plant density for road verge areas. For the appropriate of maintenance of verge area, the gradient of the verge shall not exceed 1:4.

**Response**

An urban design and landscaping plan would be prepared for each section of the project design to incorporate the urban design strategy and concept plan outlined in Appendix O of the draft EIS. This would include urban design treatments to reduce visual impacts during operation of the project. In general, the plan would include:

• Location and identification of existing vegetation and proposed landscaped areas, including species to be used
• Built elements including retaining walls and Adams Road Bridge
• Design treatments for stormwater quality measures and infrastructure
• Pedestrian and cyclist elements including footpath location, paving types and pedestrian crossings
• Fixtures such as seating, lighting, fencing and signs
• Details of the staging of landscape works taking account of related environmental controls such as erosion and sedimentation controls and drainage
• Procedures for monitoring and maintaining landscaped or rehabilitated areas.
Additionally, construction management measures are proposed to reduce visual and landscape character impacts during construction of the project as a result of general construction activities, ancillary facilities and vegetation loss.
Cutting and batter slopes have generally been designed to be 1 in 4 slope. During detailed design, some batters may be locally steepened to 1 in 2 at pinch points (or be replaced by retaining walls) or as steep as 1 in 1.5 at the bridge spill-through abutments.
Development of the landscaping plan would include consultation with Council regarding its maintenance requirements.

3.9 TransGrid

3.9.1 Utilities

Issue description
Thank you for the opportunity for TransGrid to provide its comment in relation to the exhibition of the EIS for the abovementioned road upgrade.
You would be aware that TransGrid operates the NSW high voltage electricity transmission system. In this regard, TransGrid has both owned land and high voltage transmission lines that are affected by The Northern Road upgrade between Bringelly and Glenmore Park. TransGrid’s assets are essential to the State’s electricity network and the reliability of power supply to the people of Western Sydney and NSW.
TransGrid has a statutory responsibility to maintain electricity supply to the people of NSW and there are associated restrictions and requirements to ensure both the safety of the public and the security of the infrastructure, where development occurs within an easement area or in close proximity to transmission lines.
TransGrid has two high voltage transmission lines as well as owned land affected by the proposed upgrade of The Northern Road, the impact on TransGrid’s infrastructure and land is discussed below.
It is noted that The Northern Road upgrade involves a realignment of the road around the future Western Sydney Airport site at Badgerys Creek. TransGrid’s single circuit 330 kV #39 Transmission Line crosses The Northern Road in this area. Therefore, TransGrid has been working closely with government, the various utility providers and other stakeholders involved with the development of the future airport in relation to specific impacts for TransGrid’s infrastructure.
In this regard it will be necessary for utility and infrastructure providers, such as RMS and TransGrid to liaise closely and ensure and ongoing good working relationship during the planning and construction phases of these works to ensure both public safety and access to essential infrastructure is maintained.

Response
TransGrid’s comments regarding the single circuit 330 kV #39 Transmission Line are noted.
As stated in section 5.4.10 of the draft EIS, the extent of impact to utilities and services could not be confirmed until the detailed design is finalised. A list of utilities that may require relocation is provided in Table 5.14 of the draft EIS. Since exhibition of the draft EIS, further identification and design, considering utilities has occurred and this includes the #39 Transmission Line.
Strategies to address impacts to utilities are being developed in close consultation with all utility providers during the remainder of the design and this will continue during construction of the project. Strategies may include protection or relocation of the utility, or adjustments to the project design to avoid any impacts.
**Issue description**

In addition to TransGrid’s #39 Transmission Line mentioned above; approximately 300m south of Glenmore Parkway TransGrid’s double circuit 330 kV 32/38 Transmission Line crosses The Northern Road. This is an essential high voltage supply feeder into Western Sydney.

On the western side of The Northern Road in this area, TransGrid owns land which is almost entirely affected by the easement corridor for the #32/38 transmission line. The subject land, being, Lots 9 and 10 DP 26658 is affected by both a proposed property adjustment and a temporary lease for the road upgrade. The impact of the transmission line on the land means neither asset can be considered in isolation.

As such TransGrid has concerns in relation to both the property adjustment, and the lease in relation to continued safe access to, and security of the infrastructure.

**Response**

Consultation with utility and infrastructure providers would be ongoing as part of the project. The necessary approvals would be obtained from TransGrid for all proposed work near TransGrid high voltage infrastructure and the appropriate WorkCover Guidelines for Working in Proximity to High Voltage Transmission Lines would be implemented for any approved works within the corridor.

**Issue description**

Essentially any approval that would impact TransGrid land must require the site to be remediated so that soils and water course are stable and do not result in sedimentation issues, or impact safe and stable vehicular access around the base of the transmission line structure. The site must be clean and tidy (all rubbish removed), and any environmental incidents that may occur on site (e.g. oil spills) will be reported to TransGrid’s Corporate Environment Manager.

Specifically, in relation to any environmental mitigation measures TransGrid advises that all environmental incidents, and near misses, on TransGrid land must be reported to TransGrid. All pollution incidents that threatens or harms the environment shall be reported immediately to relevant authorities, in accordance with the *Protection of the Environment Operations Act 1997 (POEO Act)*.

Environmental spill kits containing spill response materials suitable for the works being undertaken shall be kept on site at all times and be used in the event of a spill. Any spills shall be contained, cleaned up promptly and immediately reported to TransGrid.

On completion of the work disturbed areas shall be stabilised, and returned as close as possible to original condition.

**Response**

Chapter 8.7(Resources and Waste Management) and Chapter 8.9 (Hazard and Risk) of the draft EIS both assess the potential for accidental spill and leaks associated with construction and operation of the project.

The potential for such incidents to occur is considered to be low and the environmental management measures such as those identified in section 8.9.3 of the draft EIS would reduce the likelihood of impact to the environment, construction personnel and the public.

Project-specific environmental management measures have been developed with the aim of minimising or mitigating, as far as practical, hazards and risks associated with construction and operation of the project. Hazard and risk management planning would be incorporated throughout the CEMP, which may include items such as:

- Details of the hazards and risks associated with construction activities
- Risk management measures, including those identified in Chapters 7 and 8 of the draft EIS
- Procedures to comply with all legislative and industry standard requirements
• Contingency and emergency response plans, as required
• Site-specific Work, Health and Safety plans and activity specific Safe Work Method Statements
• Training for all personnel (including subcontractors) in site inductions, including the recognition and awareness of site hazards and the locations of relevant equipment to protect themselves and manage any spills.

As requested, Roads and Maritime would also notify TransGrid of any incident that affects or could affect TransGrid assets.

The relevant mitigation measures in the draft EIS, including erosion and sediment controls and incident response and notification procedures would be implemented during construction. In addition, all leased areas would be reinstated in accordance with any conditions of approval.

### Issue description

TransGrid’s Engineers have assessed the preliminary designs in relation to vertical and horizontal safe clearances to the transmission line, as well as any change to clearance to the distribution lines. It appears that there are no concerns in relation to the vertical clearances, however the transmission structure (#616) is located less than 10 metres from the road reserve where works will take place. This is well within what TransGrid will typically accept as a safe horizontal clearance, and any approval must ensure that work is conducted in accordance with TransGrid requirements, there is safe access to this structure and sufficient room to set up heavy maintenance vehicles.

In this regard TransGrid has been in consultation with RMS throughout the design process and will continue to work with RMS and its designers to obtain a suitable and safe outcome.

Specifically, with regard to TransGrid’s access for maintenance works and the carrying out of maintenance activities on its line the following is advised:

- The proposed pavement (type 9) between Ch106.02 and Ch106.03 (drawing SM- 2224) appears to be situated at the location of TransGrid’s existing access gate.
- Confirmation is requested if TransGrid’s access point (the access gate) is proposed to remain at this location for TransGrid’s maintenance vehicles.
- We are concerned that the new pavement route (type 9) is shown as ending in close proximity to the grassed drainage channel and may restrict the manoeuvring of TransGrid’s vehicles when accessing the tower.
- Also, the new pavement (type 9) with the raised surface levels and batter extending towards the tower also limits the amount of space left available for the setup of vehicles (required on both sides of the transmission line structure, being a double circuit tower). It is requested that it be considered to move this new pavement (type 9) location further away from the structure.
- It is essential that any access means (such as new pavement) to Structure 616 and the easement, be designed to cater for the weight and size of TransGrid’s maintenance vehicles - to withstand the 40-ton load capacity of maintenance trucks.
- With proposed batter works to bound two sides of Structure 616, possible water retention around the structure is of concern and this may become an issue. Tower legs could be subject to corrosion and as a result may require reinforcement and foundation repair works to be undertaken. This would need to be assessed after completion of works.
- It is requested that during construction works, adequate precaution be taken to protect the structure from accidental damage, and the easement area is not to be used for temporary storage of construction spoil, topsoil, gravel or any other construction material.
Response

TransGrid’s access requirements are noted. Consultation with TransGrid would be ongoing as part of the project. The necessary approvals would be obtained from TransGrid for all proposed work near TransGrid high voltage infrastructure and the appropriate WorkCover Guidelines for Working in Proximity to High Voltage Transmission Lines would be implemented for any approved works within the corridor.

Roads and Maritime can confirm that in accordance with the management measures outlined in the draft EIS, access to properties would be maintained at all time, unless otherwise agreed (in writing) with the property owner.

Issue description

TransGrid is concerned that the proposed acquisition of part of the freehold of this holding will restrict the only safe access for heavy maintenance vehicles (up to 40 tonne) that are required access the land for maintenance of this transmission line.

For this reason, TransGrid has formally objected to RMS in relation to the freehold acquisition of this part of its land (part Lot 9). However, TransGrid is not opposed to the grant of an easement to RMS (provided suitable heavy vehicle access can be maintained) It is understood from previous discussions with RMS that an easement would be sufficient in the specific circumstances related to this parcel of land. TransGrid requests appropriate consideration is given to this issue as TransGrid has as yet had no formal response from RMS addressing these concerns.

Proposed lease:

The proposed RMS lease area poses concerns for TransGrid as it is understood that the area is to be leased to facilitate adjustments to the water course on TransGrid’s land and “….new and upgraded drainage infrastructure”.

TransGrid has already stated its concerns in relation to stability of land around the structure and the need for heavy maintenance vehicles to gain access around this structure, this issue needs to be satisfactorily addressed in any approval for the project and prior to TransGrid agreeing to any lease of its land impacted by the transmission line.

Response

Roads and Maritime have changed the property acquisition to an easement acquisition on Lot 9 of TransGrid’s property. The relevant property acquisition sketches have been updated and provided to TransGrid on 12 September 2017 and further consultation with Transgrid occurred on 22 September 2017to discuss the easement. Further consultation between Roads and Maritime Property Services and TransGrid is ongoing.

Transgrid has also provided Roads and Maritime with specifications of the vehicles required to carry out maintenance and the requirements for access to the site. As such, Roads and Maritime have agreed to widen the existing driveway and provide a pad suitable to TransGrid’s needs. Access to the site would be left in, left out only.

Roads and Maritime will continue to consult with TransGrid regarding access and maintenance requirements.

Issue description

Also as the land is within a transmission easement corridor there can be no stockpiling of soil or construction materials, and the usual TransGrid restrictions for third party development within easements relates, along with the appropriate WorkCover Guidelines for Working in Proximity to High Voltage Transmission Lines.
Response
There would be no stockpiling of soil or construction materials within the transmission easement corridor, this would be incorporated into the CEMP. This measure has been added to the project environmental management measures outlined in Chapter 6.

The necessary approvals would be obtained from TransGrid for all proposed work near TransGrid high voltage infrastructure and the appropriate WorkCover Guidelines for Working in Proximity to High Voltage Transmission Lines would be implemented for any approved works within the corridor.

Issue description
There are a number of high voltage transmission lines that traverse this section of The Northern Road upgrade. It is essential that TransGrid’s concerns about access to, and the security of, this essential electrical infrastructure be appropriately in any approval.

For all proposed work near TransGrid high voltage infrastructure it is imperative that RMS and any other relevant stakeholders obtain necessary approvals from TransGrid, and liaise closely to ensure public safety is maintained during and post construction.

TransGrid looks forward to working amicably with RMS on The Northern Road upgrade to ensure that the project can be delivered, while maintaining public safety and access for operation and maintenance purposes to TransGrid’s infrastructure. This can only be achieved by ensuring TransGrid’s concerns and mitigation requirements are considered in relation to all work near its high voltage infrastructure.

Response
Consultation with TransGrid would be ongoing as part of the project. The necessary approvals would be obtained from TransGrid for all proposed work near TransGrid high voltage infrastructure and the appropriate WorkCover Guidelines for Working in Proximity to High Voltage Transmission Lines implemented for any approved works within the corridor.

3.10 Penrith City Council

3.10.1 General support

Issue description
Road Widening The proposed increased number of lanes along The Northern Road is supported. The increase to the number of lanes would improve road capacity and travel times.

Response
Roads and Maritime acknowledges the support for the project by Penrith City Council.

3.10.2 Ancillary facilities

Issue description
The EIS indicates that “ wherever possible compound site locations have been limited to areas that would not require vegetation clearing beyond that already required for the project” (p 579). This is supported. Clarification, however, is requested on whether the large number of scattered remnant trees on site C17, north of the water supply pipeline, will all need to be removed.

Response
There have been a number of design refinements which have resulted in an overall reduction to the construction and operational footprints for the project (refer to Chapter 4). Efforts have been made to reduce the impact of the project on vegetation, including a reduction to the footprint associated with ancillary facility C17. Further to this, construction contractors would be required to
minimise impacts on existing vegetation during establishment and operation of all ancillary facilities.

3.10.3 Consultation

Issue description
The EIS identifies a range of construction environmental management sub-plans (pp 729-735) and identifies who will be consulted in their preparation. While “other relevant agencies” are identified, Council should be consulted on all sub-plans.

Response
Council will be consulted as required in the development of relevant construction environmental management plan sub plans and in accordance with the project’s conditions of approval.

3.10.4 Traffic and transport

Issue description
The EIS provides limited detail on the underlying land use assumptions, particularly for the WSPGA. It is presumed that the RMS and its consultants have had detailed discussions and shared information with relevant State and Federal government agencies to ensure the EIS is based on reliable traffic forecasts to inform the design of the project and assess traffic and transport impacts. It is requested that further information on the underlying land use assumptions for the WSPGA is made available and addressed within an addendum or revision to the EIS.

Response
The traffic forecasts used for assessment of the project were based on the standard land use scenario developed by Transport for NSW and adopted in Roads and Maritime Strategic Traffic Assignment Model (STAM) and are consistent with the NSW DPE forecasts for land use at the time of assessment.

Population forecasts are based on three key datasets from the NSW DPE:
- 2013 Local Government Area (LGA) Population Projections
- 2012 Metropolitan Development Program (MDP) dwelling supply forecasts and
- 2013 Lot Release Schedule for the North West and South West Greenfield areas.

The land use scenario also considered further information on Urban Activation Precincts, zoning changes and longer-term residential directions.

Employment forecasts are based on trends using ABS Journey to Work data, forecasts of employment by industry and NSW DPE Major Projects register. The Bureau of Statistics and Analytics (BSA) Employment Forecasting Model uses a top-down approach in producing forecasts of jobs by distributing employment to 34 industries and then eventually into 59 SA3 regions. The model also considers new developments and trends to distribute Industry-Region control totals to the travel zone level.

Assessment of intersection capacity and performance has been carried out for traffic forecasts up to and including 2041 (the last year for which forecasts were available) and includes assumptions relating to the likely traffic generation of the Western Sydney Airport at these horizon years. Intersections within the proposal have been designed with sufficient capacity to perform satisfactorily under 2041 forecast peak period traffic volumes.
Issue description

The EIS indicates that traffic forecasts are based on the operation of the WSA by the mid-2020s (p. 188). The EIS relies upon the Western Sydney Airport Draft Environmental Impact Statement 2016 (DIRD, 2016) as its information source. The independent peer review of the WSA Draft EIS (to which Council contributed), identified some issues with the traffic and transport assessment for Stage 1 (2030) of the WSA. They included that freight traffic generation within the airport precinct (outside of air cargo) and private vehicle traffic generation from land uses within the airport precinct (outside of air passengers and direct airport employees) had not been assessed. While this additional traffic generation may be relatively minor, it is suggested that RMS and its consultants review the traffic forecasts attributed to the WSA to ensure all traffic generation is included, given a key objective of the project is to provide a resilient connection to the WSA site for freight and people (p. 31).

Response

The assessment of intersection capacity and performance has been carried out for traffic forecasts up to and including 2041 (the last year for which forecasts were available) and includes assumptions relating to the likely traffic generation of the Western Sydney Airport at these horizon years (based on the information publicly available at the time). Intersections within the proposal have been designed with sufficient capacity to perform satisfactorily under 2041 forecast peak period traffic volumes.

Issue description

The EIS does not consider the alternative of a combination of public transport (rail) and road development (p. 34), but recognises that there are a number of large public transport projects currently being constructed or planned, including the Joint Scoping Study on Western Sydney rail needs. While it is appreciated that the EIS cannot consider Western Sydney rail needs at this time, the north south rail link is critical to connect the broader Western Sydney region, including the WSA, WSPGA and SWPGA, and as such an upgraded, integrated road network should not be solely relied upon to provide these critical north south connections.

Response

Wider transport planning and land use integration is being considered by Greater Sydney Commission, NSW DPE and Transport for NSW.

Chapter 9 of the draft EIS considers the cumulative impacts of the project in conjunction with other committed projects that were known at the time of assessment. Additional north south rail capacity was not committed by Government at the time of carrying out the assessment.

Issue description

There are various references throughout the EIS to footpaths on the eastern side of The Northern Road “where required” (pp 4 and 77), “as required” (p 79), “where warranted” (p 109) and “such as between bus stops and adjacent intersections” (p 210). It is recommended that this be clarified in the detailed design phase.

Response

Details associated with the provision of a footpath along the eastern side of The Northern Road would be determined during the detailed design phase. Given the location of existing development adjacent to The Northern Road (primarily on the western side), lack of development opportunities on the eastern side, due to DEOH and Western Sydney Airport, and the provision of pedestrian crossings at all signalised intersections along the proposal, the provision of a shared path on both side of The Northern Road is not warranted.

Issue description

Council requests continued involvement in the design of The Northern Road upgrades including the proposed connection to the M12 Motorway.
Response
Roads and Maritime will continue to consult with Council in relation to the design of The Northern Road upgrades and the proposed M12 connection.

Issue description
The design proposes a continuous bus lane in each direction between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park. The bus lanes are to be 24 hour with parking not permitted in the bus lanes.

Response
The operation of the proposed bus lanes is being finalised as part of detailed design for the project and would be confirmed in consultation with Council and bus operators. Parking would not be permitted in the bus lanes.

Issue description
The provision of dedicated bus lanes is supported, however, there is no provision made to provide bus shelter infrastructure along the upgraded route. It is not reasonable to expect Council to provide this infrastructure. The bus shelters are a key facility of a major public transport route and enhance the public transport experience, promoting mode shift.

RMS has just completed the Werrington Arterial Road project and provided bus shelters in both directions. Council has received confirmation from RMS that TNR3 will be providing bus shelters to suit Council’s requirements. Bus shelters have been provided at each bus stop location by RMS. It is imperative that all stages of TNR are consistent in their delivery of infrastructure including bus shelters. Therefore, Council is urging RMS to reconsider its commitment for provision of bus shelters along TNR project.

As part of the bus shelters supply and installation process the RMS must ensure that the supplier provides a certificate that bus infrastructure has been designed and installed to meet all relevant standards and DDA compliance.

Response
The predominant land use along the project is rural residential. This is in contrast to the highly urbanised environment where The Northern Road Stage 3 (TNR3) is currently being delivered and where bus shelters have previously been committed to.

Roads and Maritime has formed the view that the existing passenger demand in the project location in the short-term does not warrant the implementation of bus shelters.

Issue description
The proposed TNR project has not provided any truck layby area within this project. At a Council meeting in March 2017, concerns were raised about the upgrade of TNR regarding removal of the existing lack truck layby area south of Glenmore Parkway. Council wrote a letter to RMS in April 2017, seeking their advice regarding the RMS Strategy/Policy on the provision of truck layby areas. Council believes that this is an important road safety initiative and therefore Council is urging RMS to reconsider its commitment for provision of a truck layby area along TNR project.

Response
The Transport Planning Branch of Transport for NSW and the Roads and Maritime Freight Branch administer the freight policy for NSW which includes identifying areas for the provision of heavy vehicle rest areas, de-coupling facilities and parking areas. The Northern Road corridor, being primarily metropolitan in nature is not currently a priority under the freight policy.

The project has no provision for a heavy vehicle inspection area, de-coupling facility or parking area for northbound traffic. However, between Littlefields Road, Luddenham and Glenmore Parkway, Glenmore Park, the project does include a heavy vehicle inspection bay for southbound traffic.
**Issue description**
Council requests that RMS consult with local residents and respond to any substantial objections prior to proceeding with the proposed new local road connections and upgrades for the following:

- New eastern extension of Littlefields Road
- New roundabout in the proposed eastern extension of Littlefields Road
- New connection from Gates Road through to Littlefields Road
- New extended Vineyard Road
- New roundabout in Kings Hill Road
- New alignment of The Northern Road and Elizabeth Drive (south of the current Elizabeth Drive).

**Response**
Roads and Maritime would consult with local residents prior to proceeding with new local road connections and upgrades.

Response to submissions from the local community regarding general traffic and transport related issues are included in Section 2.5. Additionally, any changes to impacts to local roads since exhibition of the draft EIS as a result of the design refinements is discussed in Section 5.1.1.

**Issue description**
As outlined within the Biodiversity comments within this submission, Council supports in principle the provision of a roundabout to facilitate U-turns in Kings Hill Road. However, it should be noted that an existing load limit applies to the section between The Northern Road and proposed extension of Vineyard Road. An application must be made to Council’s Local Traffic Committee (LTC) to remove the load limit on that small section of Kings Hill Road from The Northern Road to the proposed roundabout.

**Response**
Roads and Maritime will consult with Penrith Council’s Local Traffic Committee regarding the existing load limit on Kings Hill Road.

**Issue description**
The Kings Hill Road from The Northern Road to the proposed roundabout would require significant pavement upgrade to cater for the increase in heavy vehicle movements. As would the pavement design for the new roundabout.

**Response**
Roads and Maritime proposes to upgrade the pavement on Kings Hill Road. The requirements for the upgrade will be discussed further with Council.

**Issue description**
The proposed upgrade TNR project has realigned the existing The Northern Road to an easterly direction to bypass Luddenham town centre. The proposed realignment will reduce in traffic within the town centre, at the same time which may impact on local businesses that rely on passing trade. Consideration should be given to provide appropriate directional signage for traffic in the vicinity for easy access to the Luddenham town centre. Brown Tourist signage to attract passing trade into the community and for historic sites may be considered.

**Response**
During operation of the project the following management measures would be put in place to minimise the impact of the bypass of Luddenham Town Centre and attract passing trade:
• Appropriate road signage will be provided in accordance with the Roads and Maritime Services Guidelines Tourist Signposting (2012) to provide guidance to passing patrons on access to shops and services, including within Luddenham Town Centre

• Roads and Maritime, in consultation with Penrith Council will provide monetary support for preparation of plans to revitalise Luddenham Town Centre for the purpose of encouraging motorists to continue to pass through or visit Luddenham Town Centre.

**Issue description**

The proposed provision of a new shared path improving safety for pedestrians and cyclists also provides an alternative mode of transport. Whilst the inclusion of safe infrastructure for cyclists and pedestrians is acknowledged and welcomed, the nature of any cycling facility should meet the needs of the likely future user groups of the facility. The automatic provision of a shared-use path for bike riders is not always appropriate. Consideration should be given to the following points:

The Northern Road is currently used by long distance and club riders. As a major transport link to the airport, the road should provide for all modes of transport. In the case of cycle infrastructure, it should not only provide for the existing users, but also the likely future users, being riders who may choose to commute to/from work in and around the airport precinct. In this regard, the cycle facility should be continuous and direct, to be attractive to the user.

Intersection crossing treatments should be provided to give the same priority to bike riders as other vehicles. It should not be expected that bike riders are required to stop and cross at intersections with bicycle crossing lanterns on the same phase as pedestrians. The multiple crossing points and delays for a long distance bike commuter is not reasonable. A long distance rider will alternatively use the road, rather than ride on a slow, disconnected shared-use path. This particularly applies to the club training cyclists, riding long distances every weekend, often every day.

Complimentary on-road and off-road facilities are typically not necessary; a separated continuous on-road facility is preferred in this instance to cater for the likely users. However, if the discontinuous SUP only is proposed, then on-road lanes should also be included. Improved separation to travel lanes is also preferred for the cycle facility.

It is important that RMS consult with the local cycling clubs regarding the nature of the facility and ensure that the design, separation and intersection treatments are supported.

**Response**

The current shared path provision is consistent with the shared path being provided along the rest of The Northern Road (north of Bradley Street) which is being provided on the western side of the project. Given the location of existing development adjacent to The Northern Road (primarily on the western side), lack of development opportunities on the eastern side, due to the DEOH and Western Sydney Airport, and the provision of pedestrian crossings at all signalised intersections along the proposal, the provision of a shared path on both sides of The Northern Road is not warranted.

Roads and Maritime consulted with the following local and regional bicycle groups during preparation and exhibition of the draft EIS:

- Bicycle NSW
- Western Sydney Mountain Bike Club (WSMTB Club)
- CAMWEST Cyclist Group
- Mountain Bike Australia
- Western Sydney Cycling Network
- Bicycle Network
- Penrith Cycling Club
• Macarthur Collegians Cycling Club.

No submissions regarding the project were received from these groups. The provision of a shared path and no on-road cycling facilities is considered an appropriate treatment for the project.

3.10.5 Noise and vibration

Issue description
Construction is to be staged, with construction anticipated to occur over a three-year period (early 2018 to late 2020), with works generally being carried out during standard working hours “where feasible and reasonable.” It is noted that to minimise disruption to the Northern Road and the surrounding road network, some construction activities will be carried out outside of standard hours, including installation of traffic controls, night paving and key bridge construction works; however, as a standard noise management practice, where possible, the noisier activities should be restricted to standard work hours.

Response
Refer to response in section 2.6.2.

Issue description
Generally, the assessment concludes that the project’s construction phase will substantially impact the community, including triggering some receivers to be moderately and highly noise affected, particularly during periods where noise-intensive processes operate at their nearest point to receivers. Further, modelling predicts that during out of hour’s works, some residences may be exposed to exceedances of more than 25dB (A) above the sleep disturbance screening criteria. It is requested that the RMS commit to undertaking the detailed design identified in the Noise and Vibration Impact Assessment with subsequent community consultation to ensure that construction noise and vibration impacts upon nearby receivers – residential and non-residential - are minimised and scheduled for the shortest possible duration.

Response
Refer to response in section 2.6.2.

Issue description
It is requested that the project’s CNVMP specifically nominate the additional mitigation and community consultation measures it will apply to mitigate the predicted noise and vibration criteria exceedances identified in the Noise and Vibration Assessment. In particular, the CNVMP should explicitly assess the potential for sleep disturbance and address how the identified maximum noise level events would be managed to alleviate impacts to sensitive receivers.

Response
Refer to response in section 2.6.2.

Issue description
Where exceedances of the human response vibration criteria are identified at the detailed design stage, RMS should ensure that additional assessment is undertaken in line with the recommendations of the Noise and Vibration Impact Assessment.

Response
Table 7-34 of the draft EIS identifies that vibratory rolling is expected to be carried out within 100 m of residences (for various stages of works) and may impact human comfort within those residences. In these cases, the relevant mitigation measures outlined in Appendix C of the Roads and Maritime CNVG are to be followed in order to mitigate any such potential impacts. These measures include notification strategies, vibration monitoring, offering of periods of respite and offering of alternative accommodation. The precise location of vibration-intensive works and the
The final section of plant would be confirmed by the construction contractor once engaged, and the relevant mitigation measures incorporated into the CNVMP.

### Issue description

Once road upgrades are complete, modelling predicts that without noise mitigation, most receivers in the study area are expected to experience some increase in traffic noise. For receivers close to the alignment, the increase may result in an exceedance of the operational noise criteria. Further, some properties may also experience sleep disturbance impacts. In turn, there are 77 receivers that qualify for consideration of noise mitigation. All triggering receivers are residences other than three classroom buildings at Luddenham Public School. This list may be further refined during the detailed design phase. The assessment determines that mitigation of operational impacts will be delivered as at-building acoustic treatments rather than as either low noise road pavement or noise barriers, as this is the most “reasonable” application of mitigation given the proximity of the dwellings to the roadway and the spatial separation of the eligible buildings. It is requested that the RMS commit to undertaking the further detailed design identified as being required in the NVIA, along with subsequent community consultation to ensure that appropriate and effective noise mitigation measures are implemented. The selected mitigation measures and at-building acoustic treatments should be selected and implemented so as to respond to the concerns of the noise-affected community and ensure that the noise levels at sensitive receivers comply with applicable noise criteria.

### Response

Refer to response in section 2.6.2.

### Issue description

In line with the recommendations of the NVIA, post-construction traffic measurements should be collected to verify that traffic volumes and characteristics are not materially different from the forecast numbers considered in the NVIA. Where material differences are identified, further assessment should be completed to confirm that the level of impacts remain consistent with the predictions of this study.

### Response

In accordance with the draft EIS mitigation measures (NV-5 specifically), an operational noise review would be carried out within 12 months of the commencement of operation of the project. This would include monitoring to compare actual noise performance of the project against predicted noise performance and an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures. Identification of any additional feasible and reasonable measures that would be implemented with the objective of meeting the criteria in the NSW Road Noise Policy (DECCW, 2011), when these measures would be implemented and how their effectiveness would be measured and reported.

### 3.10.6 Biodiversity

#### Issue description

The proposal seeks to remove over 38.7 hectares of remnant native vegetation from the Cumberland Plain, almost all of which is already listed as Endangered or Critically Endangered. The EIS states that “The BIO Map (Office of Environment and Heritage 2015a) has not been approved by the Chief Executive of OEH and therefore these biodiversity links have not been included in the FBA (Framework for Biodiversity Assessment) calculations” (pp 293-294). The biodiversity links referred to include land on the site of the Orchard Hills Defence Establishment and regional corridor 17 linking the Mulgoa Nature Reserve to vegetation on the Defence Establishment site. This statement is concerning and it is considered to be reasonable and necessary that these links are included in the FBA as widening of The Northern Road will increase...
its barrier effects and result in the core area on the Defence Establishment site (which is also Priority Conservation Land) being further isolated with long term impacts on its viability.

The OEH’s website indicates that the BIO Map “comprises core areas of bushland and corridors that are important at a state and regional level for biodiversity outcomes”. It does not suggest that the BIO Map should not be used to guide government decision making. These links are also zoned E2 Environmental Conservation under Penrith LEP 2010, and as such, considered important to Penrith City’s biodiversity network.

**Response**

Refer to section 2.7.5 for a response to issues regarding the fragmentation of biodiversity links and habitat corridors.

**Issue description**

Further consideration should be given to having a u-turn facility in Kings Hill Road and whether this has potential to reduce the fragmentation of a potential west-east biodiversity corridor between the Mulgoa Valley and the Defence Establishment site, or at least through the Mulgoa Valley.

**Response**

The proposed design at Kings Hill Road includes a roundabout which would provide a u-turn facility for motorists. The proposed design in this area also includes a link road between Kings Hill Road and Longview Road. The intersection of Longview Road and The Northern Road would be left-in and left-out only and therefore the link road would be required to ensure motorists travelling south on the Northern Road can access Longview Road. The connectivity value of the vegetation and the impact of the proposed design on fragmentation have been assessed in BAR.

Refer to section 2.7.5 for a response to issues regarding the fragmentation of biodiversity links and habitat corridors, including proposed management measures to reduce impacts of the project on connectivity.

**Issue description**

At least two Threatened Ecological Communities, two threatened plants, six threatened animals and two migratory birds will be impacted by the upgrade:

- Cumberland Plain Woodland CEEC - approx 29.15ha
- River Flat Eucalypt Forest EEC - approx. 4.29ha
- *Pultenaea parviflora* (4 known plants) - Endangered (NSW) Vulnerable (Cth)
- *Marsdenia viridiflora* subsp. *viridiflora* (35 known plants) - Endangered (NSW) Vulnerable (Cth)
- Cumberland Plain Land Snail (*Meridolum corneovirens*) - Endangered (NSW)
- Regent Honeyeater (*Anthochaera Phrygia*) - Critically Endangered (Cth and NSW)
- Grey Headed Flying Fox (*Pteropus poliocephalus*) - Vulnerable (Cth and NSW)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) – Vulnerable
- Etern False Pipistrelle (*Falsistrellus tasmaniensis*) – Vulnerable
- Eastern Free-tail Bat (*Mormopterus norfolkensis*) – Vulnerable
- Latham's Snipe
- Cattle Egret.

**Response**

Noted.
**Issue description**

It is noted that Table 4.2 of the Biodiversity Technical Working Paper states that *Marsdenia viridiflora* subsp. *viridiflora* cannot withstand further loss. The project however proposes to remove 35 known individuals. Further, the offset strategy identifies this as having 'Red Flag' status and no credits being available to purchase. Justification has not been provided as to why this is an acceptable loss and this needs to be further addressed.

**Response**

As identified in the BAR, some impacts as a result of the project cannot be avoided even after the implementation of suitable environmental management measures (i.e. residual impacts). It is noted that the residual impact of the project on *Marsdenia viridiflora* subsp. *viridiflora* has been reduced to the removal of 31 known individuals, with the proposed retention of 4 plant species identified as part of the refined design (refer to section 5.1.3). Notwithstanding this, as identified in the BAR, the *Marsdenia viridiflora* subsp. *viridiflora* population has been identified as a species credit species that cannot withstand further loss and this has informed the assessment that has been carried out according to the FBA.

An offset requirement has been determined for this species as detailed in the BOS. The BOS does not refer to the 'Red Flag' status of any species. "Red Flag" areas are a concept from the BioBanking Assessment Methodology and do not apply to Major Projects assessed under the FBA.

As detailed in Section 2.7.8, the preferred approach to securing offsets for the project is to purchase credits from the market. Where credits are unavailable for purchase on the market, Roads and Maritime would work with public and private landholders to enter a BioBanking and/or Stewardship Agreement on their land and then buy the credits issued. Following discussions with Roads and Maritime, the Commonwealth DoEE and OEH, it was decided that an additional supplementary measures package would be developed in consultation with OEH and the Commonwealth DoEE with a focus on landscape scale measures within the local area.

**Issue description**

Mitigation measures have not been identified in detail and should be identified in order to determine the level of impact. Mitigation measure must include:

- Use of local provenance seed in all plantings.
- All areas that are to be grassed are to use direct seeding of native grasses and herbs as per Greening Australia's Grassy Groundcover Restoration.
- Reuse of topsoil from high quality bushland patches in vegetated fauna crossings and other areas to be revegetated.

**Response**

An urban design and landscape concept has been developed for the project as documented in the draft EIS, based on the project objectives and principles, to achieve an integrated design for the project. It incorporates the urban and landscape design concept plans for the project and a landscape planting concept including recommended species. As identified in the draft EIS, this would be adopted and further developed during detailed design and implemented as part of the Urban Design Landscape Plan (UDLP) for the project which is currently ongoing. There may be scope to include transplanting native species from areas to be cleared into revegetation areas but this would depend on the type of species being removed and the likely success of transplanting.

Plants to be used in revegetation would be sourced from local provenance seed where available and seed collection would be undertaken before clearing. There may be the opportunity for reuse of topsoil from cleared areas depending on the quality of the vegetation to be removed as the topsoil could contain a significant load of seed from exotic species and may not be suitable for reuse. Roads and Maritime would consider reuse of topsoil as part of the UDLP for the project.

Further details of the existing mitigation measures for the project as outlined in the draft EIS are provided in Appendix C. New or revised environmental management measures as proposed in
Appendix C have been incorporated into the revised environmental management measures included in Chapter 6.

**Issue description**
The loss of habitat, especially the loss of hollows and remnant trees has not been adequately assessed or quantified in the EIS. The EIS must identify the number of tree hollows, standing dead trees and large, remnant trees will be impacted by this proposal. It must also include the areas of vegetation that have not been included in the impacts assessments as outlined above. Several habitat trees are located within the road shoulder or median strip and can be retained rather than removed.

**Response**
Refer to section 2.7.1 for a response to issues regarding the removal of native vegetation, including impacts to hollow-bearing trees.

**Issue description**
Mitigation measures have not been identified and must be identified in order to determine the level of impact. Mitigation measure must include:

- Re-use of natural hollows in nearby bushland and reserves
- Re-use of large woody debris in nearby bushland and reserves
- Installation of suitable habitat boxes (made from hardwood and species specific) in nearby bushland and reserves.

**Response**
Further details of the mitigation measures for the project as outlined in the draft EIS are provided in Appendix C. Additional mitigation measures proposed for the project are outlined in Chapter 6.

**Issue description**
There are three key points where regional connectivity will be impacted as a result of the road widening. Two of these are within the Penrith LGA being:

- Kings Hill Rd Mulgoa
- Glenmore Park Biodiversity Corridor - this is also identified in the Cumberland Conservation Corridors Map and in OEH’s BIO Map which falls under the Cumberland Plain Recovery Plan. This importance of this linkage is not fully assessed as the EIS does not identify the connection through to Mulgoa Nature Reserve via the Glenmore Park Biodiversity corridor. This should be rectified and a full assessment of the impacts undertaken.

Loss of connectivity is a major threat on the Cumberland plain. No measures have been identified to mitigate these impacts on regional connectivity. The EIS states that they will refer to RMS Guidelines, but nothing is detailed. A number of connectivity mitigation measures must be implemented at these key locations. Mitigation measures need to include:

- A flood Culvert PXD2 is already proposed at the key connectivity point at Surveyors Creek. Alongside flood Culvert PXD2, a fauna underpass culvert is to be located to link the Glenmore Park/Surveyors Creek Biodiversity Corridor with the vegetation on the defence land. This would require the culvert to be doubled so that one side can allow for fauna movement. The fauna underpass must be independent of the drainage culvert, elevated above regular drainage levels, and a natural earth floor and with a slight angle to self-drain any water entering. The culvert for fauna must be a minimum of 3m high to provide for Eastern Grey Kangaroos, with a natural earth bottom as outlined above, and contain hardwood logs and rocks to allow escape from flooding and predators. Suitable vegetation is to be provided on either side to provide protection to fauna on approach and departure. Due to security, the culvert would need to have a grate across it to prevent access, but it would mean that in future the potential is there to
open it up for fauna movement and would avoid the road upgrade sterilising future connectivity opportunities.

- Fauna rope bridges and glider poles with vegetated rest points in the median strip to provide a two-stage crossing at suitable points along the roadway.
- Suitably placed floppy-top fencing to manage and guide fauna crossings.

**Response**

Refer to section 2.7.5 for discussion regarding the fragmentation of biodiversity links and habitat corridors.

**Issue description**

The Cumberland Plain Mitchell Landscape is an over-cleared landscape with 89 per cent of native vegetation having been cleared. Due to the likely expansion of western Sydney further impacts to biodiversity are likely to result in this region. The EIS outlines other projects that are having or will have an impact on the regions biodiversity:

- The predicted impacts from the Northern Road Upgrade – Glenmore Parkway, Glenmore Park to Jamison Road, Penrith are anticipated at about 2.4 ha of remnant native vegetation and up to 3.9 ha of planted vegetation along the M4 Motorway (6.3 ha in total)
- The predicted impacts from the Northern Road Upgrade Narellan to Bringelly are anticipated at about 59.2 ha of native vegetation
- The construction footprint of the M4 Managed Motorway project is anticipated to impact on about 31.25 ha of planted and remnant vegetation in various states of condition. This area of clearing includes 3.82 ha of remnant vegetation
- The footprint of the Western Sydney Airport is predicted to impact on 280.8 ha of native vegetation

Additional future impacts include the South West Growth Centres, realignment of transmission lines, provision of water pipelines, and the proposed M12 Motorway and other future orbital road links.

**Response**

Noted, as per BAR.

### 3.10.7 Socio-economic and land use

**Issue description**

The EIS states that “Roads and Maritime will, in consultation with Liverpool Council, provide appropriate support for preparation of plans to revitalise Luddenham town centre, for the purpose of encouraging motorists to continue to pass through or visit the town” (pp 420 and 424 (SE-14)). Given part of the village of Luddenham is within Penrith City, Council would also like to be included in this environmental management measure.

**Response**

Liverpool Council as well as Penrith City Council would be consulted in the preparation of plans to revitalise Luddenham Town Centre (See revised management measures SE-13).

**Issue description**

The EIS identifies 142 properties for full and partial acquisition. Clarification is sought on when information on acquisition is likely to be provided to Council for inclusion on Section 149 certificates.
Response
Roads and Maritime are still in the process of finalising exact boundaries for acquisition for the project. Following finalisation of all boundaries, appropriate information will be provided to Council. This is expected to occur by mid-2018.

### 3.10.8 Soils, water and contamination

#### Issue description
Whilst detailed contamination investigations have not yet been conducted, it is expected that land contaminated through existing and historical uses will be disturbed through the construction program. It is requested that the RMS ensure that comprehensive and detailed contaminated land investigation, remediation and validation procedures and protocols are prepared and implemented as part of the contaminated land management plan and that consultation with the NSW EPA occur, should land contamination be identified.

#### Response
A contaminated land management plan would be developed for the project, which would outline the investigation and management requirements for the project. As above, all sub plans would be carried out in consultation with Council. The plan would include procedures for the management of contamination if encountered, including consultation with the NSW EPA as required.

#### Issue description
It is recommended that the RMS ensure that the recommendations of the Stage 1 Contamination Assessment, as detailed in Section 6.2 ‘Recommendations’ are considered during the Phase 2 assessment. To mitigate impacts to human health and the environment, intrusive sampling and analysis of soils should be undertaken prior to the disturbance of any known or potentially contaminated land.

#### Response
Recommendations of the Stage 1 contamination investigation would be implemented including the requirement for a Phase 2 assessment. Outcomes of the assessment and further investigation and management measures would be documented in the contaminated land management plan.

#### Issue description
All remediation works in the Penrith Local Government Area require development consent. Clause 11(4) of SREP 20 states that consent is required for remediation of contaminated land, and clause 9(d) of SEPP 55 identifies any remediation work as Category 1 remediation work (work needing consent) where it is required by a Regional Environmental Plan. A Remediation Action Plan (RAP) should be included for consideration and approval by the consent authority in line with Clause 17 (1) (C) of SEPP 55 should land remediation works be required. A notice of completion of remediation work on any land within the Penrith Local Government Area should also be provided to Penrith City Council. The contamination land management plan as part of the broader CEMP and the Unexpected Finds Protocol should be prepared with consideration to the above.

#### Response
The approval process for the project is under Part 5.1 of the EP&A Act is illustrated in Figure 1-3. Any remediation works required for the project would be carried out in accordance with the conditions of approval and relevant legislative requirements. The project has been declared State significant infrastructure under the State Environmental Planning Policy (State and Regional Development) 2011. As such, the project is permissible without consent. Any remediation requirements will be determined by the Secretary of the Department of Environment and Planning.

While Roads and Maritime will consult with and seek input from Council throughout all stages of the project there is no legislative requirement for development consent endorsed by Council.
**Issue description**

Whilst odour arising from uncovered contaminated or hazardous materials is identified as a local air quality risk and subsequent management measures proposed, there is further potential for air quality impacts to arise through the disturbance of unidentified contaminated land. Measures and safeguards to minimise air quality impacts and risk to human health associated with disturbance of these lands, should be addressed in the CEMP.

**Response**

The CEMP would include relevant measures to manage impacts associated with the disturbance of contaminated land, including unexpected contamination finds. This would include asbestos management procedures if asbestos is encountered. These procedures would be developed to manage air quality impacts and risks to human health associated with disturbance of contaminated land.

**Issue description**

The project footprint contains and is in relatively close proximity to a number of water bodies and other sensitive receiving environments, which may be impacted during the construction and operation of the development. The proposed works have the potential to impact on surface water quality during the construction works due to the movement of sediment-laden runoff caused by excavation activates, vegetation removal, and other surface work, particularly before or during periods of heavy rainfall. The erosion, sediment and water quality control measures proposed to be implemented prior to, during and post construction works should effectively manage potential water quality issues during the construction stage provided scheduled monitoring and regular maintenance of these measures is undertaken.

**Response**

The soil and water management measures outlined in section 8.2.2 of the draft EIS would be implemented and incorporated into the relevant management plans for the project, including monitoring and maintenance requirements.

### 3.10.9 Urban design and visual impacts

**Issue description**

Sheet 13 of the Urban Design Concept Plans (Page 87) indicates the planting of clumps of trees to balance screening with occasional views from the road corridor. The Mulgoa Valley has an established landscape and heritage character and replanting along the corridor should suitably respond to this character in terms of species type, groupings and plant locations.

**Response**

Roads and Maritime would carry out further consultation with Council during finalisation of the landscaping plan being developed as part of detailed design. As outlined in the landscape design in the draft EIS, the development of the planting concept and layouts for vegetation during detailed design, would ensure placement and species selection is in accordance with all relevant requirements. This includes the Roads and Maritime Landscape Guideline (RTA 2008), clear zone and stopping sight distance requirements, the Obstacle Limitation Surface (OLS) requirements for the Western Sydney Airport, and biodiversity offset requirements.

**Issue description**

In the Urban Design Strategy (5.2), the general principles for vegetation and views for all three zones are considered to be inadequate. To guide a coordinated design, additional principles should be included to address:

- Conflicts between the provision of best conditions for vegetation to thrive, and potential constraints such as compacted sub-soil and ground conditions in areas of cut and fill, underground and other services infrastructure e.g. power, maintenance access requirements.
• Further clarification on how Councils can safely, effectively and efficiently maintain verges with respect to batters, plant species and intended management measures
• Further clarification on how Roads and Maritime Services contractors can safely, effectively and efficiently maintain medians

**Response**

Roads and Maritime acknowledges Council’s advice regarding the Urban Design and Landscape Plan and will continue to consult with Council during finalisation of the landscaping plan being developed as part of detailed design.

**Issue description**

Figure 25 of the Urban Design Strategy does not address the local government boundary between Penrith City and Liverpool. Further consideration should be given to the provision of signage and other potential landscape features to mark the boundary.

**Response**

The provision of gateway signage is beyond the project scope. Roads and Maritime would work with Council to identify suitable locations for Council gateway signage or other features.

**Issue description**

Road elements (5.3) does not address the following, which have the potential to impact the landscape amenity of the road corridor and surrounding landscape context:

- Infrastructure such as underground power and drainage. These should be coordinated with the vegetation and views concepts so they are located and aligned to not compromise optimum locations and conditions for planting
- Signage including identity gateway markers at the LGA boundary

**Response**

The draft EIS identifies a number of underground utilities and services that may be impacted by the project. The extent of impacts would be confirmed prior to finalising the detailed design. Strategies to address impacts may include utility protection, realignment or relocation, or adjustments to the project design to avoid impacts. Consultation with utility and infrastructure providers is ongoing and will specifically include landscaping and urban design outcomes for the project, however there are currently no plans to relocate utilities to allow for optimal roadside planting and landscaping.

Gateway signage at the LGA boundary is beyond the project scope. Roads and Maritime would work with Council to identify suitable locations for Council gateway signage or other features.

**Issue description**

Road elements – cuttings (5.3.3) – soils should be ameliorated to enable planting to restore landscape character and bushland areas.

**Response**

Roads and Maritime would carry out further consultation with Council during finalisation of the landscape plan being developed as part of detailed design. The rehabilitation of disturbed areas would be carried out in accordance with Roads and Maritime Guideline for Batter Surface Stabilisation (Roads and Maritime April 2015) which includes specific requirements for soil amelioration where required.

The construction contractor, once selected, would be required to ensure all disturbed areas are reinstated and that revegetation and planting is carried out in accordance with the landscape plan and conditions of approval for the project.

The following new mitigation measure will be implemented for the project:
Rehabilitation of the disturbed areas of the site would be undertaken in accordance with Roads and Maritime Batter Stabilisation Guidelines and Roads and Maritime contractor specifications.

**Issue description**
The following comments regarding ‘Landscape Design’ (Section 5.4) should be further considered and addressed:

- Vegetation – plants should be grown from provenance stock
- Hoop and Bunya Pines are recommended over coastal Norfolk Island Pines
- Cumberland Plain Woodland species should include Melaleuca sp.
- Riparian species should include *Casuarina, Ficus coronata, Melia, Callistemon and Acacia*
- Median and verge species should include pasture grasses

**Response**
Roads and Maritime would carry out further consultation with Council during finalisation of the landscape plan being developed as part of detailed design. The landscape design in the draft EIS provides an indicative plant species selection that would be further refined during detailed design in consultation with relevant stakeholders.

**Issue description**
The following comments regarding ‘Urban Design Concept Plans’ (pp81-89) should be further considered and addressed:

- The description of PM4 is not clear – it should include tree planting
- Sheet 7 – The feature avenue of Hoop Pines into Luddenham should be planted on both sides of the road to enable an ‘avenue’ effect. Power should be relocated underground if necessary. An extension of the avenue towards the intersection will enable it to be appreciated by TNR users, and promote the town as a bypass destination. Similarly, other landscape features including Council branded signage should be incorporated into the intersection
- Sheet 7 – The statement should address unsightly views into the incident response facility by northbound traffic, through vegetation, built form design excellence, improved circulation routes to reduce visual impact
- Sheet 7 – The statement should address the change in local government areas through Council branded signage and other features
- Sheet 10 – there is opportunity for PM2 i.e. inclusion of planted trees between CH10050 and 10325 (east) and this should be further explored
- Sheet 11 – the VMS at the pipeline is considered inappropriate given this is a feature in the landscape which has potential to be highlighted.

**Response**
Roads and Maritime acknowledges Council’s advice regarding the Urban Design and Landscape Plan and will continue to consult with Council regarding the operational requirements of the road and the feasibility of Council’s advice.

**3.10.10 Air quality**

**Issue description**
During construction, the primary risk to local air quality is dust emissions (particulate matter and combustible matter) generated during works involving the stripping of topsoil and clearing of vegetation, earthworks, stockpiling, the movements and handling of soils, and traffic movements.
on unpaved roads. Those receivers located close to the site works (~ 20m) and in the direction of prevailing winds will be the most susceptible to air quality-related impacts, particularly during dry hot periods. Potential impacts to air quality during the operational phase of the project are generally associated with motor vehicle emissions arising from changes in the volumes of motor vehicles and proximity to sensitive receptors. Safeguards and environmental management measures have been identified to manage and mitigate impacts predicted as a result of the proposed work; these measures, including air quality monitoring, reporting and compliance requirements, will be further developed and detailed in the CEMP which should form conditions of consent.

Response
Noted.

3.10.11 Resource and waste management

Issue description
It is requested that the RMS ensure that a comprehensive waste management plan is prepared and implemented to ensure that all waste arising from the construction of the project, including contaminated material and asbestos, is appropriately collected, transported and disposed of lawfully at a lawful waste management facility. Measures to this effect should be included in the plan.

Response
A waste management plan would be developed for the project, including procedures for the management of contamination and asbestos, if encountered.

3.10.12 Cumulative

Issue description
Chapter 9 of the EIS discusses the potential cumulative impacts of this project and other projects proposed in the area, including the WSA. The construction timeframe for this project and the aviation infrastructure works for the airport is outlined on page 672. There are, however, site preparation activities associated with the airport, including substantial earthworks, scheduled to commence in 2018 ahead of the aviation infrastructure works which should also be considered in this assessment.

Response
Both site preparation activities and aviation infrastructure works for the planned Western Sydney Airport have been considered within the cumulative impacts section in Chapter 9 of the draft EIS. This includes consideration of impacts related to bulk earthworks. While the draft EIS considered the overlap of Aviation Infrastructure works from mid-2019, it is noted that bulk earthworks may begin earlier. Information on the Western Sydney Airport website (August 2017) states that the construction for the airport is likely to start in 2018. The cumulative impact assessment has been updated to reflect this additional period of overlap (refer to section 5.2.10).

Issue description
Chapter 9 considers cumulative traffic impacts and suggests that, during construction, vehicles may use alternative routes to travel north or south through the area to avoid delays, such as Mulgoa Road, Luddenham Road and Mamre Road. The environmental management measures suggest that consultation be undertaken with local communities potentially affected (p 688). Council should also be included in this consultation process.

Response
Local communities, as well as Council, would be consulted with regards to alternate travel routes required during construction.
3.11 NSW Office of Environment and Heritage (Heritage)

3.11.1 Non-Aboriginal heritage

Issue description
The Project seeks to upgrade 16 kilometres of The Northern Road between Glenmore Parkway, Glenmore Park and Mersey Road, Bringelly. No State Heritage Register items have been identified as being affected, however there are two historical archaeological sites, one s170 registered item and one item on the Commonwealth Heritage Register (CHL) will be impacted by these works. A number of ‘potential’ heritage items are also discussed, however it remains unclear what level of significance, if any, these may retain.

I note the previous advice dated 23 January 2017 regarding the adequacy of the draft Environmental Impact Statement (EIS). The Department was advised of the following elements that did not satisfy the SEARS for this project:

- An Excavation Methodology and research design to manage the historical archaeological sites impacted by the proposed upgrade works; and
- The assessment required additional assessment of significance for all of the items identified within the study area as likely to retain heritage significance and which would be impacted. This was particularly raised as a concern for potential state significant archaeological sites such as Lawson’s Inn and Miss Lawson’s Guest House.

Response
The non-Aboriginal heritage assessment carried out for the draft EIS identified two registered heritage items (known items) and an additional eight ‘potential’ heritage items within the study area. This initial identification of known and potential heritage items was based on a desktop review and site survey. Assessments of significance were carried out for all 10 items, only four of which were identified as having heritage significance as follows:

- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (in relation to Chaffey Brothers Irrigation Scheme Canal) – Commonwealth heritage significance
- Item 3: Warragamba Dam to Prospect Reservoir pipeline – local heritage significance
- Item 9: Miss Lawson’s Guesthouse site – local heritage significance
- Item 10: Lawson’s Inn site – local heritage significance.

The remaining six items were not identified as being of heritage significance and were therefore not considered further in terms of impacts.

As outlined in section 2.11.1, additional assessment has been carried out since exhibition of the draft EIS (refer to Appendix D). This includes updated histories and statements of heritage significance for a number of known and potential heritage items. This included a comparative analysis for Item 9: Miss Lawson’s Guesthouse site and Item 10: Lawson’s Inn site to aid the assessment of heritage significance for these sites in accordance with the relevant guidelines.

Additionally, the non-Aboriginal heritage technical memorandum in Appendix D includes a copy of and incorporates the findings of a research design and excavation methodology for the following potentially impacted sites:

- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (in relation to Chaffey Brothers Irrigation Scheme Canal)
- Item 9: Miss Lawson’s Guesthouse site
- Item 10: Lawson’s Inn site.
There would be no impact to any of the items of heritage significance associated with Item 3: Warragamba Dam to Prospect Reservoir pipeline, therefore no further archaeological investigation is proposed for this item. Development requirements for the pipeline are discussed further below.

Further to this, as noted in the technical memorandum in Appendix D, a previous assessment by Australian Museum Consulting reviewed the Liverpool LEP listing for Item 10: Lawson’s Inn site and considered it to be of State heritage significance. However, this study did not include a full significance assessment of the site against the NSW Heritage Council’s criteria for heritage assessment, including no comparative analysis. Although the findings of the Australian Museum Consulting report were taken into consideration in the assessment of significance for the purpose of this assessment (refer to Appendix D), the site was still determined to be of local heritage significance.

In summary, although the significance assessments and associated statements of heritage significance have been updated for these items based on the results of this additional assessment, there was no change in relation to whether or not these items satisfied the criteria for local or State listing, with no State significant heritage items identified for the project.

The statements of heritage impact and associated mitigation measures for the four sites of heritage significance have also been updated in Appendix D to reflect the outcomes of this additional assessment.

**Issue description**

**The Warragamba Supply Scheme Pipeline**

The Heritage register searches within Appendix N do not consider state government agencies, such as WaterNSW, other than the Roads and Maritime Services. The Warragamba Supply Scheme (Warragamba to Prospect Reservoir Pipeline) is listed under s.170 of the Heritage Act 1977 by WaterNSW. The requirements of s.170 of the Heritage Act 1977 still apply for items so listed, because the provisions of s89J of the Environmental Planning and Assessment Act 1979 for State significant development do not suspend these portions of the Heritage Act 1977. Compliance with the State Government Agency’s Total Asset Management System (TAMS) is required when changes are proposed to a heritage item listed on a s170 register. The EIS and Appendix N discuss compliance with relevant guidelines for development adjacent to the Warragamba Supply System pipeline as mitigation for the proposed impact but do not specify what the mitigation will be. It is therefore not possible to advise appropriate conditions of consent for mitigation. This should be included in the EIS so that appropriate conditions of consent can be included.

**Response**

The non-Aboriginal heritage technical memorandum (Appendix D) includes an updated assessment of heritage significance for Item 3: Warragamba Dam to Prospect Reservoir pipeline, including reference to the Warragamba Supply Scheme which is registered on the s. 170 NSW State agency heritage register (no. 4580161). The listing includes the Warragamba Dam, associated infrastructure and pipelines. However, since the significance assessment in the listing relates to the entire scheme focusing on the dam, a new assessment of significance was carried out against the relevant NSW Heritage Council criteria for the purpose of this assessment with a focus on the pipeline (refer to Appendix D).

The statement of heritage impact was also updated, with no physical impact expected to the pipeline as a result of the project subject to the application of relevant mitigation measures. This is consistent with the outcomes of the draft EIS, however further detail has been provided in Appendix D with regards the mitigation measures applicable to this item as per the Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines (Sydney Catchment Authority 2012). This guideline outlines risks to the pipeline as a result of construction works in the vicinity and includes measures which would be implemented for the project as follows:

- Consultation with the Sydney Catchment Authority (SCA) to identify key issues relevant to particular locations to ensure the proponent or authority has the information needed to implement SCA requirements or recommendations
• Access to the Upper Canal and Warragamba Pipelines ‘Controlled Areas’, outlining access approvals and site inspections and access for SCA staff and contractors

• Risks during construction and site preparation – including vibration caused by jack hammering, pile driving or rock breaking, cut and fill works, erosion, sedimentation and stormwater impacts, dust, windblown rubbish and other airborne pollutants and illegal storage of construction materials. The SCA recommends that consent authorities require a Construction Environmental Management Plan be completed as a condition of consent for new large subdivisions and major development adjacent to the Upper Canal and Warragamba Pipelines corridors. The Construction Environmental Management Plan should identify any potential impacts of the corridors and the range of controls to be implemented during the construction phase to avoid these impacts

• Erosion and sediment control – management of eroded sediment during any construction phase when the removal of vegetation and disturbance of groundcover in the currently predominately rural areas

• Stormwater management – the SCA requires that no stormwater beyond pre-development levels enters the corridors

• Public safety and security of water supply, including security fencing

• Road and pedestrian crossings

• Land uses and landscaping along corridor boundaries (Sydney Catchment Authority 2012: 7-17).

The guideline also provides guiding principles for development proposed within and adjacent to the Warragamba Pipeline corridor which would also be implemented for the project. Further detail is provided in Appendix D.

Issue description

Orchard Hills Cumberland Plain Woodland, Commonwealth Heritage List (CHL)

The Chaffey Brothers Irrigation Scheme canal (also associated with the Mulgoa Irrigation scheme) is assessed by GML Heritage as retaining high significance. This canal system is described as series of shallow depressions in poor condition with some wooden beams noted in association with them. It is unclear how the impacts on the canal, from the northern section of the proposed road upgrade, would be mitigated other than by proposed archival recording. This may be a suitable mitigation option however, the discussion has not stated what the heritage management plan prepared by GML Heritage has advised about the section of the canal. It would be appropriate for the mitigation to reference this HMP to justify the approach proposed.

Response

As identified in the draft EIS, Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place incorporates the Chaffey Brothers Irrigation Scheme Canal. The canal is ranked as high significance in the Heritage Management Plan (HMP) prepared for the DEOH site by Godden Mackay Logan (GML) in 2013. The draft EIS identified impact to a small portion of the northern extent of the canal where it overlaps with the project, some of which was identified as being in poor condition as it is extremely shallow from erosion. The assessment in the draft EIS also identified the canal as being situated within an area of the DEOH site ranked in the HMP as having a low tolerance for change in relation to new development and demolition/remediation.

Chapter 6 of the HMP outlines the heritage management strategies and guidelines for the DEOH site, including any new development, demolition or remediation on the site. The HMP requires that impacts to the canal in relation to any new development within the DEOH site be avoided. Additionally, any demolition of built heritage items should take into account the heritage value of the item and its tolerance for change, as well as its relationship to other related elements of heritage value. Demolition of elements of moderate to high retention value should be avoided.
Although the canal in the context of the DEOH site is ranked as being of high significance with a low tolerance for change, the draft EIS concluded that given the project is impacting a small proportion of the overall canal, and that the section being impacted is of relatively poor quality, the overall impact on the historic heritage values was not considered to be significant with the implementation of the proposed management measures for the project.

The non-Aboriginal heritage technical memorandum in Appendix D provides updated statements of heritage impact for potentially impacted heritage items, including item 2. This incorporates the outcomes of further historical assessment as well as an archaeological research design and excavation methodology prepared for the canal (refer to Appendix D).

In addition to the draft EIS mitigation measures for this site which included archival photographic recording, archaeological investigation in the form of test excavation is also proposed for the extent of the canal to be impacted by the project as requested by the Department of Environment and Energy. The investigation would include clearance of vegetation, hand excavation of topsoil/overburden, and mechanical excavation of trenches across the canal in accordance with the archaeological research design and excavation methodology (refer to Appendix D for further details).

**Issue description**

**Historical Archaeological Sites and relics**

The EIS has identified two historical archaeological sites within the project impact zone, both have been assessed as being of local significance by Appendix N. These items include Lawson's Inn Site (Item 10) and Miss Lawson's Guesthouse, Luddenham (Item 9). The historical assessment for these two items failed to search the NSW Land Title system prior to 1963. This is a concerning gap in the site history without any explanation such as Crown Land ownership.

It is therefore considered that Appendix N does not satisfy the stated requirements of the SEARS in terms of its historical investigation, analysis and significance assessments for each of the items which have been identified as 'potential' through this investigation. Also the analysis and historical investigation presented does not meet the standards of the NSW Heritage Manual 1996 for investigating and assessment of significance of heritage items in NSW. Archaeological assessments should also consider comparative analysis in assessing significance and that has not been addressed in the assessment.

**Response**

As outlined in the response to community submissions in section 2.11.1, further historical research has been undertaken for the purpose of this assessment which has informed updated assessments of significance for Item 9: Miss Lawson’s Guesthouse site and Item 10: Lawson’s Inn site. Comprehensive land ownership research on the properties was undertaken, producing a chain of ownership and tenancy from first grant to the present. Research provided considerable additional material to inform a revised assessment of heritage significance, consistent with the NSW Heritage Manual 1996, however, this did not alter the previously ascribed local level of significance for Item 9: Miss Lawson’s Guesthouse site, and confirmed a local level of heritage significance, rather than state, for Item 10: Lawson’s Inn.

The archaeological assessments for Items 9 and 10, include a comparative assessment of similar sites, which has been used to inform the determination of Criteria F and G – Rarity and Representativeness, and to provide models for predicted site organisation and archaeological potential.

**Issue description**

**Assessment of Significance for item within the project area:**

Previous comments provided on 23 January 2017 raised concern with the insufficient assessment of heritage items and potential heritage items in the draft EIS. The current EIS raises the same concern. The identified items are either assessed as retaining heritage significance at a local or...
Response

As identified above, a total of 10 items potentially impacted by the project were assessed for heritage significance (two registered heritage items and eight 'potential' heritage items). These included:

- Item 1: Remnant of The Northern Road – no potential heritage significance
- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (in relation to Chaffey Brothers Irrigation Scheme Canal) – Commonwealth heritage significance
- Item 3: Warragamba Dam to Prospect Reservoir pipeline – local heritage significance
- Item 4: Fruit Orchard, Luddenham – no potential heritage significance
- Item 5: Weatherboard House, Slab Hut and Old Dairy, Luddenham – no potential heritage significance
- Item 6: Weatherboard House and Sheds, Luddenham – no potential heritage significance
- Item 7: ‘Pleasantview’ House 1, Luddenham – no potential heritage significance
- Item 8: Luddenham Village area: Chapel and School Site and Adams Road House – no potential heritage significance
- Item 9: Miss Lawson’s Guesthouse site – local heritage significance
- Item 10: Lawson’s Inn site – local heritage significance.

As outlined above, only four were identified as having heritage significance and were further assessed in relation to potential impacts as a result of the project. Updated statements of heritage significance, further clarity on which items are considered to meet criteria thresholds for heritage significance, updated statements of heritage impact and associated mitigation measures are all provided in Appendix D.

Issue description

The level of historical research needed to underpin and investigate significance is not demonstrated in the archaeological assessment. This is clear in the supporting assessments of significance for these items for example:

Item 5: weatherboard house, slab hut and old dairy, Luddenham, where no additional research was provided because the team had difficulty in searching Old System land titles in NSW. The information supporting the assessment of this item was provided by one source only. No additional historical analysis was undertaken to support this work. Inadequate investigation of historical land titles in NSW may have led to the same error for multiple items considered for this project. This is considered to be an inadequate submission against the requirements of the Heritage Manual, 1996 for Investigating and Assessing significance.

Response

As outlined in the response to community submissions in section 2.11.1 and above, further historical research including searches of the Old System of land titles in NSW provided considerable additional material to inform a revised assessment of heritage significance (including for item 5) consistent with the NSW Heritage Manual 1996. The updated assessments are included within Appendix D.
Issue description

Item 9 (Miss Lawson’s Guesthouse site) was associated with Item 10 (Lawson’s Inn Site) and dates from the same time, circa 1830s. It would be fully impacted by the proposed works; the proposed approach is open area salvage of this archaeological site. It is noted the site may retain a higher level of significance than local, however the supporting assessment has been inadequate in demonstrating detailed site specific historical research and comparative analysis to support the significance assessment. Archaeological sites may satisfy multiple values under the significance criteria other than just Criterion ‘e’ for research potential. The mitigation is considered to be inadequate because it does not provide the detailed response required by the SEARS.

Response

As outlined in the response to community submissions in section 2.11.1 and above, further historical research and survey has been undertaken for the purpose of this assessment which has informed updated assessments of significance for each item included in Appendix D. However, this did not alter the previously ascribed local level of significance for Item 9: Miss Lawson’s Guesthouse site. The updated assessment in Appendix D has also included comparative analysis in the case of Item 9: Miss Lawson’s Guesthouse site and Item 10: Lawson’s Inn site.

The Archaeological research designs for Items 9 and 10 consider the multiple possible heritage values of the potential archaeological remains on these sites (Kottaras and Desic, 2017 see Appendix D). The excavation strategy allows different elements of potential heritage significance to be investigated, should these become apparent. Additional research supporting the research designs has provided considerable new information on each of the sites, suggesting they were less functionally interconnected than previously understood.

Issue description

Item 10 (Lawson’s Inn Site) is a circa 1830s inn site, and has been assessed previously as being of state significance, however, it has been argued that the site is of local significance. There is no justification for this change in significance for this item. The mitigation proposed is also unclear because the EIS has argued in Section 7 that full archaeological sites for Items 9 and 10 will be salvaged. However, the executive summary of the Appendix (Table 2, page xvi) specifically states ‘around a quarter of the site (Item 10) would be directly impacted by construction’. Partial excavation of this site is not supported where full impacts may occur through construction and other associated activities which would represent indirect impacts as well as direct impacts. It is recommended this is resolved in the EIS as either completely avoiding the site or fully salvaging the site within an appropriate excavation methodology. The excavation would need to include a methodology an Archaeological Research Design and the nomination of an Excavation Director who meets the Heritage Council Criteria.

Response

The non-Aboriginal heritage technical memorandum in Appendix D includes a copy of and incorporates the findings of a research design and excavation methodology for a number of potentially impacted sites, including item 10: Lawson’s Inn.

As noted above and in the technical memorandum in Appendix D, a previous assessment by Australian Museum Consulting reviewed the Liverpool LEP listing for Item 10: Lawson’s Inn site and considered it to be of State heritage significance. However, this study did not include a full significance assessment of the site against the NSW Heritage Council’s criteria for heritage assessment, including no comparative analysis. Although the findings of the Australian Museum Consulting report were taken into consideration in the assessment of significance for the purpose of this assessment (refer to Appendix D), the site was still determined to be of local heritage significance.

Although construction of the project would directly impact on a portion of the historical curtilage of Lawson’s Inn, based on the updated assessment (Appendix D) the inn building, known associated outbuildings and the bulk of anticipated archaeological evidence will be avoided. The
Archaeological research design identifies the risk of impacts to associated archaeological deposits that may still be present within the project boundary, and proposes a mitigation protocol. These areas within the project boundary have been assessed as being of low archaeological potential and would be subject to test excavation in accordance with the research design and methodology for the site to determine the presence of potential heritage (refer to Appendix D).

**Issue description**

It is recommended that the following additional information be sought from the applicant prior to determination of the application by the Department to address the management of the following heritage items: Orchard Hill Cumberland Plain Woodland (Chaffey Brothers Irrigation Scheme) and Warragamba Supply Scheme pipeline and the identified archaeological sites as follows:

1. **Warragamba Supply Scheme**
   
   Information to clarify mitigation measures for the proposed impact to this item so that appropriate conditions of consent can be included, where appropriate.

2. **Orchard Hill Cumberland Plain Woodland (Chaffey Brothers Irrigation Scheme)**
   
   Information to clarify how the proposed mitigation measure of archival recording complies with the advice in the heritage management plan prepared by GML Heritage for management of this high significant item.

3. **Historical Archaeological Sites:**
   
   a) A full detailed historical archaeological assessment that satisfies the guidelines ‘Assessing Historical Archaeological Sites and Relics, 2009’ and ‘Archaeological Assessment 1996’ shall be prepared by the Applicant for item 8 (Lawson’s Inn site) (sic) and Item 9 (Miss Lawson’s Guesthouse site) by an historical archaeologist who has demonstrated experience in excavating and assessing sites of state heritage significance in the state of NSW.
   
   b) This assessment shall include a detailed excavation methodology and research design prepared by the nominated excavation director for the full mitigation of these sites, where the detailed design cannot avoid impact to them. The Excavation program must be undertaken by a person who can demonstrate open area salvage of local and potentially state significant sites in NSW under the Heritage Council of NSW Excavation Director criteria. These documents must be prepared and submitted for the review of the Heritage Council of NSW or its delegate and the approval of the Secretary of the Department of Environment and Planning.

**Response**

1. **Warragamba Supply Scheme**
   
   As outlined above, the updated assessment in Appendix D confirms the draft EIS findings that the project would not result in physical damage to the pipelines. Further detail has also been provided in the statement of impact for this item, with reference to the mitigation measures included in the Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines (Sydney Catchment Authority 2012). The listed mitigation measures and guiding principles would be implemented for the project.

2. **Orchard Hill Cumberland Plain Woodland (Chaffey Brothers Irrigation Scheme)**
   
   As outlined above, the draft EIS refers to the canal as being ranked of high significance in the HMP prepared for the DEOH site by GML. The draft EIS also identified the canal as being situated within an area of the DEOH site ranked in the HMP as having a low tolerance for change in relation to new development and demolition/remediation. However, the draft EIS concluded that given the project is impacting a small proportion of the overall canal, and that the section being impacted is of relatively poor quality, the overall impact on the historic heritage values was not considered to be significant. This still applies in relation to the updated assessment prepared for the purpose of this Final EIS (Appendix D). Further to consultation with the Commonwealth DoEE, archaeological
investigation in the form of test excavation is proposed and would be undertaken in accordance with the research design and excavation methodology prepared for this site (refer to Appendix D).

3. Historical Archaeological Sites

As outlined in the response to community submissions in section 2.11.1 and above, further historical research has been undertaken for the purpose of this assessment which has informed updated assessments of significance for each item. The historical archaeological assessment conforms to the guidelines ‘Assessing Historical Archaeological Sites and Relics, 2009’ and ‘Archaeological Assessment 1996’.

Additionally, the non-Aboriginal heritage technical memorandum in Appendix D includes a copy of and incorporates the findings of a research design and excavation methodology for a number of impacted sites, including Item 9: Miss Lawson’s Guesthouse site and Item 10: Lawson’s Inn site.

Updated assessments for Item 9 and 10 have been prepared by appropriately qualified archaeologists in accordance with the following Heritage Council Guidelines, ‘Assessing Historical Archaeological Sites and Relics, 2009’ and ‘Archaeological Assessment 1996’.

3.12 NSW Department of Industry (Land and Forestry)

3.12.1 General support

**Issue description**
The NSW Roads and Maritime Services (RMS) has submitted a State Significant Infrastructure application for The Northern Road Upgrade Project.

Therefore, Department of Industry - Lands & Forestry has no comments at this stage of the proposed Project.

**Response**
Roads and Maritime acknowledges the support of for the project by the NSW Department of Industry (Land and Forestry).

3.13 Campbelltown City Council

3.13.1 General support

**Issue description**
I refer to the Environmental Impact Statement accompanying the subject project and the public exhibition of the same and general invitation to comment thereon.

The proposed road upgrade is supported by Council as an important element in servicing existing local communities and local development, the proposed Western Sydney Airport, the South West Priority Growth Area and importantly broader district level travel and transport aspirations.

Council encourages the expeditious construction of the proposed road upgrade in a timely and environmental sensitive manner, as part of a more comprehensive transport network.

**Response**
Roads and Maritime acknowledges the support of for the project by Campelltown City Council.
3.14 NSW Office of Environment and Heritage (Biodiversity)

3.14.1 Biodiversity

### Issue description

Vegetation Zone 8 has been described in the BAR and entered into the Credit Calculator as Plant Community Type (PCT) 806 (HN627) "Derived grasslands on shale hills of the Cumberland Plain (50-300m asl)". This derived PCT has no benchmarks or estimated percent cleared in the Catchment Management Area (CMA) available in the NSW Vegetation Information System (VIS) Classification Database or the Credit Calculator. Derived PCTs can only be used where the assessor has been unable to determine the original PCT (FBA, s.5.2.1.11). According to Sections 3.1.2 and 3.2 of the BAR, the assessor has identified the original vegetation as PCT 850 (HN529) 'Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion'. Information is therefore required supporting the view that PCT 850 is the likely original PCT. Following this, OEH can advise on the next steps with respect to PCT selection and benchmarks for the assessment of Vegetation Zone 8 plot data.

### Response

Vegetation Zone 8 was originally described in the BAR and entered into the credit calculator as Plant Community Type (PCT) 806 (HN627) 'Derived grasslands on shale hills of the Cumberland Plain (50-300m asl)'. This vegetation is derived native grassland that has resulted from the removal of the original tree canopy and shrub layer. In some parts the shrub layer is regenerating although no tree canopy remains. This native grassland vegetation is considered most likely derived from a former cover of PCT 850 (HN529) 'Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion' given the landscape position, location adjacent to PCT 850, and species composition of the ground layer.

In accordance with the FBA, an assessor must only identify PCTs on the development site that are described in the vegetation information system (VIS) Classification Database as derived or secondary vegetation communities where the assessor cannot determine the original PCT (FBA, s.5.2.1.11). As such Vegetation Zone 8 has been reassigned to PCT 850, as reflected in the revised assessment included in Appendix C.

### Issue description

Benchmarks for HN528 and HN529 should be 1 and 50 m for 'Number of Trees with Hollows' and 'Fallen Logs' respectively. These benchmarks should be updated manually in the Credit Calculator with a note made in a revised BAR. It should be noted these updates are based on OEH advice and do not constitute the use of 'More Appropriate Local Data'.

### Response

For HN528 and HN529, the benchmark data for the site attributes 'Number of Trees with Hollows' and 'Fallen Logs' do not have any values assigned to them in the credit calculator. The OEH have advised that these value should be 1 and 50 m for 'Number of Trees with Hollows' and 'Fallen Logs' respectively.

These benchmarks have been manually updated in the credit calculator and the data has been used in the revised assessment included in Appendix C.

### Issue description

There are at least nineteen inconsistencies with plot/transect data entered in the Credit Calculator when compared to the values provided in Appendix A of the BAR (in particular values for ‘Native Plant Species’). It is recommended a copy of all raw field data sheets be provided to OEH for review and to determine whether the values in Appendix A (or the Credit Calculator) are correct.
**Response**

There were some inconsistencies identified with the plot/transect data entered in the credit calculator when compared to the values provided in Appendix A of the BAR. All data entered into the credit calculator has been checked and amended as necessary.

All data entered into the credit calculator has been checked for consistency with the field sheets. A copy of all raw field data sheets is provided in Appendix C.

**Issue description**

Plot 31 for ‘Grey Box- Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion - Moderate/Good’ has not been entered in to the Credit Calculator. Although the respective vegetation zone already exceeds the minimum number of plot/transects required, Table 3.1, Section 3.2 and Appendix A of the BAR indicate that Plot 31 was utilised. It is recommended the Credit Calculator be corrected to include Plot 31 or reference to it be removed from the revised BAR.

**Response**

Plot 31 was an original Rapid Biodiversity Assessment (RBA) plot carried out on the roadside along Willowdene Avenue. This plot was not used in the revised assessment as presented in this Memorandum as it was located outside of the revised construction footprint and landscape assessment area.

**Issue description**

The legend of Figure 3.1 (Vegetation survey locations) refers to HN528 as being in 'low' condition, however, Table 3.2 and the credit calculator, HN528 is in 'Moderate/Good' or 'Moderate/Good_Poor' condition. There also seems to be some duplication of PCT names in the legend of Figure 3.1. It is recommended these errors be addressed in the revised BAR.

**Response**

The legend of Figure 3.1 has been amended to show the correct classification of HN528 as Moderate/Good_Poor and the duplication with labelling has been removed (refer to Appendix C).

**Issue description**

Table 6.1 (Summary of biodiversity values assessed under the FBA) is missing the area of impact (4.68 ha) for vegetation zone 4 (PCT 849), meaning the total of 6.67 ha shown for 'Grey Box- Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion' should be 11.35 ha. It is recommended this error be addressed in the revised BAR (it is understood vegetation zone 4 is later excluded (Section 8 of the BAR) from further assessment due to having a site value score of <17).

**Response**

The impacts to Vegetation Zone 4 have been included in Table 3.3 in Appendix C to provide an overview of all impacts to native vegetation. Due to the manual override of the 'Number of Trees with Hollows' and 'Fallen Logs' for HN528, Vegetation Zone 4 now has a site score of 29.17 and requires an offset to be calculated.

**Issue description**

Species credit species *Pultenaea pedunculata* (Matted Bush-pea) was predicted by Credit Calculator for survey but has not been included in the BAR. It is recommended this species be addressed in the revised BAR.

**Response**

Species credit species *Pultenaea pedunculata* (Matted Bush-pea) was predicted by the credit calculator for survey but has not been included in the BAR.
*Pultenaea pedunculata* has recently been found in Mulgoa Nature Reserve and there is a record of *Pultenaea pedunculata* from October 2015 about 10-11km south of the study area made from Wivenhoe Conservation area at Cobbity. Prior to this record, the nearest record of *Pultenaea pedunculata* was from Prestons from 1998, around 16 km to the south east of the project.

The habitat assessment table for the BAR was created in September 2015 before the bulk of the ecological surveys were carried out from 2/9/2015 to 10/9/2015. The survey was based off the survey matrix generated by the credit calculator in September 2015. *Pultenaea pedunculata* was not identified as a species for targeted survey in the original survey matrix so this species was not targeted in the detailed field surveys for the BAR. The credit calculator is linked to a threatened species database that is constantly being updated. It is likely that the distribution data for *Pultenaea pedunculata* was edited causing it to appear in the credit calculator after the September 2015 surveys had been completed.

Despite its omission from the credit calculator at the time, the targeted surveys for other threatened plants (including *Pultenaea parviflora*) for the BAR were carried out from September 2015 to February 2016 within the flowering period and optimal survey period for *Pultenaea pedunculata*. *Pultenaea pedunculata* was not found within the study area during the surveys but there is a high likelihood that *Pultenaea pedunculata* would have been encountered during the surveys if the species was present in the habitat at that time.

A summary of the assessment for *Pultenaea pedunculata* is provided in Appendix C.

### Issue description

It is unclear why the habitat assessment table for threatened fauna species does not include the number of Atlas records in the ‘Number or records’ column. It is recommended this information be included in the revised BAR.

### Response

The habitat assessment table for threatened fauna species in the BAR did not include the number of Atlas records in the ‘Number or records’ column. This information is now included in Appendix C.

### Issue description

The BAR and Biodiversity Offset Strategy (BOS) refer to the Grey-headed Flying-fox as an ecosystem credit species. It is, however, both an ecosystem and species credit species. OEH understands while no impact to camps (species credits) have been identified and that therefore no species credits are required for the Grey-headed Flying-fox, it is recommended the revised BAR and BOS make this clear.

### Response

The BAR and BOS refer to the Grey-headed Flying-fox as an ecosystem credit species. It is, however, both an ecosystem and species credit species. The Grey-headed Flying-fox is a dual credit species because foraging habitat is broad ranging but breeding camps are localised and, if impacted, must be offset by protecting and enhancing another breeding camp.

As no breeding camps would be impacted by the project and only foraging habitat was present, the Grey-headed Flying-fox was only identified as an ecosystem credit species. No species credits are required for the Grey-headed Flying-fox.

### Issue description

The GIS shapefile (CD_TNREISVegetationZonesJacobs_20170110_V03) for native vegetation cover does not include all the areas mapped as native vegetation. OEH accepts the exclusion of derived native grassland where the original PCT had a woody over-storey, however, it is unclear why other areas of native vegetation identified as being in moderate good condition have been excluded. It is recommended justification for the exclusion of these areas in accordance with the FBA be provided, or the native vegetation cover shapefile be amended and appropriate recalculations be made to address the missing areas in the revised BAR.
Response

The revised percent extent of native vegetation cover in the landscape and area to perimeter ratio calculations were carried out using ESRI ArcGIS software. To complete the assessment of landscape values, a 550 m buffer was established from the outside edge of the construction footprint. While this is a linear road project there are some detached construction compounds which made using a buffer from the centreline impossible.

Once the native vegetation cover had been digitised, the extent of native vegetation in the landscape before and after the project was recalculated (refer to Table 4.3 in Appendix B). Current percent native vegetation cover is estimated at 12.26 per cent (score 2.5 as outlined in Table 16 of Appendix 5 of the FBA). After the project percent native vegetation cover is estimated at 11.13 per cent (score 2.5 as outlined in Table 16 of Appendix 5 of the FBA). The score for percent native vegetation cover is 0.

Issue description

The BAR does not adequately detail the measures taken to avoid impacts to Cumberland Plain Woodland and River-flat Eucalypt Forest as well as areas of habitat for the Marsdenia viridiflora subsp. viridiflora endangered population, Pultenaea parviflora, Regent Honeyeater and Cumberland Plain Land Snail in accordance with the FBA [sections 8.3.1.3(a) or 8.3.1.3(c)]. It is recommended these matters be addressed in the revised BAR.

Response

The BAR details the measures taken to avoid impacts to Cumberland Plain Woodland and River-flat Eucalypt Forest as well as areas of habitat for the Marsdenia viridiflora subsp. viridiflora endangered population, Pultenaea parviflora, Regent Honeyeater and Cumberland Plain Land Snail.

Section 8.3.1.3 of the FBA states that the proponent must seek to avoid the direct impacts of the Major Projects on all biodiversity values at the development site including impacts on:

- Endangered ecological communities (EECs) and critically endangered ecological communities (CEECs)
- PCTs that contain threatened species habitat
- Areas that contain habitat for vulnerable, endangered or critically endangered threatened species or populations, as determined in accordance with Step 5 in section 6.5.

Section 7.1 of the BAR outlines the measures that were taken to avoid impacts to EECs, CEECs, PCTs that contain threatened species habitat, and areas that contain habitat for vulnerable, endangered or critically endangered threatened species or populations. Chapter 4 of the draft EIS describes the alternatives to the project that were considered as part of the project development process and explains how and why the project was selected as the preferred option. Chapter 4 of the draft EIS also outlines how particular elements of the project have been refined.

All of the Pultenaea parviflora and Marsdenia viridiflora subsp. viridiflora records within the study area were made from habitat directly adjacent to the existing Northern Road and Kings Hill Road within Segment 1 that would be subject to road widening. There were no options for avoiding impacts to these species, as the existing road would be widened in this area instead of realigning the road. Avoiding impacts to these species would require realignment of the existing Northern Road which would have greater impact than the widening.

For Segment 2 of the project, a RBA was carried out in the area of the four short listed options under consideration. The aim of the RBA was to make an initial preliminary assessment of significant ecological values potentially affected by the Segment 2 short listed options to inform draft EIS. The RBA involved desktop analysis and field surveys and included plot-based vegetation condition assessment, fauna habitat assessment and targeted searches for threatened species. An analysis of the biodiversity data was carried out with reference to the short listed route options proposed (i.e. east versus west options). The analysis was carried out within a GIS by overlaying...
the short listed options onto the vegetation mapping layer that showed threatened ecological communities (TECs) and known or potential habitat for threatened species. Potential worst-case impacts were quantified based on a 100 m wide corridor and considered impacts to TECs, further fragmentation of woodland, and the direct loss of vegetation / habitat. Impacts to TECs (i.e. Cumberland Plain Woodland and River-flat Eucalypt Forest) were estimated to be greater for the eastern option. The total loss of vegetation and habitat (including habitat for Regent Honeyeater, Cumberland Plain Land Snail) would also be greatest with the eastern option. The western option was chosen for the project as there were predicted to be lesser impact to TECs and habitats.

The impact calculations as part of the BAR were based on a worst case scenario involving clearing of all vegetation and habitat within the construction boundary based on the draft EIS design. The revised footprint has been assessed and would result in the following reduction of impact to:

- Native vegetation has decreased by 3.50 ha compared to the draft EIS design
- Four *Marsdenia viridiflora* subsp. *viridiflora* plants along the DEOH fence has been avoided as this area won’t be used for construction or operation
- *Pultenaea parviflora* has increased to six plants after the additional targeted survey for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* was carried out in an expanded study area around the Vineyard Road extension on the 7th August 2017. Six *Pultenaea parviflora* plants were found in the area of the Vineyard Road extension of which four would be avoided as they are outside of the construction footprint
- Habitat for the EPBC Act listed species' Grey-headed Flying-fox, Regent Honeyeater, Swift Parrot and Large-eared Pied Bat has been reduced by 2.15 ha
- The TSC Act listed critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community has reduced by 2.96 ha
- The TSC Act listed River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions endangered ecological community has been reduced by 0.43 ha
- The EPBC Act listed critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community has been reduced by 1.29 ha.

Further opportunities to reduce impacts to biodiversity would be investigated and considered during detailed design of the project. Additionally, mitigation measures would be implemented to further mitigate any potential biodiversity impacts to biodiversity during construction of the project (refer to Chapter 6).

**Issue description**

Impacts to two entities are identified in the BAR as requiring further consideration: Cumberland Plain Woodland and Regent Honeyeater. The additional information required by the FBA (s9.2.4 and s9.2.5) has been provided and considered by OEH. In accordance with s9.2.1.1(c) of the FBA, OEH considers the loss of approximately 29.15 ha moderate/good condition Cumberland Plain Woodland (including 1.25 ha in high condition), and associated indirect impacts resulting from fragmentation, to be unacceptable without the implementation of additional offsets (above those already calculated), supplementary measures or other actions. It is recommended the BOS be updated, in consultation with OEH, to address this matter. OEH is satisfied with the number of Regent Honeyeater credits calculated and to be provided to offset impacts to this species' habitat; no additional offsets, supplementary measures or other actions are required for this species.

**Response**

Roads and Maritime are currently working in consultation with OEH to address this matter and determine the quantum of offsets or supplementary measures that are required. Supplementary measures at a landscape scale are being investigated in conjunction with the OEH.
Following discussions with Roads and Maritime, the Commonwealth DoEE and OEH, it was decided that an additional supplementary measures package would be developed in consultation with OEH and the Commonwealth DoEE with a focus on landscape scale measures within the local area. The package may include measures such as weed eradication programs within Cumberland Plain Woodland.

### Issue description
Sections 3.7 and 3.9 of the BOS identifies that no credits are available to meet the respective 2,021 and 1,400 credit offset requirements for the Regent Honeyeater and Marsdenia viridiflora subsp. viridiflora - endangered population, but that land may be available (for future creation of credits) via an expression of interest on the BioBanking Public Register.

OEH recommends further information be provided detailing the measures that will be taken to secure the required credits for these species. It should be noted that variation rules are not available for Critically Endangered species.

### Response
The BOS identifies that no credits are available to meet the offset requirements for the Regent Honeyeater and *Marsdenia viridiflora* subsp. *viridiflora* - endangered population, but that land may be available (for future creation of credits) via an expression of interest on the BioBanking Public Register.

If credits for Regent Honeyeater and *Marsdenia viridiflora* subsp. *viridiflora* (or any other required credit) are unavailable for purchase on the market, the first step is that Roads and Maritime would work with public and private landholders to enter a BioBanking Agreement on their land and then purchase the credits issued.

### Issue description
OEH is aware that the Department of Defence will need to clear vegetation to provide vehicle access along the inside of the new fenceline in some parts of the project. OEH considers any clearing of vegetation required a consequence of the project which should be addressed in the assessment of impacts. It is unclear if this has occurred. If not, an adjustment to the calculations of offset credits will be necessary prior to the approval of the BOS.

### Response
The potential loss of vegetation and habitat associated with the project is summarised in Table 3.3 in Appendix C. The construction footprint would impact on up to about 40.79 ha of native vegetation (refer to Table 3.3 in Appendix C). This is a decrease of 3.50 ha in comparison to the draft EIS design (the original impact to all Vegetation Zones was 44.29 ha). These impacts have been quantified based on the refined design footprint and take into consideration potential temporary disturbance during construction including compound sites and upgrading of drainage.

This refined design and associated re-calculation also takes into account the clearing that the Department of Defence will need to clear vegetation to provide vehicle access along the inside of the new fence line in some parts of the project.

### Issue description
The BAR notes that surveys were constrained by property access. It should be noted that threatened species surveys for these areas will need to be completed (and new calculations performed, if necessary) prior to the finalisation of the BOS.

### Response
An additional targeted survey for *Pultenaea parviiflora* and *Marsdenia viridiflora* subsp. *viridiflora* was carried out in an expanded study area around the Vineyard Road extension on 7 August 2017. This area was not able to be accessed during the fieldwork carried out for the draft EIS. An area of habitat of about 4.7 ha was surveyed by an experienced botanist following the methods described...
in the *NSW Guide to Surveying Threatened Plants* (OEH, 2016). Traverses of this habitat were carried out over a three-hour period for a distance of 3.131 km (3,131 m) (refer to Figure 5-1). The survey located a further six *Pultenaea parviflora* plants (two of which were in the construction footprint, and four outside of the footprint). No additional *Marsdenia viridiflora* subsp. *viridiflora* were recorded. The additional impact to *Pultenaea parviflora* has been included in the reassessment of impacts (refer to Appendix C and section 5.1.3).

### 3.14.2 Hydrology and flooding

**Issue description**

Appendices C and D (of the Mulgoa to Glenmore Park Technical Paper) provide comparisons of peak flows which show increase in peak flows (5% to >100%) in affected areas in frequent events such as 2 and 10 year ARI and the 1% AEP event. It is indicated these increases are acceptable as the affected areas are limited to undeveloped pastoral lands. OEH highlights that increasing the peak flows would result in more frequent inundation to affected pastoral lands which would increase damages and flood liability on owners of these lands. Similarly, Chapter 7 of the Technical Papers also shows significant increases in level of the PMF (up to 2m) which results in significant flood risk to undeveloped pastoral lands. OEH recommends the impact of the project on flood damages and emergency management planning be assessed and consulted with land owners and relevant councils in the early stage of the planning.

**Response**

Roads and Maritime considers that the potential impact the project would have on flooding and drainage patterns in presently undeveloped pastoral land, would be within acceptable limits. It is also acknowledged that the majority of land adjacent to the road corridor is likely to undergo significant development as part of the proposed land-use changes identified for the region (such as the WSPGA and the Western Sydney Airport). The minor impact of the project is not considered likely to preclude development on adjacent land due to changes in flood and drainage patterns.

**Issue description**

Significant increases in level of the PMF would also affect four existing dwellings resulting in over floor flooding (D1 to D4 as shown in Figure 7.27). Two of these dwellings, being D3 and D4, are not flood affected in existing conditions. The Technical Paper recommends the level of the road be lowered where it crosses Badgerys Creek to limit the impacts of the project to two of the above mentioned dwellings (D1 and D2 as shown in Figure 7.30) and limit the increase in over floor flooding to 0.2 m. OEH recommends this be investigated in more detail and considering:

- Whether the road is being and will be used as a flood evacuation route.
- Whether the road will be trafficable in flood events up to 500 year ARI.

**Response**

Roads and Maritime has committed to lowering the vertical alignment of the road to mitigate the impact the project would otherwise have on flooding behaviour in the vicinity of the existing dwellings noted by the respondent.

The Northern Road between Mersey Road and Elizabeth Drive is not proposed as a flood evacuation route and hence does not require a minimum hydrologic standard of 500 year ARI.

**Issue description**

Table 7.1 provides summary of residual impacts of the project after the implementation of proposed mitigation measures on catchment hydrology and hydraulic. The Technical Papers adopt an approach of relying on potential increase in vegetation growth due to the increase in the runoff volume to mitigate the scour risk. OEH does not support this approach and recommends that, where there is a risk of scour, identified measures, such as planned vegetation management, be
proposed and implemented. The implementation of appropriate streambank vegetation measures is essential in reducing ongoing erosion, sedimentation and impact on waterway health.

Response

Table 7.1 in the draft EIS Appendix K1 (Flooding and hydrology) outlines proposed mitigation measures where there would be a risk of scour due to increased volume and rate of water flow.

Scour protection measures such as rock mattresses would be installed at transverse drainage inlets and outlets, and rock lined spillways would be installed in permanent basins to mitigate erosion and scour risks.

Table 7.1 notes that despite installation of such mitigation measures, there may be some residual scour potential and that this risk would be further mitigated by increased vegetation expected in areas that may become wetter due to predicted flows.

Scour protection measures would be monitored for effectiveness during construction and operation and corrective measures would be implemented where required.

Planned vegetation management for the project would be undertaken in accordance with the landscape plan.

3.15 NSW Environment Protection Authority

3.15.1 Noise and vibration

Issue description

The EPA has concerns regarding the measured “rating background level” (RBL) for Saturday afternoon. This period between 1pm and 6pm Saturdays is described in the EIS as “Out of Hours Works – Day”. The RBL in this period is up to 7 dB(A) above what is measured during standard construction hours.

The EPA’s concerns are:

- That the RBL was assessed using only one day of data. Part 3 of the NSW Industrial Noise Policy states that the equivalent to one week’s worth of valid data covering the days and times of operation of the development should be used in determining RBL. This is designed to ensure multiple measurements are taken for each period and the median of data is used to set the RBL. Using only one Saturday afternoon of monitoring data does not give enough data to obtain a representative RBL for each catchment.

- There is no assessment undertaken as to why the RBL on Saturday afternoon is higher than the standard construction hours RBL. Traffic data for the Saturday afternoon period is not broken down to cover this period so the higher RBL cannot be linked to increased traffic.

The EPA recommends that the proponent either:

- Undertake further monitoring for the Saturday afternoon period, and

- Provide further justification as to why the RBL in this period is higher, or

- Use the RBL from standard construction hours in the Saturday afternoon period.

Response

Roads and Maritime acknowledges that the information presented in Table 10-3 of the noise and vibration technical working paper (and corresponding Table 7-19 of the draft EIS) is incorrect in relation to the rating background level (RBL) and associated NML values for the OOHW Day period (ie between 1pm and 6pm Saturdays). As per the recommendation from the EPA, it is proposed to apply the RBL from standard construction hours to the Saturday afternoon period instead during further assessment as part of the development of the CNVMP.
It is noted that this error does not largely affect the outcome of the impact assessment which was based on works during standard day time hours (which would account for revised OOHW Day impacts) and OOHW works which is assessed against the OOHW Night NMLs. Accordingly, this error would not change the outcome of the noise impact assessment, including assessment of potential for sleep disturbance.

### Issue description

**Recommended Condition of Consent**

**Hours of operation:**

**Standard construction hours**

- Unless permitted by an environment protection licence, construction works and activities must:
  
  a) only be undertaken between the hours of 7:00 am and 6:00 pm Monday to Friday
  
  b) only be undertaken between the hours of 8:00 am and 1:00 pm Saturday
  
  c) not be undertaken on Sundays or Public Holidays.

- All works and activities must be undertaken in a manner that will minimise noise and vibration impacts on sensitive receivers.

- The licensee must ensure that all feasible and reasonable noise and vibration mitigation and management measures are implemented during construction work authorised by this licence, in accordance with the Interim Construction Noise Guideline (DECC, 2009).

**High noise impact works**

High noise impact works and activities, except as expressly permitted by an EPL, must only be undertaken:

- a) between the hours of 8:00am to 6:00pm Monday to Friday;
- b) between the hours of 8:00am to 1:00pm Saturday; and
- c) in continuous blocks not exceeding 3 hours each with a minimum respite from those activities and works of not less than 1 hour between each block.

For the purposes of this condition ‘continuous’ includes any period during which there is less than a 1-hour respite between ceasing and recommencing any of the work that is the subject of this condition.

**Response**

Noted. All relevant conditions of consent would be adhered to in the staging and scheduling of works and associated mitigation measures to be documented in the CNVMP. Work required to be undertaken out of standard hours would be in accordance with the conditions of approval and any environmental protection licence for the project.

### Issue description

Community concerns may arise from noise impacts associated with the early arrival and idling of construction vehicles at the development site and in the area surrounding the site.

The proponent be required to ensure construction vehicles do not arrive at the project site or in surrounding areas outside approved construction hours.

**Response**

Noted. This condition of consent would be adhered to in the staging and scheduling of works and associated mitigation measures to be documented in the CNVMP. This recommended measure is in line with the existing management measures identified in the draft EIS.
3.15.2 Air quality

**Issue description**
The proponent must ensure that during the construction phase of the project all works are undertaken by such means as may be necessary to minimise dust emissions on the premises and to minimise the release of dust from the premises. This includes:

- Proactive controls to help ensure that the project does not cause exceedances of relevant particle impact assessment criteria.
- Reactive management strategies to ensure that the project impacts are acceptable under adverse conditions, including adverse weather or elevated background concentrations.

The proponent must ensure that construction work is carried out by such practicable means as may be necessary to minimise dust emissions on the premises, and prevent dust emissions from the premises.

**Response**
Roads and Maritime have experience managing potential air quality impacts associated with the construction of large-scale road development projects. All feasible and reasonable measures to minimise dust would be implemented. Section 8.6.8 of the draft EIS commits to implementing a range of both proactive and reactive control measures to manage impacts associated with dust/particulate matter.

Weather conditions such as wind direction, wind speed, soil moisture and rainfall or dew would substantially influence the day to day potential for dust generation and suspension. Accordingly, project personnel involved in the activities above need to consider the factors affecting dust generation in consultation with their environmental representatives to ensure appropriate mitigation measures are adopted.

Regular monitoring and inspections would be carried out during construction to confirm the effectiveness of mitigation measures.

**Issue description**
The environmental impacts associated with off road diesel equipment can be a major source of fine particles. The EPA recommends that the proponent assess the environmental impacts associated with heavy vehicles including off road diesel equipment and plant used in the construction of the project.

- This should include but is not limited to:
  - Compliance with relevant and current emission standards as prescribed in Australian Design Rules for heavy duty engines and vehicles.
  - Strategies for minimising air emissions from off road diesel equipment including but not limited to graders, bulldozers, loaders etc.
  - Confirmation that all off road diesel equipment will meet best available diesel emissions standards or be fitted with an appropriate diesel exhaust treatment device where possible.
  - The EPA recommends the unnecessary idling of engines be further reduced. Diesel plant engines should be turned off when not in active use and truck engines should be turned off during periods of inactivity and while waiting to load or unload material for three minutes or more.

**Response**
Emissions and pollutants associated with the operation of diesel powered machinery and plant equipment are generally considered to be too small, too infrequent or too widely distributed to generate any significant off-site pollutant concentrations.
A number of specific environmental mitigation and management measures were identified in section 6.8.6 of the draft EIS to minimise air quality impacts associated with emissions from general construction activities. These include:

- Inspecting the plant/equipment prior to commencement of works on site
- Conduction routine servicing and maintenance, and subsequent inspections to ensure that equipment continues to operation efficiently.

A CEMP and sustainability strategy would be implemented for the project which would include a number of targets (including for air quality) which would address air emissions including diesel vehicles both on and off road. Additionally, the contractor will be required to produce an air quality management plan which would need to outline the measures to be taken to ensure management of plant and equipment.

As described in section 12.2.2 of the draft EIS, the CEMP is the overarching management plan for a suite of environmental management documents. It provides a structured and systematic approach to environmental management during construction to:

- Ensure compliance with all applicable environmental laws, obligations and approvals
- To minimise environmental impacts.

The CEMP, including all air quality specific measures would be prepared in consultation with the EPA. It would be provided to the EPA for comment, together with other agency referrals.

### 3.15.3 Water quality

**Issue description**

Erosion and sediment control measures should be developed and managed in accordance with Managing Urban Stormwater Soils and Construction, 4th Edition published by Landcom (the ‘Blue Book’) and Volume 2D Main Road Construction published by DECC (2008). Volume 2D advises that main road construction requires a stronger emphasis on some management principles, particularly:

- erosion control as a pollution prevention strategy
- runoff separation by diverting ‘clean’ stormwater runoff around the site or away from operational areas
- management and maintenance of long-term controls.

The following Condition of Consent are recommended:

- The Proponent shall not cause or permit any waters to be polluted, as defined under Section 120 of the POEO Act.

**Response**

For the construction phase, the erosion and sediment control measures to be implemented are outlined in Table 8-16 of the draft EIS and are in accordance with the requirements of the Blue Book (Soils and Construction, 2008 Volume 2D Main Road). The measures contained in the Blue Book are based on field experience and have been previously demonstrated to be effective in mitigation during construction. Strict conformance with the requirements of the Blue Book during the construction period would be required to ensure that the predicted effectiveness is achieved.

As per the Blue Book, a construction SWMP would be prepared as part of the CEMP (see SWC-1) and would contain the construction phase erosion and sediment control measures from Table 8-16. The SWMP would include the requirement for monitoring the effectiveness of mitigation measures.
through site inspections, monitoring reports and audits. The SWMP includes the provision for continuous improvement through reviews and updates where opportunities for improvement have been identified.

The Protection of the Environment Operations Act 1997 (POEO Act) establishes the NSW environmental regulatory framework and includes a licensing requirement for certain activities. Environment protection licences (EPLs) are a central means to control the localised, cumulative and acute impacts of pollution in NSW. Any discharge would be in accordance with the EPL for the project.

### 3.16 NSW Department of Primary Industries

#### 3.16.1 Soil and water

**Issue description**


**Response**

The Water Management Act 2000 defines waterfront land as the bed of any river, lake or estuary and any land within 40 m of the river banks, lake shore or estuary mean high water mark.

As stated in section 8.2.3 of the draft EIS, all works on waterfront land would be carried out in accordance with the DPI Water Guidelines for Controlled Activities on Waterfront Land (2012), including but not limited to those related to instream works and waterway crossings.

**Issue description**


**Response**

Noted. As outlined throughout the draft EIS in particular Sections 7.3 (for biodiversity) and 8.2 (for water quality), waterway crossings throughout the project have been designed in accordance with Policy and Guidelines for Fish Habitat Conservation and Management (update 2013) (Department of Primary Industries 2013), Fish Passage Requirements for Waterway Crossings (Fairfull & Witheridge 2003), and Policy and Guidelines for fish Friendly Waterway Crossings (DPI 2004).

These guidelines provide an effective mitigation, built into design, to minimise impacts to fish and other aquatic wildlife from road projects which may improve the survival rate and protect threatened fish species.

**Issue description**

The Soil and Water Management Plan should be developed in consultation with DPI Fisheries and DPI Water.

**Response**

The SWMP developed for construction of the project would be developed in consultation with DPI Fisheries and DPI Water.
**Issue description**

The EIS notes 50 temporary sediment basins are proposed to be located along the alignment (see Section 8.2.6, page 484). Figure 8.7 shows the location of the sediment basins but it does not overlay the watercourses/ stream order so it is difficult to determine if any of the basins are proposed to be located within the watercourses or riparian corridors. The proponent should clarify if any basins are proposed to be located online or within the riparian corridors. Where possible it is recommended the basins are located outside the corridors, especially where there is remnant native vegetation.

**Response**

The potential impact on receiving waterways during construction would be effectively mitigated through erosion and sediment controls including appropriately sized temporary sediment basins in accordance with the requirements of the Blue Book.

The proposed locations and sizes of the 50 construction phase sediment basins for the construction phase of the road upgrade are presented in Table 8-15 of the draft EIS and shown in Figure 8-7 of the draft EIS. Additionally, detailed information regarding every watercourse crossed by the proposed alignment is provided in Table 7-50 of the draft EIS.

The design of the sediment basins would be confirmed in conjunction with construction contractors and outlined in the SWMP for the project.

Temporary sediment basins would be located to avoid riparian areas and areas of remnant vegetation. Section 3.16.2 below provides further response regarding the mapping of riparian corridors for the project.

**Issue description**

The EIS indicates the project would require up to 50 to 60 ML of water (non-potable and potable) and would be sourced from existing water sources along the proposed new alignment (section 5.4.18, page 157). Clarification is required if the water supply from existing water sources only refers to the existing farm dams or if it is proposed to extract water from the local creeks.

**Response**

Section 5.4.18 of the draft EIS states that water would be available along the project alignment from existing filling points (potable water requiring metered standpipes) and potentially from the existing water sources along the proposed new alignment. Where existing water sources are not available, water would be transported to site as required.

Existing water sources refers to existing farm dams located along or adjacent to the project. Water would only be sourced from farm dams in consultation with landowners. It is not expected that water would be sourced from local creeks.

**Issue description**

The EIS notes sections of the un-named tributary of Surveyors Creek need to be realigned where it runs along the eastern side of the Northern Road near Bradley Street (Section 5.2.8, page 109). It indicates the work would involve constructing a new channel alignment including establishing natural bed and bank profiles (section 5.4.8, page 134). The realigned creek should mimic a natural creek system from the local area. A vegetated riparian corridor should be provided along either side of the realigned creek. The riparian corridor width should be consistent with the DPI Water guidelines.

**Response**

Section 5.4.8 of the draft EIS states that the tributary of Surveyors Creek on the eastern side of The Northern Road would need to be permanently realigned to accommodate the widened road formation. The tributary is located within the DEOH site on Commonwealth land. As such realignment of the creek would be carried out in consultation with the department of Defence. It is anticipated that the work would typically involve:
• Removing vegetation (mostly shrubs and grasses) and topsoil
• Constructing the new channel alignment, including establishing natural bed and bank profiles
• Installing scour protection measures
• Establishing vegetation early in the process
• Diverting the creek to the new channel.

The Department’s requirements for the realignment of the un-named tributary of Surveyors Creek are noted. Where possible, realignment would be carried out in accordance with the DPI Water guidelines.

The existing environmental management measure SWC-3 has been updated to include the following in relation to rehabilitation of the realigned tributary of Surveyors Creek:

• The permanent stabilisation measures would consist of soft engineering solutions where reasonable and feasible and the realigned creek would mimic a natural creek system of the local area
• The riparian corridor along either side of the realigned creek would be rehabilitated in accordance with the Vegetation Management Plan to be developed for the project in accordance with the DPI Water guidelines.

3.16.2 Biodiversity

**Issue description**

A Vegetation Management Plan should be developed in consultation with DPI Water.

**Response**

A new mitigation measure would be added to the revised environmental management measures for the project as follows (refer to management measure B-19 in Chapter 6):

A Vegetation Management Plan would be prepared in consultation with DPI Water prior to construction commencing, including details on:

• The riparian corridor widths along the watercourses in proximity to the project (so that these areas can be avoided where possible)
• Riparian areas potentially temporarily or permanently impacted by the project
• The rehabilitation of riparian areas temporarily impacted
• Riparian offsets as required in accordance with DPI guidelines for the riparian areas permanently impacted.

The Vegetation Management Plan will include a scaled map which identifies:

• The riparian corridor widths in proximity to the project so that these areas can be avoided where possible
• Riparian areas potentially temporarily or permanently impacted by the project
• Rehabilitation and/or riparian offset areas as required. Where the project encroaches on the outer riparian corridor (outer 50% of the vegetated riparian zone) the activity will be offset by connecting an equivalent area to the riparian corridor to ensure the average width of the vegetated riparian zone can be achieved over the length of the watercourse.
**Issue description**
Should any native fish need to be relocated as part of dam or stream dewatering activities, then a qualified ecologist with a relevant permit issued under section 37 of the *Fisheries Management Act 1994* must be onsite to relocate any locally occurring native fish species according to the permit conditions. There is to be no relocation of any non-native fish species.

**Response**
Refer to response in section 2.7.4.

**Issue description**
Mitigation measures B-10 to B-13 and SWC1 to SWC8 should be included as conditions of approval.

**Response**
Noted.

**Issue description**
The EIS includes an Environmental Management Measure to “avoid activities in aquatic habitats and riparian zones as much as possible” (Table 12.4, B-10, page 751). The proponent should map the riparian corridor widths along the watercourses and identify the setbacks on the ground to implement this measure. Figures 2.1 and 2.2 in Appendix I show the stream order of the watercourses in proximity to the project. The DPI Water Guidelines for controlled activities on waterfront land (2012) identify the stream order and the associated riparian corridor widths.

Riparian land temporarily disturbed by the project should be rehabilitated following construction with native species from the relevant local native vegetation community. Where riparian land is permanently impacted by the project, riparian offsets should be provided along the relevant watercourse in the vicinity of the works.

A scaled map should be provided which identifies:
- the riparian corridor widths in proximity to the project so that these areas can be avoided where possible
- riparian areas potentially temporarily or permanently impacted by the project
- riparian offset areas.

**Response**
Refer to section 3.16.2.

**Issue description**
The EIS notes aquatic habitat assessments were undertaken over two days in February 2016 but due to the limited water availability and limited aquatic habitat macroinvertebrate surveys were deemed unnecessary (section 7.3.1, page 232). Figure 4.3 in Appendix I indicates aquatic surveys were undertaken at 5 sites and 4 of these were farm dams. The proponent should clarify why macroinvertebrate survey monitoring is not proposed along the tributaries of Blaxland Creek on the Orchard Hills Defence Establishment lands (Commonwealth land) and Badgerys Creek and Cosgroves Creek, particularly as the EIS notes that:
- the tributaries of Blaxland Creek at Orchard Hills are among the least disturbed catchments remaining in the Cumberland Plain and are regarded as possibly the most pristine creek system on Wianamatta Shale left in Western Sydney (page 316). It also outlines these tributaries are richer in aquatic macroinvertebrate genera than most other creeks of western Sydney and that the macroinvertebrate community of this catchment has a high representation of disturbance–sensitive species (Table 6.28, page 537). The EIS also indicates the scour potential along three of these tributaries would increase and ground conditions would become
wetter as a result of an increase in the rate and volume of flow discharging these tributaries (page 552. While the EIS notes these impacts are not expected to extend to the aquatic areas mapped as moderate to high significance, macroinvertebrate monitoring (baseline, during and post construction) along these creeks would assist to verify that the project has not had an adverse impact.

- the project directly traverses Badgerys Creek and Cosgroves Creek (page 325) and Badgerys Creek maintains permanent residual pools (Table 7.4.1, p 293 and Table 7.50, page 326) and Cosgroves Creek at the time of inspection consisted of a series of disconnected pools. The EIS notes that natural creek lines such as Badgerys Creek at the southern end of the project would be altered (page 608).

Response

Site inspections for the aquatic assessment were visual only, no fish surveys or macroinvertebrate surveys were carried out. Due to the low likelihood of threatened fish species being present, limited water availability and limited aquatic habitat, fish and macroinvertebrate surveys were deemed unnecessary at the draft EIS stage.

The draft EIS included an existing management measure for the development of a proposed water quality monitoring program (SWC-2). This measure has been amended in the revised environmental management measures for the project (refer to Chapter 6) to incorporate details of the duration of proposed monitoring at each stage of the project and requirements for monitoring locations upstream and downstream of potential impacts. This includes water quality monitoring at key fish habitat locations identified in the draft EIS as follows:

- Badgerys Creek (287912.65E / 6244897.30N)
- Cosgroves Creek (287247.11E / 6249490.76N)
- ‘Site 29a’ (286060.62 E / 6246544.14N), an intermittent stream
- The large dam at ‘Site 39’ (286460.594 E, 6247352.348N), fed by several minor 1st and 2nd order streams. These streams are ephemeral with minimal channel definition, only flowing when the upstream dams overflow
- Unnamed tributary of Surveyors Creek (286887.04E/6257728.90N).

These monitoring locations have been incorporated into Figure 5-4.

Issue description

The EIS notes existing culverts would be upgraded and enlarged to cater for increased flows (page 108). It indicates a total of 11 culverts will be installed and/or replaced at the waterway crossing locations (page 477). It is recommended the design of any upgraded and/or new culverts incorporates naturalised bases and a combination of elevated "dry" cells to encourage terrestrial movement, and recessed "wet" cells to facilitate fish passage.

The EIS notes temporary watercourse crossings may also be required for watercourses traversed by the project and if required the crossings would likely comprise a temporary causeway with culverts to maintain low flows (page 135). The EIS notes all works on waterfront land would be carried out in accordance with the DPI Water Guidelines (page 477). It is recommended this is included as an Environmental Management Measure and condition of approval.

Response

As outlined in section 7.3 of the draft EIS, detailed design of culverts has been carried in accordance with Fairfull & Witheridge (2003) and DPI (2004) to ensure that barriers to fish are not created and associated long-term impacts to the existing hydrology are minimised.

Five waterway crossings in the study area, including the revised footprint, have been identified as Type 1 – Key Fish Habitats (DPI 2013), as they contain a combination of native aquatic plants and/or woody snags. These watercourses are impacted. Intermittently flowing waterways which are also identified as Class 2 – Moderate Key Fish Habitat (Fairfull and Witheridge, 2003) due to the
presence of limited in stream aquatic vegetation are also impacted. Key fish habitats are shown on Figure 5-4 for reference.

Refer to section 2.7.5 for discussion regarding the fragmentation of biodiversity links and habitat corridors.

**Issue description**

Figures 7.7 and 7.8 (page 8 of 9 and page 3 of 3) in the EIS show a regional corridor along Surveyors Creek which links the Mulgoa Nature Reserve near Glenmore Park to creeks in the Orchard Hills Defence Establishment lands. The widening of the Northern Road would increase the barrier effects of the road where it bisects the corridor (page 342). It is recommended the project incorporates Environmental Management Measures to maintain and/or improve this corridor connection.

**Response**

Refer to section 2.7.5 for discussion regarding the fragmentation of biodiversity links and habitat corridors.

**3.16.3 Socio-economic**

**Issue description**

DPI recommends the conditions of approval acknowledge:

- The actions identified in Table 7-63 (Socio-economic and land use environmental management measures) to address impacts on agribusinesses.
- The continued consultation with landholders in regard to mitigation and compensation measures for relocation of farm infrastructure and access to agribusinesses pre and during construction.

**Response**

Noted. Many of the mitigation measures outlined in section 7.4.6 of the draft EIS involve effective and ongoing communications with the community and affected land owners. Should the project be approved, it is anticipated conditions of approval for the project would require the preparation of a Community Involvement Plan (CIP), Community Communications Strategy (CCS) or similar document for the construction phase of the project. Community and stakeholder involvement would be tailored to each phase of the project enabling appropriate consideration and balancing of community and stakeholder’s social, economic, environment and functional issues to achieve best for project outcomes.

**Issue description**

There are several sections of this road for which Department of Industry – Lands & Forestry records show ownership as Shared Crown/Council Road, as follows (listed north to south, Luddenham to Bringelly):

- Plan No: 21594-3000R (approx. 2.5 ha) for the Northern Rd between Park Rd and Purves Rd, which is south of Elizabeth Drive, Luddenham
- Plan No: 21594-3000R (approx. 1ha) for the Northern Rd at the intersection with Park Rd
- Plan No 14004 -3000R (approx. 1.5ha) for the section of the Northern Rd south of Eaton Rd Luddenham.
- Plan No 14005-3000R (approx. 4.5 ha)
- A section of the Northern Rd (approx. 3.5ha)
- DP250961 (approx. 3 ha)
• DP 250961 (approx. 3.5ha) for the Northern Road between the section west of Dwyer Rd and Vicar Park Lane, Bringelly

Lands records show that sections of the Northern Rd outside the strip between Luddenham to Bringelly are managed by the Local Government Authority. Roads in shared Crown/Council ownership should preferably be transferred as necessary to one managing authority, such as Local Government

Response

At completion of the project, a completion survey will be undertaken by Roads and Maritime and a dedicated gazettal plan will be developed along with public road classification.

3.16.4 General support

Issue description

DPI supports the eastern option for the road corridor around Luddenham Village as it has relatively smaller impact on large lot agricultural premises.

Response

Roads and Maritime acknowledges the support for the project by NSW Department of Primary Industries.

3.16.5 Assessment of route options

Issue description

The EIS notes the assessment of route options considered minimising potential impacts on areas of biological diversity and ecological integrity (Table 4.9, page 72). Clarification is required if the assessment considered minimising impacts on watercourses and riparian land that the project crosses.

Response

The options assessment prepared by WSP for the proposal in July 2015 considered the presence of and impacts to waterways in the study area as a result of the proposal. The western most options (Options 5, 6 and 7) were considered to have the greatest impact on waterways in the area. Option 9, which was further to the east than Options 5, 6, and 7, was chosen as the preferred option. Section 4.3.3 of the draft EIS outlines the evaluation process of the long-listed route options.

3.16.6 Mitigation measures

Issue description

DPI recommends the project includes the following Environmental Management Measures:

• All works on waterfront land should be carried out in accordance with DPI Water Guidelines for controlled activities on waterfront land
• A Vegetation Management Plan should be prepared in consultation with DPI Water prior to construction commencing, including details on:
  o the riparian corridor widths along the watercourses in proximity to the project (so that these areas can be avoided where possible)
  o riparian areas potentially temporarily or permanently impacted by the project
  o the rehabilitation of riparian areas temporarily impacted
  o riparian offsets for the riparian areas permanently impacted.
• Macroinvertebrate monitoring is to be undertaken in the following areas:
the tributaries of Blaxland Creek at Orchard Hills to verify that the mitigation measures are mitigating potential impacts on the sensitive macroinvertebrate community of this catchment

upstream and downstream of Badgerys Creek and Cosgroves Creek where the project traverses these creeks.

- The proposed water quality monitoring program (SWC-2) should incorporate details on the duration of the baseline monitoring and the construction and operational water quality monitoring. It is recommended the program includes monitoring locations upstream and downstream of potential impacts. The EIS notes the monitoring program will also monitor the effectiveness of the swales (see Section 5.2.12, page 114). SWC-2 indicates the monitoring program would include the requirement to monitor the effectiveness of control measures but it is suggested it includes specific reference to monitoring the effectiveness of the swales.

- Environmental Management Measure SWC-3 to stabilise the realigned tributary of Surveyors Creek should be amended to add that:

  - the permanent stabilisation measures should consist of soft engineering solutions where reasonable and feasible and the realigned creek should mimic a natural creek system of the local area.
  
  - the riparian corridor along either side of the realigned creek should be rehabilitated with local native species and the width of the corridor is consistent with the DPI Water guidelines.

- Environmental Management Measure SWC-4 to construct 50 temporary sediment basins should be amended to add that:

  - the basins are to be located outside of the riparian corridors where possible. If it is necessary to locate the basins in the riparian corridor the basins should avoid disturbing remnant native vegetation.

- Topsoil (and seedbank) should be removed from native vegetation areas that are to be permanently cleared and relocated and used in the revegetation of riparian areas,

- Native plants should be transplanted from the areas to be permanently cleared to riparian land that is to be revegetated.

Response

Section 8.2 of the draft EIS (Soils, water and contamination) states that all works on waterfront land would be carried out in accordance with the DPI Water Guidelines for Controlled Activities on Waterfront Land (2012), including but not limited to those related to instream works and waterway crossings. This has been incorporated into the revised environmental management measures for the project (refer to measure B-20 in Chapter 6).

A Vegetation Management Plan would be prepared in consultation with DPI Water prior to construction commencing. Refer to previous response in section 3.16.2. This new measure has been incorporated into the revised environmental management measures for the project (refer to measure B-19 in Chapter 6).

As outlined in the previous response in section 3.16.2, the draft EIS includes an existing management measure for the development of a proposed water quality monitoring program (SWC-2). This measure has been amended in the revised environmental management measures for the project (refer to Chapter 6) to incorporate details of the duration of proposed monitoring at each stage of the project and requirements for monitoring locations upstream and downstream of potential impacts. Monitoring the effectiveness of control measures has also been updated to include monitoring of swales during operation of the project. The water quality monitoring locations have been incorporated into Figure 5-4, as per the key fish habitat locations identified in the draft EIS.
The existing environmental management measure SWC-3 has been updated to include the following in relation to rehabilitation of the realigned tributary of Surveyors Creek:

- The permanent stabilisation measures would consist of soft engineering solutions where reasonable and feasible and the realigned creek would mimic a natural creek system of the local area.
- The riparian corridor along either side of the realigned creek would be rehabilitated in accordance with the Vegetation Management Plan to be developed for the project in accordance with the DPI Water guidelines.

The draft EIS includes an existing management measure for the provision of temporary sediment basins during construction (SWC-4). This measure has been amended in the revised environmental management measures for the project (refer to Chapter 6) to include that the basins would be located outside of riparian corridors where possible, or where it is necessary to locate the basins in the riparian corridor they would be constructed to avoid disturbing remnant native vegetation. This is linked to the revised biodiversity environmental management measures in relation to the identification and management of riparian corridors.

Additional biodiversity related measures have also been incorporated into the revised environmental management measures for the project as follows (refer to Chapter 6):

- Roads and Maritime would consider reuse of topsoil as part of the Urban Design Landscape Plan (UDLP) for the project (refer to management measure B-21).
- Roads and Maritime would consider transplanting native species from areas to be cleared into revegetation areas, depending on the type of species being removed and the likely success of transplanting. Plants to be used in revegetation would be sourced from local provenance seed where appropriate and available, and associated seed collection would be undertaken prior to clearing (refer to management measure B-22).
- Rehabilitation of the disturbed areas of the site would be undertaken in accordance with Roads and Maritime Batter Stabilisation Guidelines and Roads and Maritime contractor specifications (refer to management measure B-23).

### 3.17 Sydney Water

#### 3.17.1 Utilities

**Issue description**

Sydney Water must be consulted with regarding the following:

- Sydney Water confirms that they are major trunk and reticulation assets within the proposed The Northern Road area.
- These assets are used to supply services as per the Sydney Water Operating Licence & regulatory requirements.
- The DN900 and DN750 Raw Water mains is a critical piece of infrastructure transporting water to the Orchard Hills Filtration Plant and supply more than 250,000 of our existing customers.

**Response**

Noted. The draft EIS has identified a range of Sydney Water assets within the project area (refer to section 5.4.10 of the draft EIS). In accordance with the future consultation requirements outlined in section 6.4 of the draft EIS, Sydney Water would be consulted regarding any impacts to any major trunk or reticulation assets within the project, particularly the DN900 and DN750 Raw Water mains which are understood to supply more than 250,000 customers.
**Issue description**

For any adjustments of Sydney Water assets:

- Existing Water and Wastewater mains are to be replaced like for like, unless otherwise advised.
- New mains are to be designed and constructed to WSA 03-2011-3.1 SW Edition-2012.
- Water mains must not be located within the roads batter slope, either located at the toe or road shoulder.
- Sydney Water’s Asset Adjustment and Protection Manual provides further details and is available on the Sydney Water Website.
- Adjustment/protection, building over/adjacent to asset and/or Section 73 applications are to be submitted through our standard processes. Instructions of the processes and any of related policies can be found on Sydney Water’s website.

A Sydney Water accredited Water Servicing Coordinator can assist with in this process regarding the adjustment/deviation/protection of any/all Sydney Water assets impacted along the proposed route of this proposal and submission of subsequent applications required.

The assessment of asset adjustments can be undertaken through the Sydney Water Asset Adjustment process, which will consider the need for relocation or protection of our assets. Additionally, if assets are required to be changed, environmental approval will need to cover any works identified that may fall outside of the project boundary, but will be a result of the project works.

Sydney Water reserves the right to assess, based on final project layout & construction design prepared by the project team and/or their contractors, the impacts on our assets located within the project scope and the potential needs for adjustments funded by the project to accommodate accessibility of our pipes for operational & maintenance purposes, new pavement locations & changes to structures.

Amplification of the mains may be required to facilitate future growth along the development corridor. This will be assessed as adjustment applications are referred to Sydney Water for investigation. Sydney Water has previously met with RMS to outline our requirements for the allocation of space for the construction of future trunk assets required to service growth.

Access will need to be retained throughout the life of the project. Staging and timing will need to be undertaken as part of the design work and delivery of the project, to allow for shutdown & reconnection of our assets to ensure that Sydney Water maintains services to our customers in line with our Operating Licence.

**Response**

Any adjustments to Sydney Water assets would be carried out in consultation with Sydney Water and in accordance with Sydney Water specifications outlined above and in the attachments to Sydney Water’s submission.

**Issue description**

Works impacting Sydney Water assets (i.e. DN900 & DN750 Raw Water mains) may impact the timing of RMS’s programmed works which could add additional costs to the project. It is essential that RMS provide current Management Control Plans (MCP) regarding these projects to Sydney Water, and that updated copies continue to be forwarded to Sydney Water when changes to the programme occur.

**Response**

As outlined in section 5.4.10 of the draft EIS, the extent of impact to utilities and services cannot be confirmed until the detailed design is finalised. However, prior to construction, strategies to address potential impacts to the water mains would be developed in consultation with Sydney Water and all
efforts would be made to protect the DN900 and DN750 Raw Water mains in accordance with Sydney Water guidelines.

In the event that adequate protections cannot be achieved, these mains would need to be relocated or replaced. These works would be carried out in close collaboration with Sydney Water, and Roads and Maritime would provide current Management Control Plans to Sydney Water for review prior to the commencement of construction.

**Issue description**
The Northern Road Stage 4 from Mersey Road (just north of) to Adams Road (just north of) Case 154155 has been submitted by WSC (Cardno). An investigation and Letter of Requirements/Works Deeds was issued on 03/02/17. The existing DN150 water main needs to be adjusted. The design plans received 11/07/17 currently being reviewed by internal stakeholders.

**Response**
Noted.

**Issue description**
The Northern Road Stage 5 from The Littlefield Road Luddenham and Glenmore Parkway Glenmore Park. RMS has been in discussions with Sydney Water's Delivery Management regarding a trial agreement for the delivery of the pipe adjustment works, however, this is now to include the cut-in works.

**Response**
Noted. Discussion between Roads and Maritime and Sydney Water regarding a trail agreement for the delivery of pipe adjustment works would be ongoing and would include potential to carry out cut-in works.

**Issue description**
Stage 6 relates to Northern Road from Adams Road to Littlefields Road. A feasibility Letter of Requirements was issued on 03/02/17. Feasibility letters are only valid on the day that they are issued as their purpose is to provide advice.

There are no water or sewer assets that are impacted. Sydney Water owned land that has received a partial property acquisition from RMS. This property acquisition has been passed on to Group Property for review. The sites are Lot 12 in DP 30775 & Lot 12 in DP 232322.

**Response**
Noted.

**Issue description**
Sydney Water drinking water and wastewater mains:
- Sydney Water has no wastewater related comments in relation to the proposed development.
- However, the subject development may impact existing drinking water mains along the Northern Road. Adequate protections of the water main are required during the road works in accordance with the attached technical guidelines.
- Given certain sections of water mains are in Defence Establishment, Orchard Hills's Land, a detailed Review of Environmental Factors may be required in dealing with any unexploded explosives that may exist.
- There are high voltage electric cables on pylons in the area, which could be a potential hazard for maintenance staff when attending repair work on the main. This safety issue needs to be addressed in the EIS to minimise the risks of touching HV transmission lines.
Response
As outlined in section 5.4.10 of the draft EIS, the extent of impact to utilities and services cannot be confirmed until the detailed design is finalised. However, prior to construction, strategies to address potential impacts to the water mains would be developed in consultation with Sydney Water and all efforts would be made to protect the DN900 and DN750 Raw Water mains in accordance with Sydney Water guidelines.

In the event that adequate protections cannot be achieved, these mains would need to be relocated or replaced. These works would be carried out in close collaboration with Sydney Water and in accordance with the technical guidelines attached to Sydney Water's submission.

Any works within DEOH land would be carried out in consultation with Department of Defence. Works would not commence until a detailed assessment of unexploded ordinance has been completed and any identified ordinance had been cleared.

Potential hazards and risks associated with the construction of the project have been assessed in section 8.9 of the draft EIS. The likelihood of impacting on high voltage electrical cable would be minimised by undertaking utility checks, consulting with the relevant service infrastructure providers and if required, protecting utilities within the project area prior to the commencement of construction.

3.17.2 Environment

Issue description
Sydney Water has no comments in relation to environmental impacts relating to the subject proposal.

Response
Noted.
4 Proposed changes to the project as described in the draft EIS

4.1 Overview

The draft EIS for the project was prepared based on a concept project design (refer Chapter 5 of the draft EIS). This design has since been refined to account for design changes and in response to submissions received during exhibition of the draft EIS.

Roads and Maritime identified the need for a number of design refinements to assist in the constructability, to provide for the additional safety of road users and to minimise the environmental impact of the project.

This chapter describes the proposed changes to the project. The results of further assessment undertaken to assess the changes are described in Chapter 5.
### 4.2 Project changes

#### 4.2.1 Design refinements

An overview of the design refinements for the project is provided in Table 4-1. This includes justification for the design change and any further environmental assessment undertaken since exhibition of the draft EIS in order to assess the design change. Figure 4-2 provides an overview of the key design refinements.

Table 4-1 Overview of design refinements and further assessment undertaken

<table>
<thead>
<tr>
<th>Design refinement / location</th>
<th>Justification for refinement</th>
<th>Further assessment provided</th>
<th>Where addressed in this report</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Changes to staging and delivery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus lanes converted from continuous lanes along the main alignment to priority lanes at intersections only at opening with provision for continuous lanes in the future as demand requires.</td>
<td>The project will include bus priority at intersections for project opening. There is currently not the bus frequency along The Northern Road to warrant a dedicated bus lane. Further consideration of timing for the implementation of bus lanes between intersections will be undertaken in conjunction with the TfNSW as they develop and implement the new regional bus network to support the Western Sydney Airport and Priority Growth areas.</td>
<td>Changes to the staging and delivery of the project have not resulted in an increase to the construction or operational footprint of the project. The changes have been considered with regards to traffic and transport assessment.</td>
<td>Section 5.1.1</td>
</tr>
<tr>
<td>Staging of the incident response facility.</td>
<td>The provision of this facility would be delayed to be in line with commencement of airport operations and M12 Motorway.</td>
<td>No further assessment has been carried out.</td>
<td>N/A</td>
</tr>
<tr>
<td>Staging of Littlefields Road, Luddenham, to Glenmore Parkway Glenmore Park (see Table 4-3).</td>
<td>The complexities of utility relocations have become further understood during detailed design resulting in a delayed construction start date and extended construction timeframes of about two years.</td>
<td>Changes to the staging and delivery of the project have not resulted in an increase to the construction or operational footprint of the project.</td>
<td>N/A</td>
</tr>
<tr>
<td>Design refinement / location</td>
<td>Justification for refinement</td>
<td>Further assessment provided</td>
<td>Where addressed in this report</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td><strong>Cuttings, embankments and median</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes to batter slopes at various locations along the alignment.</td>
<td>Steepening of some batters to a maximum of 1:2 slope has occurred to minimise property impacts particularly on DEOH land. Some batters have been steepened to avoid existing utilities such as water mains.</td>
<td>Refinements to batters and medians have not resulted in an increase to the construction or operational footprint of the project. Changes to the end height of batter slopes has been considered as part of the revised noise and vibration and hydrology and flooding assessments.</td>
<td>Section 5.1.2 / Appendix B Section 5.2.1</td>
</tr>
<tr>
<td>Provision of a section of split carriage way for a short section between Gates Road and Longview Road.</td>
<td>To reduce batter impact to properties and improve gradients of driveway access on the western side of the alignment.</td>
<td>Splitting of the carriageway and change to elevation of the road has been considered as part of the revised noise and vibration and hydrology and flooding assessments.</td>
<td>Section 5.1.2 / Appendix B Section 5.2.1</td>
</tr>
<tr>
<td>Refinements to the width of the median at various locations.</td>
<td>Changes to median for consistency between project stages. Medians narrowed in some locations to reduce project footprint and at intersections to reduce length of staged pedestrian crossings.</td>
<td>Refinements to batters and medians have not resulted in an increase to the construction or operational footprint of the project. Refinements have been considered as part of the revised hydrology and flooding assessment.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

| **Utilities and services**                                     |                                                                                               |                                                                                                                                                                                                                       |                                                     |
| Relocation of Endeavour Energy substation from private property to within the road corridor and shared path areas. | Adjustments have been made to reduce property impacts on the western side of the road corridor. | Refinement has resulted in a reduction of impacts beyond the road corridor and as such no further assessment has been carried out. Refinements have been made in consultation with utility providers. | Response to Submission in Chapter 3                |
### Design criteria (geometry and alignment)

<table>
<thead>
<tr>
<th>Design refinement / location</th>
<th>Justification for refinement</th>
<th>Further assessment provided</th>
<th>Where addressed in this report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superelevation adjustments, changes to the radius of vertical curves and refinements to longitudinal grading at various locations along the alignment.</td>
<td>To make Compliant super elevations compliant with guidelines to reduce aquaplaning at several locations. Curve radius generally increased to achieve the required approach sight distance. Grading adjustments to generally improve stormwater drainage management and reduce aquaplaning.</td>
<td>Superelevation adjustments and changes to vertical alignments in some locations have resulted in changes to the height of the road pavement. Where this has occurred it has been considered as part of the revised noise and vibration and hydrology and flooding assessments.</td>
<td>Section 5.1.2 / Appendix B Section 5.2.1</td>
</tr>
<tr>
<td>Changes to the vertical alignment (elevating or lowering) of the road.</td>
<td>Minor adjustments to the elevation of the alignment have been made to assist in the management of drainage and to reduce potential impacts of operational road noise.</td>
<td>Superelevation adjustments and changes to vertical alignments in some locations have resulted in changes to the height of the road pavement. Where this has occurred it has been considered as part of the revised noise and vibration and hydrology and flooding assessments.</td>
<td>Section 5.1.2 / Appendix B Section 5.2.1</td>
</tr>
</tbody>
</table>

### Local road changes and upgrades

<table>
<thead>
<tr>
<th>Local road changes and upgrades</th>
<th>Justification for refinement</th>
<th>Further assessment provided</th>
<th>Where addressed in this report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refinement of Vineyard Road extension.</td>
<td>Road has been realigned to reduce property impacts and avoid the 750 mm watermain.</td>
<td>Refinement of Vineyard Road extension has been considered in all revised assessments related to changes in footprints such as Biodiversity, Non-Aboriginal and Aboriginal Heritage.</td>
<td>Chapter 5 Appendix C Appendix D</td>
</tr>
<tr>
<td>Adjustment to the alignment of the roundabout at Kings Hill Road and Vineyard Road.</td>
<td>To avoid existing water main fittings.</td>
<td>Although a minor refinement, additional biodiversity survey at Kings Hill Road has been carried out.</td>
<td>Appendix C Section 5.1.3</td>
</tr>
<tr>
<td>Design refinement / location</td>
<td>Justification for refinement</td>
<td>Further assessment provided</td>
<td>Where addressed in this report</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Gates Link Road alignment realigned further to the east.</td>
<td>Realignment to ensure resident can maintain access to property's water supply and allow for constant width between link road and The Northern Road to not preclude future land use. Refinements have also been made to fit with the proposed drainage strategy and reduce earthworks.</td>
<td>Refinement of Gates Link Road has been considered in all revised assessments related to changes in footprints such as Biodiversity, Non-Aboriginal and Aboriginal Heritage.</td>
<td>Chapter 5 Appendix C Appendix D</td>
</tr>
<tr>
<td>Minor adjustments to medians and kerbs along local roads.</td>
<td>General changes to raised medians and kerbs in accordance with Austroads Part 4A, Table 6.1.</td>
<td>No further assessment required.</td>
<td>N/A</td>
</tr>
<tr>
<td>The cul-de-sac at Elizabeth Drive has been reconfigured to allow for entry and exit from/to Elizabeth Drive only. Exit from the cul-de-sac to The Northern Road has been removed and replaced with u-turn facility. Second lane opening at u-turn facility on Elizabeth Drive (west of intersection with Northern Road) has been removed and replaced with give way entry into the main traffic.</td>
<td>The left turn onto The Northern Road from the existing Elizabeth Drive was removed due to concerns about the proximity to signalised intersection and traffic management and safety issues. To eliminate weaving over a short distance before the intersection.</td>
<td>Changes to the configuration at Elizabeth Drive have been considered with regards to traffic and transport assessment.</td>
<td>Section 5.1.1</td>
</tr>
<tr>
<td>Grover Crescent (north) access changed to left in, left out Grover Crescent (south) access removed.</td>
<td>Improved safety for vehicles entering The Northern Road from Grover Crescent.</td>
<td>Changes to Grover Crescent have been considered with regards to traffic and transport assessment.</td>
<td>Section 5.1.1</td>
</tr>
<tr>
<td>Design refinement / location</td>
<td>Justification for refinement</td>
<td>Further assessment provided</td>
<td>Where addressed in this report</td>
</tr>
<tr>
<td>-----------------------------</td>
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<td>-----------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td><strong>Intersections</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refinements to median widths and extents at signalised intersections.</td>
<td>Refinements made to reduce the length of staged pedestrian crossings. The extent of concrete infill of medians on the approach to intersections has also been reduced and replaced with landscaping to enhance urban design outcomes.</td>
<td>Refinements have not resulted in an increase to the construction or operational footprint of the project. As such, no additional assessments have been carried out specific to this refinement.</td>
<td>N/A</td>
</tr>
<tr>
<td>Left turn slip lanes removed and splitter islands added to Littlefields Road, Chain-O- Ponds Road, u-turn opposite DEOH and Bradley Street.</td>
<td>Removal of slip lanes allows vehicles to use the bus lane on approach to the intersections for left turns.</td>
<td>Changes to turning movements at these intersections have been considered as part of the additional traffic assessment.</td>
<td>Section 5.1.1</td>
</tr>
<tr>
<td>Reconfiguration of Littlefields Road intersection to have a left-straight lane and a right turn lane to allow changed signal phasing.</td>
<td>Reconfiguration to allow for staged pedestrian crossings and to accommodate 26m B-Double vehicles.</td>
<td>Changes to the turning movements at intersections have been considered as part of the additional traffic assessment.</td>
<td>Section 5.1.1</td>
</tr>
<tr>
<td>Round-about on Littlefields Road changed to a u-turn facility.</td>
<td>Additional u-turn facility to accommodate large vehicle access to adjoining property, replacing previously proposed roundabout.</td>
<td>No further assessment required.</td>
<td>N/A</td>
</tr>
<tr>
<td>U-turn stub added to roundabout opposite DEOH entrance.</td>
<td>To allow 26 metre b-doubles to access the left lane.</td>
<td>Operational footprint change is within the area previously assessed as part of the draft EIS construction footprint. No further assessment required.</td>
<td>N/A</td>
</tr>
<tr>
<td>Design refinement / location</td>
<td>Justification for refinement</td>
<td>Further assessment provided</td>
<td>Where addressed in this report</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Heavy vehicle inspection bays</strong></td>
<td>After a review of the proposed HVIS at Grover Crescent, it was determined that this site was not suitable from a road safety or operational perspective for the implementation of a HVIS. Several other locations have been identified and investigated, however each of these sites have issues with road safety, operation of the facility, property acquisition, property access and/or utilities. Further to this, there are currently unknowns in regard to the locations of the proposed M12 and Outer Sydney Orbital (M9) and how they would interface with The Northern Road upgrade - which may have impacts on the locations of potential northbound HVIS. The Roads and Maritime Heavy Vehicle Compliance Section identified and confirmed that there is currently no northbound HVIS. As such, the project was providing a new facility and not replacing an existing facility, as was thought throughout the early project design stages. The northbound facility to the south of Glenmore Parkway which was thought to be a HVIS is an informal truck parking bay. Provision of new facilities is beyond project scope and funding constraints mean additional scope is not possible. No new northbound HVIS is to be provided as part of the project. It was also determined that as the existing truck parking bay is an informal site and would have similar issues to a HVIS that this facility would not be provided as part of the upgrade of The Northern Road.</td>
<td>No further assessment has been carried out as a result of removing the northbound heavy vehicle inspection bays.</td>
<td>Response to Submission in Chapter 3</td>
</tr>
<tr>
<td>Design refinement / location</td>
<td>Justification for refinement</td>
<td>Further assessment provided</td>
<td>Where addressed in this report</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Traffic management facilities</strong></td>
<td></td>
<td>The removal of VMS has been considered in the revised Urban Design and Visual Impact assessment.</td>
<td>Section 5.2.5</td>
</tr>
<tr>
<td>Removal of Variable Message Signs (VMS) at the approaches to Elizabeth Drive and heavy vehicle inspection bays.</td>
<td>Further investigation determined that a VMS was not required on approach to the heavy vehicle inspection station. Space has been allowed for implementation of VMS required on the southbound approach to the M12 for the future installation of a VMS.</td>
<td>No further assessment has been carried out.</td>
<td>N/A</td>
</tr>
<tr>
<td>Staging of the incident response facility.</td>
<td>The provision of this facility would be delayed to be in line with commencement of airport operations and M12 Motorway.</td>
<td>No further assessment has been carried out.</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Flooding and water quality infrastructure</strong></td>
<td>Refinements to road design (described above) has required some changes to the proposed road and pavement drainage design.</td>
<td>Changes to drainage and water quality infrastructure have resulted in a revised water quality assessment and revised flooding and hydrology assessment.</td>
<td>Section 5.2.1 Section 5.2.2</td>
</tr>
<tr>
<td>Property adjustments including provision of new accesses at various locations.</td>
<td>To ensure property access is maintained.</td>
<td>Carried out in consultation with affected property owners. This consultation is ongoing. No further assessment currently required.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement
Figure 4-1 | Overview of design refinements for the project
Figure 4.1 | Overview of design refinements for the project
Changes to batter slopes at various locations along the mainline alignment

Refinements of drainage and water quality infrastructure

Figure 4.1 | Overview of design refinements for the project
The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement

Figure 4-1 | Overview of design refinements for the project
Figure 4.1 | Overview of design refinements for the project
Figure 4-1 | Overview of design refinements for the project
4.2.2 Corridor width and project footprint changes

Some of the design refinements outlined above have resulted in changes to the projects construction and operational footprints.

Table 4-2 provides a comparison of the construction and operational footprints calculated for the design refinements against the footprints assessed in the draft EIS, with reductions of 10 ha and 16 ha identified respectively. An error in the draft EIS footprint calculations (EIS – original) was identified during the footprint assessment which has been corrected in the table (EIS – revised).

Table 4-2 also shows a comparison of the Commonwealth land impacted by the project, with an overall reduction of 2 ha across the DEOH site and the WSA sites.

Table 4-2 Revised footprint areas for project stages

<table>
<thead>
<tr>
<th>Footprint / area</th>
<th>EIS (ha) – original</th>
<th>EIS (ha) - revised</th>
<th>Design refinements (ha)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>278</td>
<td>280</td>
<td>270</td>
<td>10 ha reduction</td>
</tr>
<tr>
<td>Operation</td>
<td>202</td>
<td>202</td>
<td>186</td>
<td>16 ha reduction</td>
</tr>
<tr>
<td>DEOH</td>
<td>25</td>
<td>25</td>
<td>24</td>
<td>1 ha reduction</td>
</tr>
<tr>
<td>WSA</td>
<td>20</td>
<td>23</td>
<td>22</td>
<td>1 ha reduction</td>
</tr>
</tbody>
</table>

Figure 4-2 provides a comparison of the draft EIS and the refined design construction footprints. Figure 4-3 provides a comparison of the draft EIS and the refined design operational footprints.

4.2.3 Project timing changes

Table 5-18 in the draft EIS outlined the indicative construction timeframe for the various construction stages of the project. Further refinement of the proposed construction staging for the project has been provided and is shown in Table 4-3. The timing of these stages would be confirmed once a construction contractor is appointed to the project.

Table 4-3 Revised construction timeframe for project stages

<table>
<thead>
<tr>
<th>Project construction stage</th>
<th>Project construction timing</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mersey Road, Bringelly, to Eaton Road, Luddenham</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Littlefields Road, Luddenham, to Glenmore Parkway, Glenmore Park</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Littlefields Road, Luddenham to Eaton Road, Luddenham</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* incident response facility to be delivered in mid 2020s
Figure 4.2 | Comparison of EIS and refined design construction footprints
Figure 4-2 | Comparison of EIS and refined design construction footprints
Legend
- EIS construction footprint
- Refined design construction footprint
- Construction compound sites
- Defence Establishment
- Orchard Hills (Commonwealth Land)
- Additional areas of construction footprint due to design refinements

Figure 4-2 | Comparison of EIS and refined design construction footprints

The Northern Road upgrade – Mersey Road to Glenmore Parkway Construction Boundary and Compound Sites
Figure 4.3 | Comparison of EIS and refined design operational footprints

The Northern Road Upgrade - Mersey Road to Glenmore Parkway Operational Boundary

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Figure 4-3 | Comparison of EIS and refined design operational footprints

Legend
- EIS operational footprint
- Refined design operational footprint
- Additional areas of operational footprint due to design refinements
- Defence Establishment
- Orchard Hills (Commonwealth Land)

The Northern Road upgrade – Mersey Road to Glenmore Parkway Operational Boundary

Page 6 of 7
GLENMORE PARK

ORCHARD HILLS

MULGOA

Legend
- EIS operational footprint
- Refined design operational footprint
- Additional areas of operational footprint due to design refinements
- Defence Establishment
- Orchard Hills (Commonwealth Land)

Figure 4-3 | Comparison of EIS and refined design operational footprints

The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement
4.2.4 Project description changes

As a result of the changes to the project as outlined in this chapter, the project description as detailed in the draft EIS has been modified to account for the following changes:

- Access from the existing Elizabeth Drive cul-de-sac to The Northern Road has been removed and replaced with a u-turn facility (previously left out only)
- Access to Grover Crescent south has been removed (previously left in only), and access to Grover Crescent north has been changed to left in and left out only (previously left out only)
- Removal of the northbound heavy vehicle inspection bays adjacent to Grover Crescent
- Proposed staging of bus lane delivery as demand requires.

A revised project description incorporating these changes to the project is provided below.

Revised project description (post exhibition)

The project involves upgrading the 16 km section of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park.

The project generally comprises the following key features:

- A six-lane divided road between Mersey Road, Bringelly and Bradley Street, Glenmore Park (two general traffic lanes and a kerbside bus lane in each direction to be delivered when demand requires). The wide central median would allow for an additional travel lane in each direction in the future, if required
- An eight-lane divided road between Bradley Street, Glenmore Park and about 100 m south of Glenmore Parkway, Glenmore Park (three general traffic lanes and a kerbside bus lane in each direction separated by a median to be delivered when demand requires)
- About eight kilometres of new road between Mersey Road, Bringelly and just south of the existing Elizabeth Drive, Luddenham, to realign the section of The Northern Road that currently bisects the Western Sydney Airport site and to bypass Luddenham
- About eight kilometres of upgraded and widened road between the existing Elizabeth Drive, Luddenham and about 100 m south of Glenmore Parkway, Glenmore Park
- Closure of the existing The Northern Road through the Western Sydney Airport site
- Tie-in works with the following projects:
  - The Northern Road Upgrade, between Peter Brock Drive, Oran Park and Mersey Road, Bringelly (to the south)
  - The Northern Road Upgrade, between Glenmore Parkway, Glenmore Park and Jamison Road, South Penrith (to the north).
- New intersections including:
  - a traffic light intersection connecting the existing The Northern Road at the southern boundary of the Western Sydney Airport, incorporating a dedicated u-turn facility on the western side
  - a traffic light intersection for service vehicles accessing the Western Sydney Airport, incorporating 160 m of new road connecting to the planned airport boundary
  - a traffic light intersection connecting the realigned The Northern Road with the existing The Northern Road (west of the new alignment) south of Luddenham
  - a ‘give way’ controlled intersection (that is, no traffic lights) connecting the realigned The Northern Road with Eaton Road (east of the new alignment, left in, left out only)
  - a four-way traffic light intersection formed from the realigned Elizabeth Drive, the realigned The Northern Road and the existing The Northern Road, north of Luddenham
  - a traffic light intersection at the Defence Establishment Orchard Hills entrance, incorporating a u-turn facility.
- New traffic lights at four existing intersections:
  - Littlefields Road, Luddenham
  - Kings Hill Road, Mulgoa
  - Chain-O-Ponds Road, Mulgoa
  - Bradley Street, Glenmore Park incorporating a u-turn facility.

- Modified intersection arrangements at:
  - Dwyer Road, Bringelly (left in, left out only)
  - Existing Elizabeth Drive, Luddenham (access removed)
  - Gates Road, Luddenham (left in only)
  - Longview Road, Luddenham (left in, left out only)
  - Grover Crescent south, Mulgoa (access removed)
  - Grover Crescent north, Mulgoa (left in, left out only).

- Dedicated u-turn facilities at:
  - the existing The Northern Road at Luddenham, south-west of Elizabeth Drive
  - the existing Elizabeth Drive, Luddenham around 800 m east of The Northern Road
  - Chain-O-Ponds Road, Mulgoa

- Twin bridges over Adams Road, Luddenham

- Local road changes and upgrades, including:
  - closure of Vicar Park Lane, east of the realigned The Northern Road, Luddenham
  - Eaton Road cul-de-sac, west of the realigned The Northern Road, Luddenham
  - Eaton Road cul-de-sac, east of the realigned The Northern Road, Luddenham
  - Elizabeth Drive cul-de-sac, about 300 m east of The Northern Road with a connection to the realigned Elizabeth Drive, Luddenham
  - Extension of Littlefields Road, east of The Northern Road, Mulgoa
  - a new roundabout on the Littlefields Road extension, Mulgoa
  - a new service road between the Littlefields Road roundabout and Gates Road, including a 'give way' controlled intersection (that is, no traffic lights) at Gates Road, Luddenham
  - extension of Vineyard Road, Mulgoa between Longview Road and Kings Hill Road
  - a new roundabout on the Vineyard Road extension at Kings Hill Road, Mulgoa.

- A new shared path on the western side of The Northern Road and footpaths on the eastern side of The Northern Road where required

- The upgrading of drainage infrastructure

- Operational ancillary facilities including:
  - heavy vehicle inspection bays for southbound traffic, adjacent to Longview Road, Mulgoa
  - an incident response facility on the south-western corner of the proposed four-way traffic light intersection at Elizabeth Drive, Luddenham to be implemented for the operation of the Western Sydney Airport and the proposed M12 Motorway.

- Roadside furniture and lighting as required

- The relocation of utilities and services

- Changes to property access along The Northern Road (generally left in, left out only)

- Establishment and use of temporary ancillary facilities and access tracks during construction

- Property adjustments as required

- Clearance of unexploded ordinance (UXO) within the Defence Establishment Orchard Hills as required.
5 Assessment of impacts of the refined project

Additional investigations or assessment have been carried out since exhibition of the draft EIS due to project design refinements as outlined in Chapter 4, and in response to submissions received from Government agencies and the community as outlined in Chapter 2 and Chapter 3 respectively. Table 5-1 provides a summary of the ‘key’ and ‘other’ issues as assessed in the draft EIS, the additional assessments carried out since exhibition of the draft EIS including a summary of their scope and need for the assessment, and where this has been addressed in this Final EIS. Where required, additional technical assessment has been provided as appendices as referenced in the table.

Table 5-1 Summary of assessments in the draft EIS and additional assessment completed in the final EIS

<table>
<thead>
<tr>
<th>Assessment issue</th>
<th>Where addressed in the draft EIS (Appendix E of this report)</th>
<th>Need for further assessment</th>
<th>Where addressed in the final EIS (this report)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic and transport</td>
<td>Section 7.1 Appendix G – Technical working paper: Traffic and transport</td>
<td>To consider project design refinements associated with minor changes to the vertical and horizontal alignment and changes to staging and delivery</td>
<td>Section 5.1.1</td>
</tr>
<tr>
<td>Noise and vibration</td>
<td>Section 7.2 Appendix H – Technical working paper: Noise and vibration</td>
<td>To assess project design refinements associated with minor changes to the vertical and horizontal alignment of the project</td>
<td>Appendix A – Noise and Vibration: additional information in response to submissions Appendix B – Technical Memorandum: Noise and vibration Summarised in Section 5.1.2</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Section 7.3 Appendix I – Technical working paper: Biodiversity</td>
<td>To assess project design refinements that resulted in changes to the footprint of the project and in response to submission</td>
<td>Appendix C – Technical Memorandum: Biodiversity Summarised in Section 5.1.3 and throughout response to submissions in Sections 2 and 3</td>
</tr>
<tr>
<td>Socio-economic and land-use</td>
<td>Section 7.4 Appendix J – Technical working paper: Socio-economic</td>
<td>To consider the implication of project design refinements and footprint changes on property impacts and land use</td>
<td>Section 5.1.4</td>
</tr>
<tr>
<td>Assessment issue</td>
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The assessment below provides a final statement of impact of the project with changes assessed for consistency against the outcomes of the assessments provided in the draft EIS. Where the assessment has resulted in a material change to the project, a revised impact assessment is provided below as is the case for biodiversity (Section 5.1.3), water quality (Section 5.2.2) and non-Aboriginal heritage (Section 5.2.4).

Overall, changes to the project have been assessed as being generally consistent with the outcomes of the draft EIS. The mitigation measures identified in the draft EIS would continue to apply, with a number of revised or new environmental management measures developed in response to the changes as summarised below and included in Chapter 6.

## 5.1 Key issues

### 5.1.1 Traffic and transport

Section 7.1 of the draft EIS summarises the existing traffic conditions influencing The Northern Road, identifies the potential impacts to those conditions as a result of the construction and operation of the project, and assesses those impacts in light of the project. Section 7.1 of the draft EIS also recommends environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Traffic and Transport Assessment (Appendix G) of the draft EIS informs the assessment.

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Assessment approach

Section 7.1.1 of the draft EIS outlines in detail the assessment approach used in assessing the construction and operational impacts of the project.

The assessment of construction traffic and transport impacts involves a review of the types of construction activities proposed, staging of works, working hours and the need for temporary periods of road occupancy to allow for construction. Potential impacts on general traffic, local traffic, access, and bus operations were assessed, and mitigation and management measures to minimise impacts proposed.

The operational traffic assessment was based on the development of an Aimsun microsimulation traffic model. The model is part of a wider model of The Northern Road corridor that is being used for assessing the functional performance of The Northern Road Upgrade between Mersey Road, Bringelly and Jamison Road, Penrith. The Northern Road base models were validated against travel times recorded during the same period as the turning movement surveys.

The traffic and transport assessment considered the following scenarios:

- Existing 2015 base case
- 2021 and 2031 without the project (Do minimum)
- 2021 and 2031 with the project.

The ‘without The Northern Road Upgrade (between Mersey Road and Glenmore Parkway)’ scenario included the following road upgrades and land uses:

- Proposed M12 Motorway (by 2031)
- Western Sydney Airport (by 2031)
- Realignment of the existing The Northern Road around the Western Sydney Airport site as a two-lane undivided road.

An assessment of the traffic and transport impacts of the project assesses the traffic and transport impacts for two design years (2021 and 2031) for the weekday peak periods. The cumulative impacts of the increase in background traffic as well as the impacts of road upgrades and the forecast levels of development within the study area were included in the assessment. The assessment also considered the impacts on all road users including public transport, pedestrians and cyclists.

The design refinements since exhibition of the draft EIS have been reviewed and considered against the findings of the draft EIS. No further modelling has been carried out.

Existing environment

The Northern Road is a State road within Sydney’s road network and is one of the main north–south connections in south-western Sydney. It stretches from Narellan, west of Campbelltown, via Penrith to Bligh Park south-east of Richmond.

Section 7.1.2 of the draft EIS outlines the existing traffic and transport conditions for the project area. The information is summarised below and provides a baseline of existing traffic conditions from which potential impacts of the project have been modelled and assessed.

The draft EIS outlines the existing traffic volumes adopted for modelling purposes. Traffic volumes on the road network within the study area were derived from traffic surveys undertaken between November 2014 and July 2015.

Key existing traffic conditions include:

- Journey to Work data indicates that car journeys to work, whether as passenger or driver make up some 90 per cent of the total trips into or out of the study area
- Only two per cent of trips to work in the area are made by public transport
- There is only one bus route operating twice on weekdays in the study area
- There are no formal cycle facilities provided in the study area
- Level of Service (LoS) (the standard measure used to assess the operational performance of intersections) shows that currently all intersections along The Northern Road between Mersey Road and Glenmore Parkway operate satisfactorily during the peak periods
- Analysis of observed average speeds (based on floating car travel time surveys) along The Northern Road shows that traffic travels generally slower than the sign posted speed limits. This is due primarily to delays at roundabouts, traffic turning right at priority intersections and delays caused by cars being unable to overtake heavy vehicles
- The observed casualty crash rate per kilometre of road per year is significantly lower than the average performance for similar roads in NSW.

Main impacts as documented in the draft EIS

Construction impacts

The key traffic and transport related construction impacts identified in the draft EIS included:

- Generation of additional traffic to support construction of the project. Based on arrivals to and departures from site at peak periods each working day, traffic generation is likely to be in the order of 230 additional light vehicle movements per day and about 12-13 truck movements per hour in the peak hours. The likely increase in average daily traffic volume as a result of construction activities would be less than five per cent, which is likely to have a negligible impact on the LoS along The Northern Road and Elizabeth Drive
- Temporary adverse changes to traffic conditions such as active traffic controls and temporary lane closures reducing traffic speeds and increasing travel times
- Access to some properties may be temporarily affected by the construction activities, particularly in areas where construction would be occurring along the existing The Northern Road corridor. Where access is affected, alternative arrangements would be made in consultation with land owners
- Construction impacts on Commonwealth land would be limited to temporary changes to access to the DEOH land, with no change to access to land within the site of the Western Sydney Airport. The temporary access changes to the DEOH site would be necessary to facilitate construction of the widened The Northern Road, which would comprise a new signalised intersection at the main DEOH entrance, and a new u-turn bay on the western side of The Northern Road at the DEOH entrance intersection
- Minor impacts to public transport. Impacts to the existing 789 bus route through the area would generally be minimal, with benefits being provided through the provision of a dedicated bus lane. The signalisation of intersections on The Northern Road between Elizabeth Drive and Glenmore Parkway may add up to two minutes of delay to this route; however this is well within the variability of long cross-regional bus route
- Overall, the project would improve the accessibility and safety for pedestrians and cyclists along The Northern Road by providing dedicated space for cyclists and pedestrians that is separated from traffic and reducing the potential for conflicts with cars
- The project would improve reliability and travel times for freight traffic currently travelling on The Northern Road by providing additional traffic capacity and relieving existing traffic constraints, particularly at existing priority and roundabout intersections along The Northern Road
- The project would result in a number of improvements to road safety.
**Operational impacts**

The operational traffic and transport assessment found that, once complete, the project would cater for the substantial forecast traffic growth and provide connectivity to and from the Western Sydney Airport – connecting the M4 Western Motorway and the proposed M12 Motorway. The project would also improve road safety and public and active transport facilities, promoting more sustainable and efficient journeys.

Analysis of the intersection performance along The Northern Road with the project shows that most of the intersections within the study area would operate satisfactorily under the 2021 and 2031 future year scenarios with LoS C or better. The only exception would be the intersection of The Northern Road and Elizabeth Drive, which would be operating near capacity in the evening peak hour at LoS D by 2021. This is due to the large volumes of conflicting traffic movements that are forecast to travel through this intersection by 2021.

Modelled travel times also indicate that the project would result in reduction of travel times in both directions along The Northern Road when comparing the project scenario with the Do Minimum scenario. In this section, northbound travel times are likely to remain similar to those without the project since the project would introduce delays at five new signalised intersections.

The project’s long-term operational impacts on traffic and transport on Commonwealth land would be positive. Access to the DEOH site would be improved through the upgrading and signalising of the intersection at the site’s main entrance. Further, the project’s design includes formalising access to the site of the Western Sydney Airport, which would facilitate access for service vehicles and deliveries.

The project would include the provision of a wide central median that would remove existing right turns at some intersections and property accesses resulting in additional travel distance and time for some properties.

**Implications of the revised design on the project**

The design refinements outlined in Figure 4-1 have been considered against the outcomes of the traffic and transport assessment carried out for the draft EIS as outlined in Chapter 7.1 of the draft EIS. Refinements that could have potential to result in minor changes to the traffic and transport assessment include:

- Changes to staging and delivery
- The provision of split carriageway between Gates Road and Longview Road
- Refinements to medians and kerbs along the main alignment and local roads
- Refinements to intersections
- Assessment of potential construction impacts.

Section 7.1.3 of the draft EIS provided an assessment of potential construction traffic impacts associated with the project. The design refinements outlined in this Final EIS have been reviewed against the outcomes of draft EIS construction traffic assessment.

**Intersection performance**

Section 7.1.4 of the draft EIS provides an analysis of the intersection performance along The Northern Road with the project. The analysis shows that most of the intersections within the study area would operate satisfactorily under the 2021 and 2031 future year scenarios with Level of Service (LoS) C or better. The only exception being the intersection of The Northern Road and Elizabeth Drive which would be operating near capacity in the evening peak hour at LoS D by 2021. This is due to the large volumes of conflicting traffic movements that are forecast to travel through this intersection by 2021.

A review of the design refinements provided in Table 4-1 has the following implications for intersection performance:
• Changes to staging and delivery of the proposed bus lanes is unlikely to affect the performance of intersections. The intersections would be built with the ultimate number of lanes at the stop line and would allow for a ‘bus jump’ (traffic light phasing staged to allow bus priority). Given the very small number of buses using The Northern Road, buses merging back into general traffic lanes would not alter the performance of the intersections.

• Refinements to median lengths at signalised intersections would not change accessibility or functionality as long as the median is retained. Overall, this would have negligible impact on traffic arrangements and therefore the operation and Level of Service (LoS) of the intersections.

• Addition of splitter islands allows for pedestrians crossing side streets to be separated from left turning traffic, removing this conflict and separating left turning vehicles from buses. Due to the low forecast pedestrian volumes along The Northern Road and the relatively low volumes of left turning traffic at most intersections, this would have minimal impact on intersection performance, in most cases a very minor improvement.

• Signal phasing changes would allow for shorter minimum phase times for Littlefields Road and Gates Road extension. This would result in a very minor improvement in operation by reducing minimum phase time for side streets in the event of a pedestrian fall across The Northern Road.

• The performance of intersections related to Commonwealth Land as a result of the design refinements would be in accordance with the assessment provided above.

**Travel times**

Section 7.1.4. of the draft EIS provides a comparison of modelled travel times along the existing The Northern Road corridor with and without the project. The modelled travel times indicate that the project would result in reduction of travel times in both directions along The Northern Road when comparing the project scenario with the ‘Do Minimum’ scenario. In this section, northbound travel times are likely to remain similar to those without the project since the project would introduce delays at five new signalised intersections.

A review of the design refinements provided in Table 4-1 has the following implications for travel times with the introduction of the project:

• Changes to staging and delivery of the proposed bus lanes may result in a very small increase in bus travel time due to the fact that buses would be required to merge in and out of the general traffic lanes at the approached to bus stops (either at intersections or mid-block) rather than utilise a stand-alone bus lane. Changes to travel times for general traffic would be negligible as the number of buses that use The Northern Road is very small.

• Provision of a section of split carriage way for a short section between Gates Road and Longview Road would have no impact of the modelled traffic arrangements or travel times.

• Changes to the width of the median would not change the functionality of the main alignment and would therefore have no impact on traffic arrangements and not result in changes to travel times.

**Impacts on local roads and access**

The project would include the provision of a wide central median that would remove existing right turns at some intersections and property accesses. Table 7-13 of the draft EIS summarised the changes to access as a result of the project and also outlines the maximum additional travel distance and time that would result from changes to access.

A review of the design refinements provided in Table 4-1 has the following implications for local roads and access:
Changes to staging and delivery of the proposed bus lanes is unlikely to result in additional impacts to local roads or property access during the initial construction of the project. Should provision for continuous lanes be required in the future, as demand requires, construction impacts similar to those described in this report may be experienced although those impacts would be in mid-block areas where the continuous lanes would be connected to the intersection bus lane areas.

Changes to the width and length of the median would not result in a change of access to and from the main alignment and would therefore have no impact on traffic arrangements or further access issues.

Changes at Elizabeth Drive would result in small increases in travel distance for trips accessing the properties on the cul-de-sac (up to an additional 150 m). Reassignment of this traffic would not substantially affect the operation of the intersection of The Northern Road and Elizabeth Drive.

The potential construction traffic and transport impacts due to the proposed design refinements have also been considered. Overall, potential construction related impacts associated with the refined design for the project are considered consistent with those presented in the draft EIS. This is due to the fact that, in general, the design refinements have only marginally altered the design of the road when compared to the draft EIS design. Additionally, construction plant and equipment, and haulage routes would be the same as outlined in the draft EIS.

Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6. Several new measures have been developed in response to submissions received during exhibition of the draft EIS. In summary, the new traffic and transport management measures relate to:

- The use of local roads by heavy vehicles to access temporary ancillary facilities would be limited as far as is reasonably practicable
- Roads and Maritime will consult with Councils regarding the requirements for upgrade of local roads
- Roads and Maritime will consult further with all utility providers on required access and consents for utility corridors prior to construction.

5.1.2 Noise and vibration

Section 7.2 of the draft EIS identified the noise and vibration impacts from construction and operation of the project. It also recommended environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Noise and Vibration Assessment (Appendix H) of the draft EIS informs the assessment.

Assessment approach

The assessment approach for the draft EIS includes the identification of sensitive receivers and noise catchment areas (NCAs), background noise monitoring and modelling of both the operational noise and construction noise and vibration impacts of the project. These predictions were assessed against the relevant criteria including for construction the EPA Interim Construction Noise Guideline (ICNG) and the Roads and Maritime Construction Noise and Vibration Guideline (CNVG), and for operational noise the Roads and Maritime Noise Criteria Guideline (NCG) which describes Roads and Maritime’s implementation of the EPA Road Noise Policy (RNP).

Section 7.2.3 of the draft EIS details the construction noise and vibration assessment criteria relevant to the project including:
Noise Management Levels (NML’s) applied to the assessment of surface construction activities and construction sites

Sleep disturbance criteria applied to the assessment of construction activities that may be carried out during the night-time (10pm to 7am)

Construction traffic noise criteria

Construction vibration criteria.

Section 7.2.3 of the draft EIS also details the operational noise criteria applied to the assessment in accordance with the NCG criteria as follows:

- Receivers adjacent to the bypass around Luddenham and the approaches to Elizabeth Drive were assigned new road criteria
- Receivers adjacent to the redeveloped sections of road were assigned redeveloped road criteria
- Where new and redeveloped roads meet a transition zone criteria were applied
- NCG criteria for non-residential uses were also applied.

The draft EIS also included the assessment and identification of feasible and reasonable environmental management measures.

Existing environment

Ambient noise within the study area is determined by the traffic on the existing The Northern Road and adjoining roads such as the M4 Western Motorway and Elizabeth Drive.

As identified in Section 7.2.4 of the draft EIS, the existing (or baseline) noise environment was established by carrying out long-term, unattended noise surveys along the study corridor to determine the existing level of background noise at all receivers potentially affected by the project. These monitoring results are also used to establish construction noise parameters.

Traffic count surveys were undertaken concurrently with the long term unattended noise monitoring surveys to validate the noise model. The locations in which background noise monitoring surveys and traffic count surveys were carried out are shown on Figure 7-2 of the draft EIS.

The results of unattended noise monitoring are presented in Table 7-27 and Table 7-28 of the draft EIS. Background noise level data have been used to determine the RBL, which are used to define the NML’s in accordance with the ICNG.

Main impacts as documented in the draft EIS

Construction impacts

Predicted construction noise impacts

Construction noise impacts were assessed based on the indicative timeframes and staging of works presented in Chapter 5 of the draft EIS. Table 7-29 of the draft EIS lists the sound power levels adopted for each item of plant and equipment in the modelling of construction noise impacts.

As a conservative approach, noise modelling assumed that all 21 ancillary facilities for the project would operate simultaneously for the entire duration of the construction program as a worst-case assessment. Noise modelling was also provided to consider noise impacts that may arise from the operation of ancillary facilities alone to allow for the assessment of longer term impacts arising from the operation of ancillary facilities even once mainline road works have moved beyond a sensitive receiver.

Construction of the project would be contained to standard construction hours where it is feasible and reasonable to do so. However, some works would likely need to be carried out during evening, night or weekend periods as required to ensure safe work practices or to avoid unacceptable impacts on traffic and disruptions to the road network. Further assessment of the location and...
justification of out of hours works has been provided in response to submissions during exhibition of the draft EIS (refer to Appendix A of this Final EIS). This also provides further detail regarding the application of standard and additional mitigation measures for each activity in accordance with Appendix C of the CNVG where feasible and reasonable.

The predicted $L_{Aeq}$ noise level from all standard hours (daytime) and out-of-hours (Saturday afternoons, evenings and nights) construction works is presented in full in Appendix H of the draft EIS and summarised in Section 7.2.5 of the draft EIS as below.

In summary, during standard hours works, it is predicted that:

- The NML will not be exceeded at any time for most receivers (>60 per cent) within NCAs 1, 6 and 8
- Across the entire study area, noise from even the loudest works will comply with the NML at 80 per cent of all residences
- Of all works scenarios, road works and paving are expected to generate the greatest number of NML exceedances at residences, which are mostly located in NCAs 1, 2 and 5
- The highest NML exceedances are predicted to occur at residences within NCA 2
- At 195 residences (11 per cent of all residences) within the study area the worst case exceedance of the NML from any standard hours works would be 10 dB(A) or less. At such times of peak impact, construction noise would be clearly audible
- At 118 residences within the study area (7 per cent) the worst case exceedance of the NML would be between 10-20 dB(A). At such times of peak impact, construction noise would be moderately intrusive
- At 29 residences within the study area (2 per cent) the worst case exceedance may be more than 20 dB(A). At such times of peak impact, construction noise would be highly intrusive
- At times of the loudest works (road works and paving) 39 residences are predicted to be highly noise affected (noise levels > 75dB(A)). Fewer residences would be highly noise affected during quieter works (eg, 0 residences during bridge works). NCA 2 is predicted to have the highest number of highly noise affected receivers (25 during paving works)
- Within most NCAs, it is expected that noise from the nearest ancillary facility (in isolation of noise from any other mainline works) may exceed the NML by up to 10 dB(A) at a small number of receivers (up to 12 receivers within NCA 5) when that facility is operating at peak capacity. Additionally, one receiver in each of NCA 4 and NCA 5 may be exposed to noise levels up to 20 dB(A) above the NML during times of peak operations.

In summary, during out-of-hours work, it is predicted that:

- Across the entire study area, noise from even the loudest works will comply with the NML at 60 per cent of all residences
- Paving is the out-of-hours work predicted to generate the greatest number of NML exceedances at residences, which are mostly located in NCAs 1, 2, 5 and 8
- The highest NML exceedances are predicted to occur at residences within NCA 2
- At 209 residences (12 per cent of all residences) within the study area the worst case exceedance of the NML from any out-of-hours work would be 5 dB(A) or less. At such time of peak impact, construction noise would be noticeable
- At 313 residences within the study area (18 per cent) the worst case exceedance of the NML would be between 5-15 dB(A). At such times of peak impact, construction noise would be clearly audible
• At 99 residences within the study area (6 per cent) the worst case exceedance of the NML would be between 15-25 dB(A). At such times of peak impact, construction noise would be moderately intrusive
• At 73 residences within the study area (4 per cent) the worst case exceedance may be more than 25 dB(A). At such times of peak impact, construction noise would be highly intrusive
• Noise from the ancillary facilities (in isolation of noise from any other mainline works) may give rise to exceedances of the NML at up to 539 residences when nearby facilities are operating at peak capacity. The NML exceedance is predicted to be greater than 15 dB(A) at 31 of these residences.

Exceedances of the sleep disturbance screening criterion are predicted to be highest from paving works and for residences within NCAs 2, 3 and 5.

Over all NCAs, 87 residences may be exposed to exceedances of more than 15 dB(A) and 22 residences would be subject to exceedances of more than 25 dB(A) above the sleep disturbance screening criterion when paving works are most adjacent to those receivers.

Over all NCAs, noise from ancillary facilities alone may give rise to exceedances of the sleep disturbance criterion within 225 residences.

Exceedances of the NML from standard hours works are predicted at the following non-residential receivers within the study area. The noise levels reported relate to periods when works are nearest to the subject site:

• Power Station - minor exceedances of up to 2 dB(A)
• Horse N Around – moderate exceedances of up to 11 dB(A) at the most affected building
• Shell Service Station – moderate exceedances of up to 17 dB(A)
• IGA Luddenham – moderate exceedances of up to 12 dB(A)
• Luddenham Public School - minor exceedances of up to 4 dB(A)
• St James Anglican Church - moderate exceedances of up to 11 dB(A)
• Luddenham Uniting Church – minor exceedances of up to 2 dB(A).

As noted in the draft EIS, the construction contractor may develop different NMLs, construction scenarios, timings, offset distances, equipment and concurrent / overlapping activities. The construction impacts in this case will likely be different to the impacts assessed as part of this Final EIS. In all cases, during the detailed design stages, the construction contractor will be responsible for re-assessing all construction noise and vibration impacts in accordance with the ICNG and CNVG and providing a detailed CNVMP, which describes the construction impacts and the necessary noise, vibration and management mitigation measures which will be implemented throughout the project. The CNVMP will also reference the project specific Environmental Protection Licence (EPL) which may require specific mitigation measures.

Construction traffic noise impact

The assessment of predicted noise impacts as a result of construction traffic have been detailed in Appendix H of the draft EIS. This was based on the volumes of construction traffic predicted to be generated by the project as outlined in Section 7.1 of the draft EIS. It is noted that the project’s construction traffic would access construction sites using only designated heavy vehicle routes such as the M4 Motorway, Elizabeth Drive and The Northern Road. In summary, the draft EIS identified that construction traffic would not increase existing traffic noise levels by more than 2dB, and therefore no further assessment of construction traffic noise impacts was required.
Construction vibration

Vibration from the project’s construction processes could potentially impact humans, buildings or other vibration-sensitive ‘special uses’ such as medical imaging or electronics facilities. All non-residential uses (including commercial properties) were assessed to be sufficiently well removed from the project such that no impact as a result of vibration is predicted. Residential receivers are the only type of receiver within the study area identified in the draft EIS as being potentially affected by construction vibration.

Safe work distances are presented in Table 7-33 of the draft EIS. The structural damage criteria were assessed as being complied with where vibratory rolling or rock breaking is operated not closer than 22 m from any dwelling or sensitive structure. Impact piling required for bridge works is expected to occur not closer than 190 m to the nearest residence, and so, is not predicted to cause structural damage.

Vibratory rolling is expected to be carried out within 100 m of residences (for various stages of works) and so may impact human comfort within those residences. In these cases, the procedures outlined in Appendix C of the CNVG are to be followed in order to mitigate any such potential impacts. These measures include notification strategies, vibration monitoring, offering of periods of respite and offering of alternative accommodation.

Table 7-34 of the draft EIS provides an indicative number of vibration-sensitive receivers expected to be situated within the 22 m (preservation of structural integrity of buildings) and 100 m (protection of human comfort) safe working distances. As noted in the draft EIS, the precise location of vibration-intensive works and the final section of plant would need to be confirmed during detailed design.

Operational impacts

In accordance with the RNP, the following four scenarios were modelled as part of the draft EIS, where 2021 is taken to be the year of opening of The Northern Road project:

- Year of Opening – 2021, No Build (Do Nothing)
- Year of Opening – 2021, Build
- 10 Years after Opening – 2031, No Build (Do Nothing)
- 10 Years after Opening – 2031, Build.

Each of these scenarios was modelled for both daytime (7am-10pm) and night-time (10pm-7am) periods.

Detailed predictions of the project’s operational noise at each receiver within the operational noise assessment area is presented in Appendix H of the draft EIS. A summary is presented in the draft EIS as follows:

- Most receivers in the study area are expected to experience some increase in traffic noise. For receivers close to the alignment, the increase may result in an exceedance of the operational noise criteria
- The receivers expected to be subject to the greatest increase in traffic noise are the:
  - semi-rural receivers adjacent to the new bypass alignment in the vicinity of Willowdene Avenue
  - semi-rural receivers located near either the bypass’ northern or southern junctions with the existing The Northern Road. These receivers will have noise exposure to both the existing Northern Road and the new bypass.
- Operational noise mitigation is not required for 1026 receivers (93 per cent of all receivers) within the study area
- There are 77 receivers (74 unique buildings) which qualify for consideration of noise mitigation. All triggering receivers are residences other than three classroom buildings at
Luddenham Public School. These 77 mitigation-qualifying receivers are shown in Appendix H

- With reference to the mitigation qualification triggers, of these 77 receivers:
  - none were triggered by the cumulative limit (alone)
  - 34 were triggered by the “Build minus No Build > 2 dB(A)” test (only), and
  - 43 receivers were triggered due to a combination of both triggers
  - no receivers were identified as acute alone (in absence of other triggers).

The preferred operational noise mitigation options for these receivers were considered in order of preference of application given in the RNP as follows:

- Low noise pavement surfaces
- Noise mounds
- Noise walls
- At-property treatments.

It was identified in the draft EIS that at-property treatments would be the most reasonable form of noise mitigation for these eligible receivers.

The draft EIS identified six of these receivers as being located on Commonwealth land, including five receivers located on Commonwealth owned land at the planned Western Sydney Airport site and one receiver located on Commonwealth land located west of Willowdene Avenue (these are shown in Appendix B of this Final EIS).

Implications of the revised design on the project

As outlined in section 4.2, there have been a number of design refinements since exhibition of the draft EIS for the project which have resulted in minor changes to the project’s horizontal and vertical alignments. These changes have the potential to alter some of the operational noise predictions presented in the draft EIS, and the associated number of receivers identified as qualifying for consideration of noise mitigation.

An assessment has been carried out to identify additional receivers that would potentially qualify for consideration of noise mitigation as a result of these design refinements (in addition to the 77 mitigation-eligible receivers identified in the draft EIS). The results of the technical assessment are presented in Appendix B.

In summary, one additional residential receiver (2778-2828 The Northern Rd, Luddenham) was identified as likely to qualify for consideration of noise mitigation, bringing the total to 78 receivers. Roads and Maritime carried out additional consultation with this property owner in December 2017 to inform them of the outcomes of the assessment. This receiver is not located on Commonwealth land therefore the impacts specific to the environment of Commonwealth land remain unchanged from what was presented in the draft EIS. As identified in the draft EIS, further assessment and verification of noise impacts and any additional mitigation measures would be determined post-construction.

The potential construction noise and vibration impacts due to the proposed design refinements have also been considered as part of this assessment. Overall construction related noise and vibration impacts associated with the design refinements for the project are considered consistent with those presented in the draft EIS. This is due to the fact that, in general, the design refinements have only marginally altered the horizontal alignment when compared to the draft EIS design. Additionally, construction plant and equipment and haulage routes would be the same as outlined in the draft EIS. Further information regarding potential worst case noise impacts, out of hours works and the application of standard and additional mitigation measures as outlined in Roads and Maritime’s CNVG (2016) is presented in Appendix A, to support the response to submissions in section 2.6.
Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6, including new or revised measures as identified in this Final EIS as follows:

- Vibration monitoring would be undertaken for works in the vicinity of the Warragamba Dam pipeline
- Safe working distances for vibration intensive plant to be adopted in proximity to the Warragamba Dam pipeline
- Hoarding (2.4 metres) to be installed at the perimeter of all ancillary facilities except where it can be justified that the acoustic benefit of the hoarding is not warranted
- Haulage routes will be located as far away as possible from residential receivers, where this is reasonable and feasible
- Where it has been identified as necessary (e.g., in response to community complaints), noise monitoring will be undertaken to check that the noise mitigation measures are effective
- Static noise sources, such as generators, pumps, and lighting towers, will be located as far as possible from sensitive receivers
- Loading and unloading will be carried out away from sensitive receivers, where practicable
- Ensure all deliveries occur during standard construction hours where reasonable and feasible.

Where possible, the project has been designed and planned to avoid and minimise construction and operational noise and vibration impacts. Despite this, noise and vibration impacts would occur during construction of the project, and road traffic noise impacts would occur during operation.

Noise management throughout construction of the project would aim to achieve the NMLs throughout the alignment. Where these cannot be satisfied, construction noise impacts will be mitigated using reasonable and feasible noise and management mitigation measures as per the ICNG and CNVG.

A CNVMP would be prepared during the detailed design stage of the project and applied to all construction processes throughout the project. The CNVMP would be developed in accordance with the relevant guidelines and would include the application of feasible and reasonable measures to mitigate construction noise and vibration.

5.1.3 Biodiversity

Section 7.3 of the draft EIS provides an assessment of potential impacts to terrestrial and aquatic biodiversity from construction and operation of the project and recommends environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Biodiversity Assessment Report (BAR) (Appendix I), of the draft EIS informs the assessment. The working paper includes the Biodiversity Offset Strategy (BOS) for the project. This assessment is also informed by Appendix C of this Final EIS, Technical Memorandum: Biodiversity.

Assessment approach

Section 7.3.1 of the draft EIS outlines the assessment approach used in assessing the construction and operational impacts of the project.

The biodiversity assessment was completed in accordance with the requirements specified by the SEARs and Commonwealth EIS Guidelines. The SEARs state that biodiversity impacts related to the proposed development including terrestrial and aquatic ecology, and riparian corridors, are to be assessed in accordance with the Framework for Biodiversity Assessment (FBA) unless
otherwise agreed by OEH, and the Policy and Guidelines for Fish Habitat Conservation And Management—Update 2013 (NSW Department of Primary Industries 2013). This includes a requirement for a BAR and a BOS to be developed. Additionally, the FBA requires proponents to identify and assess the impacts on all nationally listed threatened species and ecological communities. The Commonwealth EIS guidelines outline the specific assessment requirements for matters of national environmental significance, impacts to the environment of Commonwealth land and content of the draft EIS.

Potential impacts to biodiversity not considered by the FBA are also addressed in the BAR. This includes aquatic biodiversity, habitat fragmentation (i.e., the physical dividing up of once continuous habitats into separate smaller ‘fragments’), edge effects (i.e., changes in environmental conditions such as altered light levels, wind speed, temperature that occur along the edges of habitats), injury and mortality to fauna, invasion and spread of weeds, and noise, vibration, and dust impacts.

The BAR incorporated the results of desktop assessment and field surveys.

As outlined in section 4.2, there have been a number of design refinements to the project since exhibition of the draft EIS which have resulted in changes to the project’s construction footprint. This has affected the calculated direct impacts of the project as assessed within the BAR and corresponding information presented in section 7.3 of the draft EIS.

A revised assessment of the impacts under the FBA has been carried out including recalculation of landscape values, impacts to native vegetation (including threatened ecological communities), impacts to threatened species, and impacts to MNES, including impacts to the environment of commonwealth land. This included an additional field survey.

The assessment is presented in Appendix C (Technical Memorandum – Biodiversity) and includes both the assessment of project changes as well as response to submissions relevant to biodiversity. A summary of the revised impacts of the project is presented below, with comparison against the results presented in the BAR and section 7.3 of the draft EIS.

**Existing environment**

**Landscape scale biodiversity features**

As identified in Table 7-41 of the draft EIS, a number of landscape features were identified for the project in accordance with Chapter 4 of the FBA such as the Interim Biogeographic Regionalisation for Australia (IBRA) region and sub-region, Mitchell landscape, rivers and streams, and extent of native vegetation cover before and after construction of the project.

As the project is a linear shaped development, biodiversity landscape values were also assessed according to Appendix 5 of the FBA as summarised in Table 7-42 of the draft EIS.

Alteration to the proposed construction footprint has resulted in the need for recalculation of landscape value components including the percent extent of native vegetation cover in the landscape and the area to perimeter ratio. The connectivity value and patch size calculations remain valid with the design change therefore recalculation of these values was not required. The results are presented in Appendix C.

Table 5-2 provides a summary of the revised landscape component scores based on the revised construction footprint (refined design) assessed against the draft EIS design.
Table 5-2 Summary of the revised landscape component scores for the project

<table>
<thead>
<tr>
<th>Threatened species</th>
<th>EIS design</th>
<th>Refined design</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score for per cent native vegetation cover</td>
<td>1.25</td>
<td>0</td>
<td>Slight reduction</td>
</tr>
<tr>
<td>Score for connectivity value class</td>
<td>2.5</td>
<td>2.5</td>
<td>No change</td>
</tr>
<tr>
<td>Area / perimeter ratio score</td>
<td>1</td>
<td>2</td>
<td>Slight increase</td>
</tr>
<tr>
<td>Average patch size score</td>
<td>12.5</td>
<td>12.5</td>
<td>No change</td>
</tr>
</tbody>
</table>

The landscape value score as determined by the BioBanking credit calculator is 17, similar to that previously assessed in the BAR in which the landscape value score was calculated as 17.25.

Native vegetation

The extent of native vegetation within the study area was initially mapped in GIS using digital aerial photography to identify plant community types (PCTs) for the project. These PCTs were verified and refined through the field surveys. In total, five PCTs were identified for the project as described in Table 7-43 of the draft EIS, including:

- PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 850: Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
- PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- PCT 806: Derived grasslands on shale hills of the Cumberland Plain (50-300 m asl)*
- PCT 1071: *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion.

*As outlined in the response to OEH’s submission in Section 3.14.1, PCT 806 ‘Derived grasslands on shale hills of the Cumberland Plain (50-300m asl)’ has been reassigned to PCT 850 ‘Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion’ as reflected in the revised assessment included in Appendix C and summarised in the revised impact assessment below.

The condition of these PCTs was assessed in accordance with Chapter 5 of the FBA and classified into vegetation zones based on areas of native vegetation with the same PCT and of a similar broad condition state. A total of ten vegetation zones were identified for the project as outlined in Table 7-44 of the draft EIS.

Groundwater dependent ecosystems

As identified in Section 7.3.2 of the draft EIS, no high probability groundwater dependent ecosystems (GDEs) are mapped within or near the study area. However, PCT 850 and PCT 849 are identified as having a high probability of being a GDE. Additionally, PCT 835 is considered by to be a high probability groundwater dependent wetland community (Kuginis et al, 2012).

All PCTs within the project were identified in the draft EIS as being unlikely to be GDEs given their location in the landscape. Additionally, the majority of watercourses within the study area are ephemeral and most flow events occur in direct response to major rainfall. These systems are not considered to support GDEs (Serov et al. 2012). There is no evidence of base-flow feeding any of
the streams within the study area. As such, none of the riparian zones within the study area are considered to be GDEs.

**Threatened ecological communities**

The field survey for the draft EIS identified two TECs listed under the TSC Act as being located within the project, as identified in Table 7-45 and Figure 7-9 of the draft EIS as follows:

- Cumberland Plain Woodland in the Sydney Basin Bioregion – critically endangered (PCTs 849, 850)
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – endangered (PCT 835).

The field survey for the draft EIS identified one TEC listed under the EPBC Act, as being located within the project, as identified in Table 7-45 and Figure 7-9 of the draft EIS as follows:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – critically endangered (PCTs 849, 850):

In accordance with the condition criteria provided in the Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Threatened Species Scientific Committee 2009), the draft EIS identified two categories of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest located within the project as follows:

- 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.

**Threatened flora species**

The field surveys for the draft EIS recorded one threatened flora species as follows:

- *Pultenaea parviflora* (listed as endangered under the TSC Act and vulnerable under the EPBC Act). Four *Pultenaea parviflora* plants were recorded across three areas in two locations within the western road reserve of The Northern Road and along Kings Hill Road.

The field surveys for the draft EIS recorded one endangered population listed under the TSC Act as follows:

- *Marsdenia viridiflora* subsp. *viridiflora* in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas. This endangered population was recorded in four locations (all relatively disturbed) adjacent to the current The Northern Road alignment (two locations on the fence of the DEOH, and roadside vegetation adjacent to 2509 The Northern Road, and 2627 The Northern Road).

**Threatened fauna species**

Database searches and desktop review as part of the draft EIS identified 51 threatened fauna species listed under the TSC Act, including 20 listed under the EPBC Act, within a 10 km search radius around the project study area as outlined in Table 7-48 of the draft EIS. Habitat assessment during preparation of the draft EIS confirmed the presence of potential habitat for 24 of these species.

The following threatened fauna species were recorded in the study area for the project as identified in the draft EIS as follows:
The Cumberland Plain Land Snail was recorded in the form of live snails and shells which were found in a variety of habitats.

Three threatened insectivorous bats were recorded via Anabat as follows:
- Eastern Bentwing-bat
- Eastern False Pipistrelle
- Eastern Freetail-bat

The Grey-headed Flying-fox was recorded in one location on private property off Willowdene Avenue during spotlight surveys.

No other threatened fauna species were recorded during the surveys. However, the following species listed under the EPBC Act are considered moderately likely to occur:

- The Regent Honeyeater is considered moderately likely to occur in the study area based on the presence of suitable foraging habitat.
- The Swift Parrot is considered moderately likely to occur in the study area during winter based on the presence of suitable foraging habitat and recent records near to the study area.
- A population of the Large-eared Pied Bat is considered moderately likely to utilise the study area due to the proximity of the foraging habitat to the lower Blue Mountains and recent records of the species from the locality (i.e. from Mulgoa Nature Reserve).

Aquatic biodiversity

The project directly traverses Badgerys Creek and Cosgrove Creek. There are a number of other unnamed tributaries/drainage lines and farm dams traversed by the project, with the Nepean River as the downstream receiving environment to the project area.

As identified in the draft EIS, no protected or threatened fish species are considered likely to occur within the study area due to the limited water and aquatic habitat present.

Fish habitat classification criteria for watercourses in the project area and recommended crossings types are provided in Table 7-50 of the draft EIS.

No watercourse crossings have been mapped as Key Fish Habitat by DPI Water (2007), however five waterway crossings in the study area have been identified as Type 1 – Key Fish Habitats (DPI, 2013), as they contain a combination of native aquatic plants and/or woody snags. These watercourses are impacted, intermittently flowing waterways which are also identified as Class 2 – Moderate Key Fish Habitat (Fairfull & Witheridge, 2003) due to the presence of limited in stream aquatic vegetation. These are shown as key waterways in Figure 8-6 of the draft EIS and replicated in Figure 5-4 of this Final EIS. Also refer to Section 5.1.3.

Listed migratory species

No migratory species listed under the EPBC Act were recorded during the targeted bird surveys as part of the draft EIS. However, the Latham’s Snipe was recorded opportunistically in the study area on three occasions, all in an area of flooded grassland on the DEOH site. 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.

The Cattle Egret was observed repeatedly in paddocks throughout the study area and broader locality as identified in the draft EIS. The Great Egret is also considered moderately likely to occur in the wetlands throughout the study area. The White-throated Needletail and Fork-tailed Swift are considered likely to fly over the study area during migration.
Revised impact assessment

Assessment of potential impacts

Removal of native vegetation

The potential loss of vegetation and habitat associated with the revised construction footprint for the project has been assessed in Appendix C, and summarised in Table 5-3. In summary, the revised construction footprint would impact on up to about 40.79 ha of native vegetation. This is a decrease of 3.50 ha when compared to the assessment of the draft EIS design.

Removal of TSC Act listed threatened ecological communities

Based on the refined design, the overall impact to the critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community has reduced by 2.96 ha. The impact to the River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions endangered ecological community has been reduced by 0.43 ha.

Table 5-3 Revised impacts to native vegetation (assessed under the FBA)

<table>
<thead>
<tr>
<th>Vegetation zone</th>
<th>PCT</th>
<th>Condition</th>
<th>Status (TSC Act)</th>
<th>Impact (ha) - EIS design</th>
<th>Impact (ha) - refined design</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>6.67</td>
<td>5.38</td>
<td>1.29 ha reduction</td>
</tr>
<tr>
<td>2</td>
<td>Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good</td>
<td>EEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</td>
<td>2.53</td>
<td>2.43</td>
<td>0.1 ha reduction</td>
</tr>
<tr>
<td>3</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>4.92</td>
<td>4.92</td>
<td>No change</td>
</tr>
<tr>
<td>4*</td>
<td>Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good_Poor</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>4.68</td>
<td>4.30</td>
<td>0.38 ha reduction</td>
</tr>
<tr>
<td>5</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good_Poor</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>3.21</td>
<td>3.11</td>
<td>0.1 ha reduction</td>
</tr>
</tbody>
</table>
### Vegetation zone

<table>
<thead>
<tr>
<th>Vegetation zone</th>
<th>PCT</th>
<th>Condition</th>
<th>Status (TSC Act)</th>
<th>Impact (ha) - EIS design</th>
<th>Impact (ha) - refined design</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/Good_Poor</td>
<td>EEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</td>
<td>1.76</td>
<td>1.43</td>
<td>0.33 ha reduction</td>
</tr>
<tr>
<td>7</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/Good_High</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>1.25</td>
<td>1.37</td>
<td>0.12 ha increase</td>
</tr>
<tr>
<td>8</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/Good_Derived grassland</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>12.01</td>
<td>10.81</td>
<td>1.2 ha reduction</td>
</tr>
<tr>
<td>9</td>
<td><em>Phragmites australis</em> and <em>Typha orientalis</em> coastal freshwater wetlands of the Sydney Basin Bioregion</td>
<td>Moderate/Good_Other</td>
<td>-</td>
<td>6.17</td>
<td>6.05</td>
<td>0.12 ha reduction</td>
</tr>
<tr>
<td>10</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/Good_Medium</td>
<td>CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>1.09</td>
<td>0.98</td>
<td>0.11 ha reduction</td>
</tr>
</tbody>
</table>

**Totals**: 44.29 - 40.79 - 3.50 ha reduction

*Note: * = The impacts to Vegetation Zone 4 have been included in Table 5-3 to provide an overview and comparison of impacts to native vegetation. Due to the manual override of the ‘Number of Trees with Hollows’ and ‘Fallen Logs’ for HN528, Vegetation Zone 4 now has a site score of 29.17 and requires an offset to be calculated. A discussion on biodiversity impacts is included below.

#### Removal of EPBC Act listed threatened ecological communities

The assessment of impacts based on the draft EIS design identified that the project would result in the direct clearing of about 16.37 ha of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. After detailed design, this impact has been reduced by 1.29 ha to 15.08 ha (refer to Table 5-4).
Table 5-4 Summary of impacts to the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community

<table>
<thead>
<tr>
<th>Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest condition category</th>
<th>EIS design impact (ha)</th>
<th>Refined design impact (ha)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category A (core)</td>
<td>10.69</td>
<td>9.99</td>
<td>0.70 ha reduction</td>
</tr>
<tr>
<td>Category C</td>
<td>1.47</td>
<td>1.50</td>
<td>0.03 ha increase</td>
</tr>
<tr>
<td>Category C Derived Native Grassland</td>
<td>4.21</td>
<td>3.59</td>
<td>0.62 ha reduction</td>
</tr>
<tr>
<td>Total</td>
<td>16.37</td>
<td>15.08</td>
<td>1.29 ha reduction</td>
</tr>
</tbody>
</table>

Removal of threatened plants

The draft EIS identified that the project would impact the following threatened plant species and endangered population:

- *Pultenaea parviflora* (Endangered – TSC Act)

The impact to these plants has been recalculated based on the refined design. The revised calculations also incorporate the results of an additional targeted survey conducted for *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* and other threatened plants around the Vineyard Road extension on the 7 August 2017. This was to account for the construction footprint changes at this location. Additionally, as stated in the BAR, this area was not able to be accessed during the fieldwork carried out for the original assessment therefore additional survey was required at this location following design refinements. The survey located a further six *Pultenaea parviflora* plants (two of which were in the construction footprint, and four outside of the footprint). No additional *Marsdenia viridiflora* subsp. *viridiflora* were recorded (refer to Figure 5-1).

The draft EIS construction footprint contained (and therefore would have removed) all known individuals and habitat for the *Marsdenia viridiflora* subsp. *viridiflora* endangered population in the study area. The refined design has resulted in the avoidance of four *Marsdenia viridiflora* subsp. *viridiflora* plants in the area of the DEOH fence between Kings Hill Road and Longview Road (see Figure 5-2). There is no requirement to impact on the location of these plants and exclusion zones would be established around the plants during construction in accordance with standard Roads and Maritime procedure. This reduces the overall impact to 31 individuals.

The draft EIS construction footprint contained (and therefore would have removed) all known *Pultenaea parviflora* plants within the draft EIS design footprint as well as the two additional plants recorded in the Vineyard Road extension during the August 2017 survey (six *Pultenaea parviflora* plants in total). The August 2017 survey of the Vineyard Road extension recorded six additional *Pultenaea parviflora* plants of which four are outside of the construction footprint. The impact assessed in the draft EIS was to four *Pultenaea parviflora* plants because the extent of habitat along the Vineyard Road extension was unable to be surveyed at the time. The overall impact to *Pultenaea parviflora* is now estimated at six plants.
Table 5-5 Summary of threatened plant species impacts from the refined design footprint

<table>
<thead>
<tr>
<th>Threatened species</th>
<th>Ecosystem or species credit species</th>
<th>Status</th>
<th>EIS impact</th>
<th>Refined design impact</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pultenaea parviflora</td>
<td>Species credit species</td>
<td>Endangered</td>
<td>4 individuals</td>
<td>6 individuals</td>
<td>2 additional plants to be impacted 4 additional plants avoided</td>
</tr>
<tr>
<td>Marsdenia viridiflora subsp. viridiflora – endangered population</td>
<td>Species credit species</td>
<td>Endangered population</td>
<td>35 individuals</td>
<td>31 individuals</td>
<td>4 individuals avoided</td>
</tr>
</tbody>
</table>
Figure 5-1  Additional targeted survey for Pultenaea parviflora and Marsdenia viridiflora subsp. viridiflora undertaken in the Vineyard Road extension
Figure 5-2 | Marsdenia viridiflora subsp. Viridiflora to be retained
Removal of threatened fauna species habitat and habitat features

Impacts to threatened fauna species habitat and habitat features have been recalculated based on the refined design as summarised in Table 5-6. Overall, based on the refined design, the project would have less impact on threatened fauna species habitat and habitat features than the design assessed as part of the draft EIS.

Table 5-6 Summary of threatened fauna species impacts from the refined design footprint

<table>
<thead>
<tr>
<th>Threatened species</th>
<th>Status</th>
<th>EIS design habitat impact (ha)</th>
<th>Refined design habitat impact (ha)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumberland Plain Land Snail</td>
<td>Endangered</td>
<td>13</td>
<td>12.40</td>
<td>0.60 ha avoided</td>
</tr>
<tr>
<td>Grey-headed Flying-fox</td>
<td>Vulnerable</td>
<td>26.25</td>
<td>24.10</td>
<td>2.15 ha avoided</td>
</tr>
<tr>
<td>Regent Honeyeater</td>
<td>Critically endangered</td>
<td>26.25</td>
<td>24.10</td>
<td>2.15 ha avoided</td>
</tr>
<tr>
<td>Swift Parrot</td>
<td>Endangered</td>
<td>26.25</td>
<td>24.10</td>
<td>2.15 ha avoided</td>
</tr>
<tr>
<td>Large-eared Pied Bat</td>
<td>Vulnerable</td>
<td>26.25</td>
<td>24.10</td>
<td>2.15 ha avoided</td>
</tr>
</tbody>
</table>

Impacts to habitat for EPBC listed migratory species

An assessment of significance pursuant to the *Matters of National Environmental Significance Significant Impact Guidelines 1.1* (Department of the Environment, 2013) was completed for recorded migratory species and those with a moderate or high likelihood of occurrence (refer to Appendix I of the draft EIS).

As identified in the draft EIS, habitat in the study area is not considered to comprise important habitat for the Latham’s Snipe or other potentially occurring migratory species. The draft EIS concluded that although the project is expected to result in the loss of occasional habitat for migratory species, but not important habitat, the proposed project is unlikely to result in a significant impact on migratory species listed under the EPBC Act.

Seasonal and temporal variation in impacts to threatened fauna species

As identified in the draft EIS, the direct impacts of the project during the Grey-headed Flying-fox breeding season is likely to be negligible. The foraging habitat to be impacted may be productive from winter to spring (based on the widely ranging flowering period of *Eucalyptus tereticornis* and *Eucalyptus moluccana* so the ability of the Grey-headed Flying-fox to forage in the area of impact would be impacted at this time. During some years conditions may not be suitable for foraging as the trees may not flower but it is not possible to predict when or whether this may occur. As such, there were no specific management measures identified in the draft EIS regarding seasonal impacts of key species, however, pre clearing surveys would be conducted to identify the presence of any species.
As identified in the draft EIS, the Regent Honeyeater may utilise habitat within the study area on occasion outside of the breeding season when birds disperse from core habitats (ie during winter). Likewise, the Swift Parrot would only be present on occasion in the habitat during winter (outside of the breeding season) when it migrates to mainland Australia from Tasmania. No direct impacts to these species would occur during the breeding season.

As identified in the draft EIS, 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. There are no maternity roosts in the study area. The main foraging period for males and females in the study area may be during autumn and winter (April to September) and the impact to this species would likely be most pronounced during this time.

Impact to aquatic biodiversity

As identified in the draft EIS, the construction of the project has the potential to impact aquatic ecosystems due to changes in water quality, habitat loss (eg the removal of large woody debris or snags) and instream barriers.

Many of the watercourses in the study area are artificial dams, situated in minor gullies which are either first or second order streams, and as such are not considered key fish habitat. Threatened species are unlikely to be present within these dams. However, there is a possibility that native and invasive fish species as well as freshwater turtles and eels have colonised these dams. Should dams or creeks be dewatered during the construction of the project, then native fish or aquatic fauna would need to be relocated in to a similar aquatic environment to which it was found by trained aquatic ecologists under a Fisheries Permit issued by the NSW DPI.

Overall, aquatic impacts during construction of the project would be short-term and managed through the implementation of appropriate management measures, including those for water quality (refer to Section 5.2.2).

Fragmentation of biodiversity links and habitat corridors

As outlined in section 2.7.5 of this Final EIS, the draft EIS acknowledged that the construction and operation of the project would create barrier effects that restrict fauna movement, particularly for fauna groups such as mammals, frogs, and reptiles. Mobile species such as birds and bats may not be affected to the same extent.

The draft EIS identified that the detailed design of culverts would ensure that barriers to fish are not created and associated long-term impacts to the existing hydrology are minimised. Additionally, in response to submissions, two fauna crossings have been included as part of the refined design of culverts at Badgerys Creek and Surveyors Creek crossings. Further details are provided in section 2.7.5, including cross sections of the proposed culverts incorporating fauna passage.

Edge effects on adjacent native vegetation and habitat

As identified in the draft EIS, many patches of vegetation within the project are small, irregularly shaped, and fragmented. As such, many areas of vegetation within and directly adjacent to the construction footprint are already subject to considerable edge effects. However, there is potential for a high magnitude residual impact to occur to some of the more intact habitats within the study area from edge effects (such as those off Willowdene Avenue). These impacts would be long-term.

Overall, new edge effects from the project are predicted to result in the modification of about 1.94 ha of vegetation that would remain at the edge of the project once construction is complete (based off a 50 metre edge effect buffer).

Injury and mortality of fauna (including vehicle strike)

Construction impacts

Fauna injury or death has the greatest potential to occur during vegetation clearing and the extent of this impact would be proportionate to the extent of vegetation that is cleared. Some mobile
species, such as birds, may be able to move away from the path of clearing and may not be greatly affected unless they are nesting. However, other species that are less mobile (e.g. ground dwelling reptiles), or those that are nocturnal and nest or roost in trees during the day (e.g. arboreal mammals and microchiropteran bat species), may find it difficult to move rapidly when disturbed. Common fauna species such as possums, reptiles and frogs are the most likely to be affected.

Entrapment of wildlife in any trenches that are dug is a possibility if the trenches are deep and steep sided. Wildlife may also become trapped in machinery that is stored in the study area overnight that may result in injury or death.

Operational impacts

There is potential for fauna mortality during the operational phase of the project through vehicle collision (i.e. roadkill). Mammals, reptiles, amphibians and birds would potentially be impacted by vehicle strike, particularly those common species (e.g. macropods) that are tolerant of disturbance and/or those species that can utilise roadways for movement pathways or as foraging habitat. The impact on threatened species however is expected to be minimal and, based on evidence from other arterial roads in the locality, most vehicle strike impacts can be expected to occur to common mammals such as possums and macropods and exotic animals including foxes.

Invasion and spread of weeds and pests

Construction impacts

As identified in the draft EIS, proliferation of weed and pest species is likely to occur during construction and the impacts would be greatest as a result of vegetation clearing during the construction phase. This impact has potential to have the greatest impact to the quality and integrity of TECs and threatened species habitat.

The most likely causes of weed dispersal and importation associated with the project include earthworks, movement of soil, and attachment of seed (and other propagules) to vehicles and machinery during all phases.

Project activities have the potential to disperse pest species such as rabbits out of the project footprint across the surrounding landscape as a result of habitat removal, noise, and human presence during construction and operation. In the context of the project this impact is predicted to be minimal.

The forests of southwest Sydney are currently experiencing ‘Bell miner associated dieback’ (also known as BMAD). This can lead to psyllid populations increasing to the extent that they cause substantial canopy damage. In western Sydney, *Eucalyptus moluccana* (Grey Box) trees appear to be the most affected, as is the case with the vegetation in the study area. ‘Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners’ is listed as a key threatening process under the TSC Act.

The project would involve vegetation removal and some localised fragmentation of local wildlife corridors between The Northern Road and Willowdene Avenue where some intact habitat patches would be broken apart. This could increase the prevalence and severity of BMAD in the locality due to increased fragmentation and removal of trees used as habitat by psyllids and Bell Miners. The magnitude of this impact is unknown and the potential extent and severity of any increased effects of BMAD cannot be quantified. The influence of the project on BMAD is however likely to be insignificant when compared to the broad scale clearing that has occurred in the past for agriculture and urban development. Additionally, the project would not interfere with the objectives or proposed actions as identified by the BMAD working group and outlined in the BMAD strategy, and would not interfere with any of the 10 priority actions identified to help recover species affected by BMAD (refer to Appendix I for further details).
Invasion and spread of pathogens and disease

Several pathogens known from NSW have potential to impact on biodiversity as a result their movement and infection during construction. Of these, three are listed as a key threatening process under either the EPBC Act and/or TSC Act including:

- Dieback caused by Phytophthora (Root Rot; EPBC Act and TSC Act)
- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis (EPBC Act and TSC Act)
- Introduction and establishment of exotic Rust Fungi of the order Pucciniales on plants of the family Myrtaceae (TSC Act).

While these pathogens were not observed or tested for in the study area the potential for pathogens to occur should be managed during construction. The most likely causes of pathogen dispersal and importation associated with the project include earthworks, movement of soil, and attachment of plant matter to vehicles and machinery during all project phases (construction and operation).

Operational impacts

Proliferation of weed and pest species is likely to occur during operation. The effects of proliferation of weed and pest species may not be experienced immediately or even in the short-term, however, would likely commence a few months after the construction phase commences and gradually increase over months and seasons as the project is operational resulting in potential long-term impacts.

Noise and vibration, light, dust and contaminants

Construction impacts

As identified in the draft EIS, some night works would be required during construction of the project which would potentially result in noise and vibration impacts to fauna and may disrupt foraging, reproductive, or movement behaviours. The impacts from noise emissions are likely to be localised to the construction areas and are not considered likely to have a significant, long-term, impact on wildlife populations. Additionally, night works would require the use of artificial lighting, essentially creating ‘daylight’ conditions. Ecological light pollution may potentially affect nocturnal fauna by interrupting their life cycle.

Dust pollution is likely to be greatest during periods of substantial earthworks, vegetation clearing, vehicle movements for construction and decommissioning activities and during adverse weather (such as high wind) conditions. However, deposition of dust on foliage is likely to be highly localised, intermittent, and temporary (particularly during the wet season) and is therefore not considered likely to be a major impact of the project.

During the construction phase localised release of contaminants (i.e. hydraulic fluids, oils, fluids, etc.) into the surrounding environment (including drainage lines) may accidentally occur. The most likely result of contaminant discharge will be the localised contamination of soil and potential direct physical trauma to flora and fauna that are exposed to contaminants.

Operational impacts

As identified in the draft EIS, there would be increased noise and vibration levels in the study area and immediate surrounds during operation as vehicles use the roadway. The noise and vibration from vehicles would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours. Within the area of impact, some sensitive species (e.g. woodland birds) may avoid the noise and some more tolerant species, including small mammals, would habituate over the longer-term.

During operation the roadside would be subject to artificial lighting, essentially creating permanent ‘daylight’ conditions. However, due to the frequency and sustained nature of the lighting, it is
unlikely that animals would habituate to the light disturbance and a long-term impact in the area of lighting is likely.

Dust is likely to be generated throughout the lifecycle of the project through vehicle movements and the greatest impacts during operation would be to vegetation directly adjacent to the road. The deposition of dust on foliage is likely to be highly localised, intermittent, and temporary (particularly during the wetter seasons) and is therefore considered unlikely to be a major impact of the project.

During operation the accidental release of contaminants is likely, which would potentially result in localised contamination of soil and potential direct physical trauma to flora and fauna that come into contact with contaminants. Similarly pollutant runoff during operation of the road would have the potential to impact on water quality, however this would be managed through the implementation of water quality vegetated swales and rock check dams (refer to Section 5.2.2 of this Final EIS) which have been assessed to sufficiently reduce and manage water quality impacts to sensitive receiving waters (ie Key Fish Habitat) during operation. Therefore impacts to aquatic habitat identified for the project are expected to be minimal.

Summary of impacts to the environment on Commonwealth land

The draft EIS provided a summary of potential impacts to the environment of Commonwealth land as a result of the project, including biodiversity impacts associated with clearing of vegetation on Commonwealth land. This has been recalculated based on the refined design construction footprint as summarised in Table 5-7. In summary, there would be a decrease in clearing of remnant native vegetation by about 0.88 ha. This incorporates a decrease in clearing of the Critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community by 0.80 ha.

Table 5-7 Revised impacts to vegetation on Commonwealth land

<table>
<thead>
<tr>
<th>Feature</th>
<th>Original impact</th>
<th>Revised impact after design refinements</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remnant native vegetation (excluding man-made dams)</td>
<td>13.34 ha</td>
<td>12.46 ha</td>
<td>0.88 ha decrease</td>
</tr>
<tr>
<td>Critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community</td>
<td>10.07 ha</td>
<td>9.27 ha</td>
<td>0.80 ha decrease</td>
</tr>
</tbody>
</table>

Further to this, a detailed breakdown of impacts to biodiversity on Commonwealth land and NSW state land is provided in Table 5-8 and Table 5-9 below.

Table 5-8 Revised impacts to biodiversity on Commonwealth land and NSW State land

<table>
<thead>
<tr>
<th>Feature</th>
<th>Impact on Commonwealth land</th>
<th>Impact on NSW State land</th>
<th>Total area impacted by refined design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native vegetation and threatened ecological communities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remnant native vegetation</td>
<td>16.35 ha</td>
<td>24.44 ha</td>
<td>40.79 ha</td>
</tr>
<tr>
<td>(12.46 ha excluding man-made dams)</td>
<td>(12.46 ha excluding man-made dams)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community</td>
<td>9.27 ha</td>
<td>5.81 ha</td>
<td>15.08 ha</td>
</tr>
<tr>
<td>Feature</td>
<td>Impact on Commonwealth land</td>
<td>Impact on NSW State land</td>
<td>Total area impacted by refined design</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Cumberland Plain Woodland in the Sydney Basin Bioregion</td>
<td>9.67 ha</td>
<td>21.2 ha</td>
<td>30.87 ha</td>
</tr>
<tr>
<td>River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</td>
<td>2.79 ha</td>
<td>1.07 ha</td>
<td>3.86 ha</td>
</tr>
</tbody>
</table>

**Species credit species (species that cannot be predicted by habitat surrogates)**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Impact on Commonwealth land</th>
<th>Impact on NSW State land</th>
<th>Total area impacted by refined design</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pultenaea parviflora</em></td>
<td>None</td>
<td>6 plants</td>
<td>6 plants</td>
</tr>
<tr>
<td><em>Marsdenia viridiflora</em> subsp. <em>viridiflora</em> – endangered population</td>
<td>13 plants on the perimeter fence</td>
<td>18 plants</td>
<td>31 plants</td>
</tr>
<tr>
<td>Cumberland Plain Land Snail</td>
<td>5.72 ha</td>
<td>6.68 ha</td>
<td>12.40 ha</td>
</tr>
<tr>
<td>Regent Honeyeater</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
</tbody>
</table>

**Ecosystem credit species (species that can be predicted by habitat surrogates)**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Impact on Commonwealth land</th>
<th>Impact on NSW State land</th>
<th>Total area impacted by refined design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Painted Snipe</td>
<td>3.89 ha</td>
<td>2.16</td>
<td>6.05 ha</td>
</tr>
<tr>
<td>Barking Owl</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Black-chinned Honeyeater (eastern subspecies)</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Diamond Firetail</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Eastern Bentwing-bat*</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Eastern False Pipistrelle</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Eastern Freetail-bat</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Flame Robin</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Gang-gang Cockatoo</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Greater Broad-nosed Bat</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Grey-headed Flying-fox*</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Little Eagle</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Little Lorikeet</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Masked Owl</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Painted Honeyeater</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Powerful Owl</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Scarlet Robin</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Speckled Warbler</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Spotted Harrier</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Square-tailed Kite</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Swift Parrot</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Varied Sittella</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Yellow-bellied Sheathtail-bat</td>
<td>9.34 ha</td>
<td>14.76 ha</td>
<td>24.10 ha</td>
</tr>
<tr>
<td>Vegetation zone</td>
<td>PCT</td>
<td>Condition</td>
<td>Area impacted on Commonwealth land (ha)</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good</td>
<td>2.19</td>
</tr>
<tr>
<td>2</td>
<td>Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good</td>
<td>1.94</td>
</tr>
<tr>
<td>3</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good</td>
<td>2.18</td>
</tr>
<tr>
<td>4*</td>
<td>Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good_Poor</td>
<td>0.72</td>
</tr>
<tr>
<td>5</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good_Poor</td>
<td>0.15</td>
</tr>
<tr>
<td>6</td>
<td>Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good_Poor</td>
<td>0.85</td>
</tr>
<tr>
<td>7</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good_High</td>
<td>0.24</td>
</tr>
<tr>
<td>Vegetation zone</td>
<td>PCT</td>
<td>Condition</td>
<td>Area impacted on Commonwealth land (ha)</td>
</tr>
<tr>
<td>----------------</td>
<td>-----</td>
<td>-----------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>8</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/ Good-Derived grassland</td>
<td>3.20</td>
</tr>
<tr>
<td>9</td>
<td>Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion</td>
<td>Moderate/ Good_Other</td>
<td>3.89</td>
</tr>
<tr>
<td>10</td>
<td>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion</td>
<td>Moderate/Good_Medium</td>
<td>0.98</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>16.35</strong></td>
</tr>
</tbody>
</table>
**Biodiversity offsets**

Table 5-10 provides a summary of the biodiversity offset credits required for the project based on the refined design, including a comparison against the previous calculations prepared as part of the draft EIS.

The revised credit calculations take into account the amendments to the landscape assessment, altered areas of impact, avoidance of some threatened species impacts, amendment of some benchmark data in the BioBanking credit calculator, and reassignment of the Derived Native Grassland to HN 529 (PCT 850).

Table 5-10 Summary of biodiversity offset credits required

<table>
<thead>
<tr>
<th>Threatened ecological communities</th>
<th>Species credits required – draft EIS</th>
<th>Species credits required – revised design</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)</strong></td>
<td>178.00</td>
<td>160.54</td>
</tr>
<tr>
<td><strong>Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)</strong></td>
<td>307.00</td>
<td>346.77</td>
</tr>
<tr>
<td><strong>Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850)</strong></td>
<td>409.66</td>
<td>684.68*</td>
</tr>
<tr>
<td><strong>Phragmites australis and Typha orientalis coastal freshwater wetlands of the Sydney Basin Bioregion (PCT 1071)</strong></td>
<td>142.00</td>
<td>139.00</td>
</tr>
<tr>
<td><strong>Derived grasslands on shale hills of the Cumberland Plain (50-300 m asl) (PCT 806)</strong></td>
<td>223.39</td>
<td>.*</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,260</td>
<td>1,331</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Threatened species</th>
<th>Species credits required – draft EIS</th>
<th>Species credits required – revised design</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cumberland Plain Land Snail</strong></td>
<td>169</td>
<td>161</td>
</tr>
<tr>
<td><strong>Marsdenia viridiflora subsp. viridiflora - endangered population</strong></td>
<td>1,400</td>
<td>1,240</td>
</tr>
<tr>
<td><strong>Pultenaea parviflora</strong></td>
<td>60</td>
<td>90</td>
</tr>
<tr>
<td><strong>Regent Honeyeater</strong></td>
<td>2,021</td>
<td>1,856</td>
</tr>
</tbody>
</table>

Notes: * = Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion now includes the impact and credit requirement for Derived grasslands on shale hills of the Cumberland Plain (50-300m asl).
Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6. This includes a number of additional environmental management measures identified as a result of the revised assessment of impacts as outlined in this section, as well as in response to community and stakeholder submissions as outlined in Chapter 2 and Chapter 3.

Additional biodiversity measures for the project have been incorporated into the revised environmental management measures outlined in Chapter 6. In summary, the revised biodiversity management measures relate to:

- Ecologists and landscape architects will work together on the preparation of revegetation plans and specifications that clearly identify the locations of areas to be revegetated.
- Identified connectivity measures at Surveyors Creek and Badgerys Creek to be further considered during design in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (RMS in prep). In particular, design where connectivity has been considered is to include culvert design, lighting and fencing.
- Exclusion zones would be established around *Marsdenia viridiflora* subsp. *viridiflora* plants proposed to be retained in the area of the DEOH fence between Kings Hill Road and Longview Road, in accordance with standard Roads and Maritime procedure.
- Exclusion zones would be established around the four *Pultenaea parviflora* plants to be retained in the area of the Vineyard Road extension in accordance with Roads and Maritime procedure.
- Roads and Maritime will investigate options for salvage of genetic material and/or translocation of *Marsdenia viridiflora* subsp. *viridiflora* and *Pultenaea parviflora* plants that are to be impacted prior to construction.
- A Vegetation Management Plan (VMP) would be prepared in consultation with DPI Water.
- All works on waterfront land would be carried out in accordance with the DPI Water Guidelines for Controlled Activities on Waterfront Land (2012).
- Roads and Maritime would consider reuse of topsoil as part of the Urban Design Landscape Plan (UDLP) for the project.
- Roads and Maritime would consider transplanting native species from areas to be cleared into revegetation areas, depending on the type of species being removed and the likely success of transplanting. Plants to be used in revegetation would be sourced from local provenance seed where appropriate and available, and associated seed collection would be undertaken prior to clearing.
- Rehabilitation of the disturbed areas of the site would be undertaken in accordance with Roads and Maritime Batter Stabilisation Guidelines and Roads and Maritime contractor specifications.
- Offsets requirements (including Biobanking credits and additional supplementary measures) would be delivered in accordance with a Biodiversity Offset Strategy and supplementary measures package for the project in consultation with OEH and DOEE.

5.1.4 Socio-economic and land use

Section 7.4 of the draft EIS outlines the socio-economic values of the study area and identifies the potential impacts to these values as a result of the construction and operation of the project, as well as nominated environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Socio-economic Assessment (Appendix J), of the draft EIS informs the assessment.
Assessment approach

The socio-economic impact assessment outlined in the draft EIS involved a process of analysing, monitoring and managing the intended and unintended social and economic impacts, both positive and negative, of the project. It involved identifying, assessing and evaluating changes to or impacts on, communities, business and industry that are likely to occur as a result of the project, in order to mitigate or manage impacts and maximise benefits. The assessment was developed in accordance with the Roads and Maritime Environmental Impact Assessment Practice Note N05 – Socio-economic assessment and to address socio-economic matters outlined in the SEARs and the economic and social matters identified in the Commonwealth EIS Guidelines.

The information sources used in carrying out the assessment comprise ABS Census Data and previous assessments. A complete list of information sources used in the assessment is provided in the working paper. Additional surveys have also been used to gather further information to assist the assessment. The outcomes of consultation and key stakeholders including local communities, business representatives, local government officers and community service providers informed the assessment.

The study area for the assessment included the Australian Bureau of Statistics (ABS) Statistical Areas Level 2 (SA2) geographies of:

- Glenmore Park-Regentville SA2 (referred to as Glenmore Park-Regentville)
- Mulgoa-Luddenham-Orchard Hills SA2 (referred to as Mulgoa-Luddenham-Orchard Hills)
- Badgerys Creek-Greendale SA (referred to as Badgerys Creek-Greendale).

It also considered at a broader level, regional impacts on communities and businesses in the Local Government Area’s (LGA) of Penrith City and Liverpool City as well as the wider Sydney region.

Economic appraisal of individual business impacts were not carried out as part of the socio-economic assessment in the draft EIS or this Final EIS.

Existing environment

Section 7.4.2 of the draft EIS describes the existing socio-economic characteristics and features of the study area to provide a baseline against which the project’s socio-economic impacts can be assessed. As outlined above, the existing environment (or baseline) has been derived from ABS Census 2011 data which is the most comprehensive dataset currently available. The data has been supplemented with more recent information from surveys or from previous assessments.

The existing environment outlined in the draft EIS includes information on land use and land use zoning, population and housing, the economy, community values, social infrastructure and transport and access. The economic environment of the study area is also described including information on existing businesses along The Northern Road, within Luddenham and agri-business that could be impacted by the project. This is summarised below.

Property and land use

The project extends from the Liverpool LGA in the south to Penrith LGA in the north and west. Land use zones within the study area are shown in Figure 7-12 of the draft EIS. In summary, the project comprises predominantly agricultural land uses that vary in their scale and intensity, from small-scale market gardens and hobby farms to capital-intensive agribusiness developments such as the Leppington Pastoral Company. Rural use zones generally cover the southern part of the study area, mainly south of the WaterNSW Supply Pipelines, including the rural village of Luddenham. Residential zones are mainly located at Bringelly, Luddenham and Glenmore Park.

There is also some land zoned for special purposes including the DEOH site in the northern end of the study area and the site of the Western Sydney Airport to the south, both located on Commonwealth owned land.
Other land use zones within the study area include infrastructure associated with the existing The Northern Road corridor and the WaterNSW supply pipelines, environmental conservation and management areas, business and recreation zones.

**Social environment**

Over the 10 years to 2015, the population of the study area grew by about 6,559 people, an average of about 1.7 per cent per annum. Population growth in the region is expected to continue, focused in the Western and Southern Sydney Priority Growth Areas, and around the Western Sydney Airport.

The demonstrated relatively low levels of population mobility in the study area, particularly Mulgoa-Luddenham-Orchard Hills, demonstrates a stable community and is likely to reflect the rural nature of the area.

At the 2011 Census, the study area exhibited overall higher levels of home ownership, lower levels of residential tenancy (i.e. rentals), and lower levels of public housing occupancy than the respective NSW averages. Housing costs in the study area are relatively high, with median weekly rent and monthly mortgage costs above the NSW average. Further detail on housing costs and tenure are summarised in Table 7-57 of the draft EIS.

**Community values**

Community values include those values held as important to residents for quality of life and well-being. Community values are heavily influenced by the local amenity and character in the study area particularly agriculture, rural residents and local towns such as Luddenham and Mulgoa. Community values are further outlined in the draft EIS.

The study area has undergone change in recent decades, with the increasing urban development and development of residential estates such as Glenmore Park. These areas offer residents a range of urban residential uses, as well as access to open space, recreation and conservation areas. The development of a Western Sydney Airport is also likely to drive further growth in urban development in the study area and wider region over the coming years.

**Social infrastructure**

The study area includes a range of community facilities and services catering for communities in the study area and surrounding region. These facilities and services include churches, cultural facilities, community centres, educational facilities and schools, child care centres, emergency services, and sport, recreation and leisure facilities. Those facilities which are located near the project and which could be potentially impacted are described in Table 7-58 of the draft EIS.

**Socio-economic disadvantage and need for assistance**

A community’s level of socio-economic disadvantage may influence the ability of that community to cope with or respond to changes. The ABS produces a range of indices that indicate relative levels of socio-economic advantage and disadvantage.

In relation to the study area, communities in the southern part of the study area, south of Elizabeth Drive, generally demonstrate higher levels of relative disadvantage compared with communities in the northern part of the study area.

Overall the study area generally had levels of people needing assistance below the Penrith and Liverpool LGAs and NSW averages.

**Transport and access**

The study area is serviced by a range of transport infrastructure and facilities, including major roads, public transport and active transport. This includes the existing The Northern Road which is a key north–south connection and provides an important radial connection across western Sydney for residents, business and industry. Right turn access is currently provided to/from properties fronting The Northern Road and at intersections with The Northern Road.
In 2011, car travel was the predominant mode of travel to work for residents in the study area, with about 74.3 per cent of people aged 15 years or over using the car for all or part of their journey to work.

The study area is also serviced by a number of bus routes, of which only one currently operates along The Northern Road between Mersey Road and Glenmore Parkway; Route 789 which connects Penrith to Luddenham. A number of school bus routes also connect to schools within the study area, some of which use The Northern Road for part of the route.

Public transport was used for travel to work by about 7.3 per cent of people in the study area aged 15 years or over. This was well below the NSW average and is likely to reflect the limited public transport access in parts of the study area.

Existing pedestrian and cyclist facilities along The Northern Road are limited. Between Glenmore Parkway and the M4 Motorway, there is a short, isolated section of road shoulder along The Northern Road that is marked for cycle use. Other pedestrian or cycle facilities along The Northern Road are generally located within Luddenham.

About 1.7 per cent of people in the study area aged 15 years or over walked or cycled to work, which was below the NSW average (at 4.8 per cent). This is likely to reflect the more rural nature of the study area and distance to employment centres.

**Economic environment**

In 2011, income levels varied across the study area, with higher median incomes for the study area as a whole generally driven by very high incomes in Glenmore Park-Regentville. There were about 19,691 people in the study area aged 15 years or over who were either employed or looking for work at the 2011 Census. This represented a labour force participation rate of 69.2 per cent, which was above the NSW average. The study area had a relatively low rate of unemployment, with 3.9 per cent of the study area’s labour force unemployed at the 2011 Census.

As identified in the draft EIS, there was about 338 agricultural businesses in the study area, of which about 129 businesses were farming livestock, and about 217 businesses were farming crops. The majority of these are considered to be small businesses employing less than 20 people. Agricultural enterprises that are making a substantial contribution to the study area’s agricultural output include dairies (Leppington Pastoral Company), poultry and egg farms (Inghams, Farm Pride Foods), pastoral and grazing farms. Smaller operations in the study area comprise enterprises such as nurseries, honey producers, market gardens (including vegetable growers) and producers of agricultural products (such as fertilisers).

There were 3,495 registered businesses in the study area in June 2015. Construction had the most businesses; accounting for about 27.2 per cent of all businesses in the study area. This was followed by transport, postal and warehousing (12.0 per cent); rental, hiring and real estate services (9.6 per cent); and agriculture, forestry and fishing (8.0 per cent). There were very few large businesses (greater than 200 employees) identified within the study area. These were manufacturing businesses located in the Badgerys Creek-Greendale area.

A range of businesses are located within Luddenham village that service the needs of local and regional communities. Business surveys conducted as part of the draft EIS identified that the majority of these businesses have operated within Luddenham for more than six years, with three businesses indicating that they have been operating in Luddenham for more than 20 years. Most Luddenham businesses employ up to about five people, with one indicating they employed 21-50 people. Most of the businesses surveyed indicated that they served a predominantly ‘local’ catchment within about 20 km of Luddenham. However, the surveys found that businesses within the town centre also attract some customers from across the greater Sydney area.

Currently, The Northern Road runs through the Luddenham town centre, where the majority of local businesses are located and provides a regular stream of passing trade, which was identified as important to a number of businesses surveyed. The existing business environment of the study area is expected to change over time due to such things as the development of the Western Sydney Airport and urban growth and development. This is likely to result in the diversification of
businesses within the study area and broader region and changes to existing businesses and industries. Increased population density around centres is also likely to drive demand for local services and changes to local business.

Main impacts as documented in the draft EIS

Construction impacts
Temporary leases of land would be required during construction to accommodate ancillary construction facilities such as worksites, compounds and laydown areas. Details of temporary leases of land required for construction compounds are outlined in Table 7-59 of the draft EIS.

Potential socio-economic impacts during construction would include:

- Direct land use impacts associated with the location of construction compounds, temporarily disrupting use and access to land including rural or vacant land, residential and commercial uses
- Temporary decrease in local amenity for residents, community and business facilities and natural areas near to construction worksites and work areas, due to increased noise and dust from construction activities
- Increased construction traffic and temporary changes in local access and connectivity, including for motorists, public transport users, pedestrians and cyclists during construction resulting in delays and disruptions
- Temporary decrease in visual amenity due to the presence of construction works including light spill from any night-time construction works
- Removal and/or relocation of farm infrastructure near to the construction footprint, such as farm dams, fencing and internal roads
- Increased movement of construction vehicles within the construction footprint, potentially increasing the likelihood of the spread of weeds and pests between rural properties.

Any structures, facilities or infrastructure located on the affected lands would likely be demolished and/or relocated, in consultation with the landowner. Following construction, land occupied by construction works but not required for the ongoing operation of the project would be reinstated to its pre-construction use.

Compensation for the project would be determined in accordance with the NSW Property Acquisition (Just Terms Compensation) Act 1991.

Overall, potential impacts would be temporary and short-term in nature and are not expected to be significant given the implementation of proposed environmental management measures. While these impacts may be a concern for some individuals, overall they are not expected to be significant.

The project would also impact positively on employment through the creation of direct employment opportunities through the construction phase. The project would also generate a number of indirect jobs in local, regional and national businesses and industries that support the construction phase, such as retailers who provide goods and services to support the day-to-day needs of the construction workforce, suppliers of construction materials and equipment, and transport operators.

As identified in the draft EIS, it is estimated that the WSIP as a whole, of which the project is one element, would create about 4,000 direct and indirect jobs during the 10-year lifetime of the program. Based on the expected project cost, it is estimated that around 928 of these jobs would be associated with the project (indicative only). Furthermore, in accordance with the NSW Government Policy on Aboriginal Participation in Construction (NSW Finance and Services 2016) a percentage of the project value would be spent to support Aboriginal participation during construction.
Operational impacts

The draft EIS identified that operation of the project would require the acquisition of properties including privately owned land, as well as land owned by Roads and Maritime, other NSW Government agencies and the Commonwealth Government. The majority of land to be partially or fully acquired for the project comprises residential uses. A revised property acquisition table is provided in Table 5-12 of this Final EIS based on the revised design.

The acquisition of land required for the operation of the project would be permanent and would result in long-term impacts to property as a result of the project. Roads and Maritime would continue to consult with property owners to effectively mitigate potential land use and access impacts where possible through detailed design.

Roads and Maritime would acquire properties for the project in accordance with the provisions of the NSW Property Acquisition (Just Terms Compensation) Act 1991. Among other things, the Act provides the basis for assessing compensation.

The draft EIS identified primary production uses as the largest land use area directly impacted by the project, with over 100 ha of land used for primary production, zoned for rural uses (RU), impacted by the operational footprint. Other land use impacts would include transport and infrastructure, land identified as ‘special category’ including Commonwealth land within the DEOH and Western Sydney Airport site, and a small portion of naturally vegetated and drainage areas. A revised assessment of directly affected land uses based on the revised design is included in Table 5-13 of this Final EIS.

Overall, the project would result in some localised land use changes but would not affect the broader distribution and supply of these land uses in the project area or broader region.

The draft EIS identified some potential adverse impacts to local amenity at those properties where The Northern Road moves closer to homes, businesses or community facilities due to the realignment or widening of the road corridor. Additionally, the project would potentially have a negative impact on some local businesses, particularly in Luddenham, where businesses in the town would no longer be exposed to passing traffic.

Overall, the operation of the project would contribute to improved access and connectivity to community services and facilities at the regional, State and national level, within or near to the study area, through improved travel time savings and improved travel time reliability. These impacts would be felt at the regional and national levels, through improved access not only to the planned airport site, but also to the Western Sydney Priority Growth Area and the South West Priority Growth Area. Through improved access and connectivity, the project would help to stimulate economic development that would eventually benefit local communities in terms of improved social infrastructure in the project area.

Implications of the revised design on the project

Property impacts

Section 7.4 of the draft EIS provides an assessment of the project’s likely impacts on the socio-economic environment of the project area during both construction and operation of the project. This assessment includes details of temporary and permanent acquisitions required.

Project design refinements have resulted in minor changes to the project construction and operational footprint and therefore the location and type of acquisition has also changed.

The proposed design refinements would generally result in a reduction in property impacts associated with the operation of the project. These properties would include a combination of privately owned land as well as land owned by Roads and Maritime, other NSW Government agencies and the Commonwealth Government. The majority of land to be partially or fully acquired for the project comprises residential uses. Table 5-11 compares the draft EIS predicted property impacts against the revised property impacts taking into consideration the proposed design refinements.
Table 5-11 Revised property impacts table (EIS vs refined design)

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Impacted lots</th>
<th>Impacted owners</th>
<th>Impacted houses</th>
<th>Impacted sheds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predicted property impacts (draft EIS)</td>
<td>142</td>
<td>83</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Revised property impacts (current refined design)</td>
<td>121</td>
<td>76</td>
<td>8</td>
<td>15</td>
</tr>
</tbody>
</table>

Generally, affected properties would be partially acquired by Road and Maritime where only part of the property would be directly impacted by the project. In some instances, Roads and Maritime would give consideration to total acquisition (dual offer) or acquisition of any residual parcels created by the location and design of the project. This would provide affected property owners with a level of flexibility or choice during the property acquisition process in relation to property decisions. For example, some property owners may want to retain residual parcels for future use. Roads and Maritime would continue to consult with land owners through the detailed design about these land parcels. The acquisition of land required for the operation of the project would be permanent and would result in long-term impacts to property as a result of the project.

Table 5-12 provides a revised summary of property acquisitions required for the project taking into consideration the proposed design refinements.

Table 5-12 Revised summary of property acquisitions

<table>
<thead>
<tr>
<th>Property ID</th>
<th>Property (lot number)</th>
<th>Existing land use*</th>
<th>Acquisition type</th>
<th>Dwellings affected</th>
<th>Buildings (sheds) affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lot 1 DP235845</td>
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<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Lot 97 DP27550</td>
<td>Residential</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Lot 1 DP250684</td>
<td>Residential</td>
<td>Partial</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Lot 96 DP27550</td>
<td>Residential / business</td>
<td>Partial</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Lot 95 DP27550</td>
<td>Residential / business</td>
<td>Partial</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Lot 94 DP27550</td>
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</tr>
<tr>
<td>7</td>
<td>Lot 93 DP654182</td>
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</tr>
<tr>
<td>8</td>
<td>Lot 92 DP27550</td>
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<td>-</td>
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</tr>
<tr>
<td>9</td>
<td>Lot 102 DP812653</td>
<td>Rural / residential</td>
<td>Partial</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Property ID</td>
<td>Property (lot number)</td>
<td>Existing land use*</td>
<td>Acquisition type</td>
<td>Dwellings affected</td>
<td>Buildings (sheds) affected</td>
</tr>
<tr>
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<td>10</td>
<td>Lot 1 DP838361</td>
<td>Rural / Western Sydney Airport / Commonwealth land</td>
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<td>Lot 28 DP259698</td>
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</tr>
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<td>Lot 1 DP851626</td>
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<td>partial</td>
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<td>Property ID</td>
<td>Property (lot number)</td>
<td>Existing land use*</td>
<td>Acquisition type</td>
<td>Dwellings affected</td>
<td>Buildings (sheds) affected</td>
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<td>27</td>
<td>Lot 104 DP846962</td>
<td>Residential</td>
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<td>-</td>
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<td>Lot 3 DP827223</td>
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<tr>
<td>34</td>
<td>Lot 5 DP232324</td>
<td>Crown land (road reserve)</td>
<td>Full</td>
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<td>-</td>
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<td>35</td>
<td>Lot 4 DP232324</td>
<td>Crown land (road reserve)</td>
<td>Full</td>
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<td>36</td>
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<tr>
<td>37</td>
<td>Lot 1 DP517853</td>
<td>Rural Residential</td>
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<td>38</td>
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<td>Partial</td>
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<td>Yes (1)</td>
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<tr>
<td>43</td>
<td>Lot DP160890</td>
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<td>Property ID</td>
<td>Property (lot number)</td>
<td>Existing land use*</td>
<td>Acquisition type</td>
<td>Dwellings affected</td>
<td>Buildings (sheds) affected</td>
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</tr>
<tr>
<td>44</td>
<td>Lot 5 DP599382</td>
<td>Residential</td>
<td>Partial</td>
<td>-</td>
<td>-</td>
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<tr>
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</table>

Notes:
* Information on existing land use is based on a review of aerial photography and visual inspections
** Strip of land located along road reserve

Roads and Maritime would acquire properties for the project in accordance with the provisions of the *NSW Property Acquisition (Just Terms Compensation) Act 1991*. Among other things, the Act provides the basis for assessing compensation.

The acquisition process includes the appointment of a dedicated case manager (Property Manager Acquisition) to help landowners understand their rights and provide a single point of contact right through the acquisition process. The case manager helps affected landowners who have their home acquired with finding new homes, find new schools for children and other services to ease the experience of moving. The case managers have also been involved in the partial acquisition on this project.

Access to residual property parcels would be maintained through the current design via either The Northern Road or the local road network, however some permanent changes may be required. Roads and Maritime would continue to consult with property owners to effectively mitigate potential land use and access impacts where possible through detailed design.

Where partial acquisition of rural properties would occur, infrastructure such as fencing, dams, sheds and other structures, within the project construction footprint would be demolished or
relocated due to the project. Any relocation of rural infrastructure for the project would be carried out in consultation with the property owner, prior to the removal of the infrastructure.

As outlined in section 3.10.2, there have been a number of design refinements which have resulted in an overall reduction to the construction footprint and associated lease areas, including ancillary facility C17. Additionally, a lease area within WaterNSW land previously proposed for drainage works would no longer be required based on the refined design. Other minor changes to temporary leases of land may be required to accommodate the design refinements. This would result in limited changes to impacts on farm infrastructure such as dams, irrigation, fencing, shed and storage areas, and other facilities. Where this infrastructure would be demolished and reinstated or relocated as a result of the project, this would be carried out in consultation with the property owner, prior to the removal of the infrastructure.

No additional environmental management measures have been proposed beyond those identified in the draft EIS.

**Land use impacts during operation**

The proposed design refinements would result in an overall reduction in the size of the operational footprint of 16.26 ha. As outlined in Table 5-13, the proposed design refinements would result in a net decrease in the land required by the project for all land uses with the exception of land that is currently zoned for infrastructure, mainly transport of other infrastructure corridors; which would experience an increase of 0.05 ha. Where this land lies within the operational footprint of the project design it would remain in use as infrastructure and would be zoned accordingly.

Primary production uses would still comprise the largest area of land directly impacted by the project. As a result of the proposed design refinements, 11.56 ha of land currently used for primary production, and earmarked for rezoning to infrastructure land use within the draft EIS, would no longer be impacted by the project.

Table 5-13 Revised extent of directly affected land uses within the operational footprint

<table>
<thead>
<tr>
<th>Land use</th>
<th>Penrith LGA</th>
<th></th>
<th>Liverpool LGA</th>
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<th>Total region</th>
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<td>Change</td>
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<td>draft EIS</td>
<td>footprint (ha)</td>
<td>draft EIS</td>
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<td>73.97</td>
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<td>94.17</td>
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<td>-0.16</td>
<td>13.22</td>
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</table>

The use of land affected by temporary leases during construction would be temporarily disrupted or suspended for the duration of the lease. Any structures, facilities or infrastructure located on the affected lands would likely be demolished and/or relocated, in consultation with the landowner. On completion of construction, any land not required for the project’s long-term operation would be reinstated to its former use.
No additional environmental management measures have been proposed beyond those identified in the draft EIS.

**Social and economic impacts**

The draft EIS considered a range of potential social and economic impacts associated with project. The design refinements would not result in a significant change to the social and economic impacts outlined in the draft EIS.

**Impacts on local businesses**

An error was identified in the draft EIS in relation to Figures 7-13 and 7-14 of the draft EIS which show the location of directly affected businesses and agricultural businesses respectively. These figures correspond to Table 7-62 of the draft EIS which summarises the potential impacts to businesses. It has been identified that some of the impacted primary production lots identified in this table of the draft EIS were not included in the corresponding figures as follows:

- Market Garden and Cattle at 350-370 Willowdene Avenue, Luddenham
- Primary production at 2422-2430 The Northern Road, Luddenham
- Primary production at 28 Eaton Road, Luddenham.

These additional properties are shown in Figure 5-3.

**Environmental management measures**

A consolidated list of environmental management measures for the project is provided in Chapter 6. Several new measures have been developed in response to submissions received during exhibition of the draft EIS.

In summary, the new socio-economic management measures to be implemented during pre-construction and construction relate to:

- Strategies to address impacts to utilities would be developed in consultation with utility providers during detailed design and during construction of the project
- As part of the tender process, the contractor would also be required to prepare a Small to Medium Enterprise (SME) Participation Plan in line with the NSW Government SME Policy Framework to show how their tender will support local industry, including jobs, skills and capability development.

Additionally, Liverpool and Penrith City Councils would be consulted in the preparation of plans to revitalise Luddenham town centre and appropriate gateway signage or other features.
Market garden and cattle at 350-370 Willowdene Avenue, Luddenham

Lot20/DP258561
Total area: 10.13ha

Acquisition area: 3.56ha

Legend

EIS operational footprint
Refined design operational footprint
Western Sydney Airport site (Commonwealth Land)

Land to be acquired for road purposes
Lot boundary

Figure 5.3 | Directly affected businesses not shown in the EIS
The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement

Figure 5.3 | Directly affected businesses not shown in the EIS
Figure 5.3 | Directly affected businesses not shown in the EIS
5.2 Other issues

5.2.1 Hydrology and flooding

Section 8.1 of draft EIS describes the environmental values relating to hydrology and flooding and identifies the potential impacts to these values as a result of construction and operation of the project. This chapter also recommends environmental management measures to avoid, minimise and mitigate the impacts to and of the project.

The working paper, Flood risk assessment (Appendix K), of the draft EIS informs the assessment.

Assessment approach

Hydrologic and hydraulic models of the catchments draining across and through the project were established to assess potential flood related impacts on the project during operation, and potential changes in flood behaviour on the surrounding environment as a result of the project.

The DRAINS rainfall-runoff modelling software package was used to generate discharge hydrographs (a graph showing the volume of water that flows past a point in a waterbody’s course per second) for a range of design storm events.

The key tasks comprising the flooding investigation are broadly described below:

- Develop hydrologic and hydraulic models, to define flood behaviour in the vicinity of the project corridor
- Run the flood models and prepare exhibits showing flooding behaviour under present day (pre-project) conditions for the 2 year, 10-year and 100-year Average Recurrence Interval (ARI) events, as well as the Probable Maximum Flood (PMF) – these were used to establish the baseline
- Iteratively develop the drainage design and develop a preferred set of measures which are aimed at mitigating the impacts of the project on flooding, as well as mitigating the impacts of flooding on the project
- Assess the residual impact the project would have on the 2 year, 10-year and 100-year Average Recurrence Interval (ARI) events, as well as the Probable Maximum Flood (PMF) assuming the preferred set of flood mitigation measures is incorporated into its design
- Assess the impact a partial blockage (20 per cent) of major hydraulic structures (pipes and culverts) would have on flooding behaviour under post-construction conditions
- Assess the impact future climate change (30 per cent increase in the intensity of the 100 ARI event) would have on flooding behaviour under post-construction conditions.

Flooding behaviour in the vicinity of the project was defined for events with ARIs of between 2 and 500 years, as well as the PMF. The Average Recurrence Interval or ARI defines the average frequency of rainfall and/or flood events. For example, the 2 year ARI event describes a smaller, more frequent and therefore more likely event with a statistical probability of occurring once in every two years. Conversely, the 100-year ARI event describes a much larger, but less likely event with a statistical probability of occurring once in every 100 years.

The project’s design has been an iterative process wherein the drainage, civil, structural and earthworks designs have developed together. Drainage has been considered at each stage of the design and the hydrologic and hydraulic models have developed as the design has developed in meeting the project’s design objectives, including the key flooding and hydrology objectives of achieving 100 year ARI flood immunity, and scour protection at drainage inlets and outlets for storms up to 50 year ARI.
Since exhibition of the draft EIS design checks have been carried out to compare and check the consistency of the design exhibited and the current project design. The transverse drainage was checked by:

- Comparing culvert locations, types and dimensions
- Remapping of the catchments contributing to each structure and comparison of those areas
- Re-running of the TUFLOW model for the section of the main alignment about 600m north of Chain-O-Ponds Road to confirm that flooding conditions were not exacerbated in existing development located downstream of the road corridor
- Re-running of the TUFLOW model for Badgerys Creek where the main alignment has been lowered to confirm that the resulting afflux is comparable to the findings of the sensitivity study that is presented in the draft EIS.

The pavement drainage was checked by:

- Comparing outlet locations with those shown in the draft EIS
- Remapping of the catchments draining to outlets and comparing with the areas shown in the draft EIS
- Checking peak flows in drainage line MC DL16 to make sure that the rate of flow had not been increased in private property.

Catch drain types, lengths and locations were checked against the draft EIS and the lengths of scour protection at the inlets and outlets of transverse drainage structures have been compared against the draft EIS design.

**Existing environment**

Section 8.1.2 of the draft EIS outlines the existing environment including details regarding the catchment and waterways traversed by the project, which are shown in Figure 8-1 of the draft EIS. In summary, the project falls within the following catchments:

- **Badgerys Creek catchment** – the catchment is about 1,370 ha in size and drains east to South Creek which then flows north to join the Hawkesbury River at Windsor. Downstream of The Northern Road the Badgerys Creek catchment is located within the Western Sydney Airport site on Commonwealth land
- **Duncans Creek catchment** – the catchment is about 1,560 ha in size and drains west to the Nepean River
- **Cosgroves Creek catchment** – the catchment is about 1,476 ha in size and similarly to Badgerys Creek, drains east to South Creek
- **Unnamed tributary of South Creek catchment** – the catchment is about 732 ha in size and forms part of the South Creek catchment, which ultimately forms part of the Hawkesbury Nepean catchment
- **Mulgoa Creek catchment** – the catchment is 3,896 ha in size. Runoff from the catchment drains west to the Nepean River
- **Blaxland Creek catchment** – the catchment is about 1,403 ha in size and drains east to South Creek. The drainage lines that cross The Northern Road in this catchment either directly or indirectly discharge into the DEOH site located on Commonwealth land
- **Surveyors Creek catchment** – the catchment is about 1,336 ha in size and drains west to the Nepean River.
At the southern extent of the project, The Northern Road crosses through the Badgerys Creek Catchment before following a natural ridgeline that forms the catchment divide between Cosgroves Creek and Duncans Creek.

North of Luddenham, The Northern Road also follows a natural ridgeline that forms the catchment divide between Mulgoa Creek, Duncans Creek, Cosgroves Creek, an unnamed watercourse and Blaxland Creek.

The northern extent of the project is located in the upper reaches of the Surveyors Creek catchment.

The catchments that contribute runoff to the existing transverse drainage of The Northern Road have generally been cleared of native vegetation, with the predominant ground cover being grass.

The WaterNSW supply pipelines run in an east to west direction and cross The Northern Road a short distance north of the Gates Road intersection. The pipelines lie about 13 m below the natural surface where they cross The Northern Road, and either side of the road in a series of relatively deep open trenches. The condition of these trenches is affected by catchment runoff which discharges to their base via a series of concrete lined chutes. Further details are provided in Appendix K. of the draft EIS

A description of existing flooding behaviour of the catchments traversed by the project is presented in Table 8-2 of the draft EIS.

In summary, higher flooding conditions are generally confined to the farm dams and the incised reaches of the drainage system for events up to the 100 year ARI.

The exception to this is some dwellings on the western (upstream) side of the road corridor within the Badgerys Creek catchment which have been identified in the draft EIS as being marginally affected by a 100 year ARI flood event, and Lot 94 DP654182 which would be surrounded by floodwater during events as frequent as 2 year ARI. Additionally, depths of flow in the vicinity of the dwelling would increase to just over 1 m during a PMF event.

Dwellings located within Duncans Creek catchment in Lot 11 DP248069, Lot 104 DP884343 and Lot 105 DP884343, while above the adjacent peak 100 year ARI flood level have been identified as being impacted by a PMF event.

Additionally, the draft EIS identified the likelihood that several buildings located near the entrance to the DEOH site within the Surveyors Creek catchment are subject to flooding during storms as frequent as 2 year ARI. Several residential properties that are located on the western side of The Northern Road between Bradley Street and Glenmore Parkway that are subject to flooding during a 2 year ARI storm event. During a Probable Maximum Flood (PMF) event, depths of inundation in the vicinity of several dwellings that are located on the western side of The Northern Road between Bradley Street and Glenmore Parkway would exceed 1 m.

**Main impacts as documented in the draft EIS**

The key hydrology and flooding related impacts identified in the draft EIS are summarised below.

Flooding during construction could potentially impact areas within and near the construction area (specifically, temporary construction ancillary sites) and/or cause damage to construction plant and equipment. Construction sites could increase potential runoff to the catchments during heavy rainfall due to an increase of impermeable surface. However, this increase would be relatively small in terms of the overall catchment area, and unlikely to significantly increase the severity of any flood events. Buildings and structures associated with site compounds may obstruct flows and reduce storage capacity, or divert flows into sensitive areas where increased flow velocities can cause scour and erosion.

The project would increase the scour potential in the drainage lines which run through the DEOH site located on Commonwealth land. The increase in scour potential would extend only a short distance from the corridor as the increase in peak flow attributable to the project as a percentage of
the total flow reduces in the downstream direction due to the discharge of additional catchment runoff to the affected drainage line.

The draft EIS identified that the project would result in an increase in both the rate and volume of runoff discharging to a number of receiving drainage lines, including those on Commonwealth land. While peak flood levels would be increased as a result of the project for events up to 100 year ARI, affected areas are limited to undeveloped pastoral land. Due to the relatively steeple sided nature of the drainage lines that cross the project corridor, increases in peak flood levels attributable to the project do not translate into a significant increase in the spatial extent of flood affected land for events up to 100 year ARI.

The project would result in substantial increases in peak flood levels along its upstream side during a PMF event. While the affected areas generally comprise undeveloped pastoral land, the lowering of the road in the affected area was shown to reduce impacts on affected properties near Badgerys Creek.

While the construction of three permanent ponds along the eastern side of the project would dampen the effects of the project on catchment hydrology, there would still be an increase in the rate and volume of flow discharging to three drainage lines within Blaxland catchment, which runs through the DEOH site. As a result, the scour potential along these drainage lines would increase and ground conditions would become wetter.

There would be minor increases in both the rate and volume of runoff discharging to the existing dams that are located downstream of the project corridor.

The draft EIS also identified that implementation of the transverse drainage and flood mitigation strategy would ensure that the required 100-year ARI level of flood immunity is achieved. As flow velocities in the vicinity of The Northern Road are relatively mild and depths of inundation typically less than 2 m, damage to the road embankment should not occur provided suitable scour protection measures are incorporated in areas of the project that are subject to flooding.

Implications of the revised design on the project

The design refinements outlined in Table 4-1 have been considered against the outcomes of the hydrology and flooding assessment carried out for the draft EIS as outlined in section 8.1 of the draft EIS. Refinements that could have potential to result in minor changes to the hydrology and flooding assessment include:

- Refinements to drainage and water quality infrastructure
- Refinements to cuttings, embankments and median along the main alignment
- Geometry and alignment changes along the main alignment and local roads
- Refinements to medians and kerbs along the main alignment and local roads.

Section 8.1.3 of the draft EIS provided an assessment of potential impact of the project on flooding behaviour during construction of the project. The design refinements outlined in this Final EIS have been reviewed against the outcomes of the draft EIS construction flooding and hydrology assessment.

Construction impacts

The potential construction hydrology and flooding impacts due to the proposed design refinements have also been considered. Overall, potential construction related impacts associated with the refined design for the project are considered consistent with those presented in the draft EIS. This is due to the fact that, in general, the design refinements have only marginally altered the design of the road when compared to the draft EIS design. Additionally, construction plant and equipment, construction timings and haulage routes would be the same as outlined in the draft EIS.
**Operational impacts**

The potential impacts of the project on flooding behaviour and the scour potential within receiving drainage lines has been considered during the design phases of the project and is ongoing as the design is finalised. Detailed flood modelling has been carried out to identify the potential residual flooding and drainage related impacts of the project following the incorporation of a preferred set of transverse drainage upgrade and flood mitigation measures into its design.

The design checks outlined above have indicated that the finalised drainage design for the project can be developed to ensure performance is consistent with the commitments made in the draft EIS.

**Environmental management measures**

A consolidated list of environmental management measures for the project is provided in Chapter 6. One new measure has been developed in response to submissions received during exhibition of the draft EIS. In summary, the new hydrology and flooding management measures relate to:

- Roads and Maritime will consult further with all utility providers regarding any drainage infrastructure required within their utility corridors prior to construction.

**5.2.2 Soils, water and contamination**

Section 8.2 of draft EIS the existing soils, water and contamination within the project and the potential impacts as a result of the construction and operation of the project. This chapter also recommends environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Soils, water and contamination (Appendix L), has been used to inform this chapter.

**Assessment approach**

Section 8.2.1 of the draft EIS outlines in detail the assessment approach used in assessing the construction and operational impacts of the project.

Surface water was assessed based on the potentially impacted hydrological catchments draining the project. Water quality modelling using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) model, was also carried out to determine the pollutant load reductions that can be achieved by permanent water quality swales (with rock check dams) for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorus (TP).

The catchment draining to an individual control measure was delineated by considering the formation of the proposed carriageway and the proposed pipe drainage network. The total catchment area was divided into two sub-catchments according to the different land-use characteristics of the ‘impervious road catchment’ area, and the batter slope or ‘pervious road side’ area.

The MUSIC model was set up to represent proposed catchment conditions. Models of the swales were created by adopting the sub-catchment areas estimated in the catchment analysis. Rock check dams were also added to the model as per the design of typical swale details.

For the protection of aquatic ecosystems in this region, the ANZECC/ARMCANZ (2000) default trigger values for physical and chemical stressors for ‘South-East Australian slightly to moderately disturbed lowland rivers’ have been applied. The NSW Healthy Rivers Commission (HRC) nutrient guidelines (1998) listed are for mixed use rural areas.

Sensitive receiving environments were identified using aquatic habitat as an indicator which was assessed against the Department of Primary Industries Policy and Guidelines for Fish Habitat Conservation and Management, 2013 and Fish Passage Requirements for Waterway Crossings (Fairfull & Witheridge, 2003).
Groundwater was assessed based on the regional and local shallow and deep geological units underlying the project. The groundwater assessment includes an assessment of the project against the Level 1 Minimal Impact Considerations of the NSW Aquifer Interference Policy (DPI Water, 2012).

A Stage 1 Contamination Assessment was also carried out as part of the draft EIS to identify potential Areas of Environmental Interest (AEI) which would assist in identifying construction limitations and constraints within the project with respect to contamination. Preparation of a Stage 1 contamination assessment report was based on the data obtained from the desktop background review and observations from the inspection of the project. Intrusive site sampling was not carried out. A search of the NSW EPA Contaminated Sites Register and Record of Notices (under Section 58 of the Contaminated Land Management Act 1997) carried out as part of the desktop assessment was based on a one kilometre radius of the project.

As outlined in section 4.2, there have been a number of design refinements to the project since exhibition of the draft EIS which have resulted in changes to the project’s proposed road and pavement drainage design.

A desktop assessment was carried out to identify the number and location of proposed sediment basins and water quality swales required as part of the revised design. Water quality modelling was carried out for the revised design.

The results of the MUSIC model were compared against the result previously achieved for the road and pavement drainage proposed in the draft EIS.

**Existing environment**

Section 8.2.2 of the draft EIS outlines the existing environmental conditions relevant to soils, water and contamination. This is considered to provide a baseline of existing conditions from which potential impacts of the project have been assessed including an assessment of the existing geology and soils and identifying AEIs for the contamination assessment, as well as the existing catchments and key fish habitat for the purpose of the water quality assessment.

**Landscape context**

The project area traverses a north–south oriented ridge that forms the watershed separating the catchment areas of South Creek in the east and the Nepean River in the west. The eastern side of the project contains several north-east flowing creeks including Badgerys Creek, Cosgroves Creek and Oaky Creek which join South Creek about 7 km to the east. On the western side of the project, several creeks including Duncans Creek, Surveyors Creek and Mulgoa Creek flow north-west to join the Nepean River about 4.5 km to the west. There are a number of farm dams along the entire alignment.

Landscape character varies from generally semi-rural in the majority of the study area to occasional pockets of suburban areas including at Luddenham and Glenmore Park.

**Regional geology**

As identified in the draft EIS, the Penrith 1:100,000 Geological Series Sheet 9030 indicated that the project is predominately underlain by Bringelly Shale (Rwb), Quaternary alluvium (Qal) and Cranebrook Formation (Qpc). Bringelly Shale (Rwb) is composed of shale, carbonaceous claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff (Clarke and Jones 1991) and underlies the crests, slopes and drainage lines of the majority of the project. Further description of the geological formations underlying the project is provided in Table 8-7 of the draft EIS and shown on Figure 8-2 of the draft EIS.

**Soils**

The Penrith 1:100,000 Soil Landscape sheet 9030 indicated that the soil landscape groups within the project consist three principal soil landscapes. These are erosional Luddenham (lu), residual
Blacktown (bt) and fluvial South Creek (sc) soil landscape groups. Table 8-8 of the draft EIS describes the soil landscape groups within the project.

The basal geology is overlain by South Creek soils within the immediate vicinity of major creeks, transitioning to Blacktown soils on crests and low rises and Luddenham soils on hills and ridge slopes. The alluvial South Creek soil landscape is characterised by flat landforms with incised channels that are subject to frequent episodes of inundation, erosion and aggradation. Soil landscapes in the project are shown on Figure 8-3 of the draft EIS.

**Acid Sulfate Soils (ASS)**

The Australian Soil Resource Information System (ASRIS, 2015) database was consulted to determine the presence and risk of ASS along the proposed alignment. The ASS Probability within the proposed alignment was classified as Extremely Low Probability of occurrence. ASS is therefore not considered to be a risk to the project.

**Soil salinity**

The assessment of salinity potential along the alignment was undertaken using the map of the salinity potential in western Sydney (NSW Department of Infrastructure, Planning and Natural Resources, 2002). The majority of the alignment occurs in areas of moderate salinity potential.

As identified in the draft EIS, durability and aggressivity samples of soil material would be collected and analysed prior to the construction phase, to determine potential impacts of soil salinity on pavement infrastructure. Soil salinity potential for the project is mapped on Figure 8-4 of the draft EIS.

**Contaminated land**

As part of the Stage 1 contamination assessment carried out as part of the draft EIS, a search of the NSW EPA Contaminated Sites Register and Record of Notices (under Section 58 of the Contaminated Land Management Act 1997) was undertaken. No registered sites that were either regulated or had been notified were identified within the project. The notified/regulated sites within one kilometre of the project are summarised in Table 8-9 of the draft EIS which identified the Caltex Service Station on The Northern Road at Luddenham as being under assessment. However due to the distance from the project (> 250 m) this site was identified as being unlikely to be a source of potential contamination for the project.

A search of areas of concern from the UXO website was undertaken in March 2016 for the purpose of the draft EIS. At the time of undertaking this assessment, no known areas of concern with respect to UXO were identified within or adjacent to the project including the DEOH site. Additionally, the likelihood of encountering UXO during construction activities has been assessed as low.

A site inspection was conducted on 19 November 2015 as part of the Stage 1 contamination assessment carried out for the draft EIS. A number of AEIs were identified during the site inspection as detailed in Table 8-10 and Figure 8-5 of the draft EIS, including some sites of moderate likelihood of contamination exposure. This includes the DEOH site located on Commonwealth land.

**Catchment context**

As summarised in Section 5.2.1, the study area falls within the hydrological catchments of Duncans Creek, Badgerys Creek, Cosgroves Creek, Mulgoa Creek, unnamed tributary of South Creek, Blaxland Creek and Surveyors Creek.

The project directly traverses a number of unnamed tributaries and drainage lines (sometime associated with farm dams), as well as Cosgroves Creek and Badgerys Creek.
**Key fish habitat**

Five receiving waterways have been identified as Type 1 – Key Fish Habitats (DPI, 2013), as they had a combination of native aquatic plants and/or woody snags. These watercourses are impacted, intermittently flowing waterways which are also identified as Class 2 – Moderate Key Fish Habitat (Fairfull & Witheridge, 2003) due to the presence of limited in stream aquatic vegetation. The waterways are:

- Badgerys Creek (287912.65E / 6244897.30N)
- Cosgroves Creek (287247.11E / 6249490.76N)
- ‘Site 29a’ (286060.62 E / 6246544.14N), an intermittent stream
- The large dam at ‘Site 39’ (286460.594 E, 6247352.348N), fed by several minor 1st and 2nd order streams. These streams are ephemeral with minimal channel definition, only flowing when the upstream dams overflow
- Unnamed tributary of Surveyors Creek (286887.04E/6257728.90N).

Key hydrological features of the project area, including these key waterways, are shown on Figure 8-6 of the draft EIS.

Whilst the waterways have been surveyed and generally contain suitable habitat for fish, the water quality of these sites is generally poor to moderate and flow at times intermittent. As such no threatened or protected fish species are expected to occur within the creeks located in the study area. Further information on potential fish habitat is provided in the Section 7.3 of the draft EIS.

**Water quality**

Baseline water quality monitoring was not carried out during preparation of the draft EIS, however monthly sampling carried out at three sites relevant to the project, as part of the Western Sydney Airport EIS, were used as a baseline for comparison to a range of ANZECC/ARCMANZ trigger values.

In summary, the waterways in the study area are considered eutrophic and generally exceed the both the nominated HRC and ANZECC/ARMCANZ guidelines for protection of aquatic ecosystems. The water surface conditions reported during sampling infer that the visual amenity of the creeks is generally poor. Additionally, the metal concentrations, particularly copper and zinc are elevated, most noticeably in Badgerys Creek, which also exhibits high concentrations of chromium and nickel.

A visual inspection was also undertaken for waterway crossings along the proposed alignment. A summary of the water quality condition of the main waterways is provided in Table 8-11 of the draft EIS, and was generally identified as being of poor to moderate quality based on the visual inspection.

**Groundwater**

As identified in the draft EIS, it is expected that three groundwater systems exists along the project alignment including shallow incidental perched aquifers, a regional shallow unconfined water table, and a deep confined aquifer unit.

One registered groundwater works (GW108906) was identified in the study area during a review of the DPI Water’s Groundwater PINNEENA online database accessed in March 2016 as part of the draft EIS. However, this was identified as being inactive. Other groundwater works within the study area are monitoring piezometers presumed to refer to local, site specific investigation for geotechnical or due diligence purposes. No active Water Access Licences were identified within 400 m of the proposed alignment.

A review of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011* indicated that there are no listed high priority groundwater dependent ecosystems located in the project area.
As identified in the in Section 7.3.2 of the draft EIS and summarised in Section 5.1.3, no high probability GDEs are mapped within or near the study area. Additionally, the majority of watercourses within the study area are ephemeral and most flow events occur in direct response to major rainfall, with no evidence of baseflow feeding any of the streams within the study area. As such, none of the riparian zones within the study area are considered to be GDEs. Similarly, a review of the Bureau of Meteorology GDE Atlas did not indicate the presence of other GDEs.

Revised impact assessment

Geology and soils
As identified in the draft EIS, excavation would involve the stockpiling of spoil prior to reuse or removal from site. Without effective mitigation, these and related construction activities would give rise to potential for erosion of unconsolidated material and entrainment by runoff and subsequent transported off site. Soil erosion and sedimentation have the potential to result in negative impacts to surface water quality throughout the construction phase through increased sediment loads entering downstream environments.

The Acid Sulfate Soil Probability within the proposed alignment was classified as Extremely Low Probability of occurrence. Acid Sulfate Soil is therefore not considered to be a risk to the project. The majority of the alignment occurs in areas of moderate salinity potential. Construction activities are not expected to increase the potential for salinity impacts along the project.

The geology of the land within the project is not anticipated to be impacted by construction or operation of the project.

Contaminated land
There is a potential for contaminated material to be disturbed through construction activities. This includes the potential for UXO and other contaminated materials such as asbestos to be encountered during earthworks on the DEOH site. However, the majority of AEIs have been identified as being unlikely to be exposed to site users and environmental receptors to contamination during construction works. This risk increases where excavation works are proposed take place within these areas. A Contaminated Land Management Plan would be prepared to effectively manage contaminated material during construction of the project, and would include an unexpected finds procedure for the management of unexpected contamination if encountered. There would be some potential operational contamination risks associated with the project as a result of accidental leaks or spills. However overall, the project would only represent a minor increase in the potential for contamination compared with current operation of the road, associated increased vehicle traffic in the future.

Groundwater
As identified in the draft EIS, there is no expected drawdown to the regional shallow unconfined water table. There is therefore no expected impact to groundwater users including water supply users, GDEs, riparian areas or wetlands during construction of the project.

Similarly, the project is not expected to interact with groundwater during operation. Therefore, there is not expected to be any material impact on groundwater levels, flow or connectivity.

Surface water
The construction phase of the project has the potential for further degradation of downstream water quality and impacts on the status of key fish habitats if effective management measures are not implemented, monitored and maintained throughout the construction phase.

One of the main impacts to water quality and aquatic habitat from any construction project is sediment entering nearby waterways. The potential impact on receiving waterways during construction would be effectively mitigated through erosion and sediment controls including appropriately sized temporary sediment basins in accordance with the requirements of the Blue
Book. The Blue Book criteria of ‘Minimum 150 m$^3$ of annual sediment loss’ would be adopted. Impacts associated with the revised design and location of temporary sediment basins during construction would generally be consistent with those assessed as part of the draft EIS and would not result in any additional impacts on water quality.

Watercourse crossings would be designed and constructed to minimise impacts on natural flow regimes and to not present any barriers. All waterway crossings would be designed in conjunction with *Why do fish need to cross the road – Fish Passage requirements for Waterway Crossings* (Fairfull and Witheridge, 2003) and the *Policy and Guidelines for Fish Friendly Waterway Crossings* (DPI, 2004).

All works on waterfront land would be carried out in accordance with the *DPI Water Guidelines for Controlled Activities on Waterfront Land* (2012), including but not limited to those related to instream works and waterway crossings.

Additionally, preconstruction water quality monitoring would be carried out upstream and downstream of proposed waterways that have the potential to be impacted during the construction of the project. This would provide further information on the existing water quality and allow the development of site specific trigger values as per ANZECC/ARMCANZ (2000) to ensure there is no further degradation in water quality or impact on the nominated environmental values.

Overall, potential impacts on surface water quality during construction are considered minor and manageable with the application of proposed mitigation measures.

During operation, the project has the potential to affect existing local water quality due to the generation of additional or new pollutants directly attributable to the widened or new sections of road respectively and associated increased vehicle traffic in the future.

The refined design proposes 23 operational water quality swales (a reduction from the 24 proposed in the draft EIS). Pollutant removal is facilitated by the interaction between the flow and the vegetation along the length of the swale. Rock check dams are also proposed to provide additional treatment by slowing down the runoff and allowing it to temporarily pond during storm events. The location and size of each swale has been optimised to maximise filtering out of suspended materials and pollutants, including those proposed upstream of identified sensitive receiving waterways (i.e. Key Fish Habitat).

GPTs and water quality basins have been considered by Roads and Maritime as part of the water quality treatment type selection process. Since the generation of gross pollutant loads from the upgraded road is significantly lower than those generated from an urbanised catchment of residential or commercial landuse, any gross pollutants from the upgraded road would be removed at the swales as part of a road maintenance program.

Space constraint along a narrow road corridor was the main reason for not adopting specific water quality basins. These constraints included private and commonwealth properties, utilities, topographical constraints and need for clearing of trees and valuable vegetation.

The details of these swales are summarised in Table 5-14 and shown in Figure 5-4.
Table 5-14 Water quality treatment measures – Swales

<table>
<thead>
<tr>
<th>Location</th>
<th>Swale name</th>
<th>Swale length (m)</th>
<th>Receiving Creek</th>
<th>Catchment area to swale (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Mersey Road, Bringelly and Eaton Road, Luddenham</td>
<td>S1*</td>
<td>257</td>
<td>Badgerys Creek</td>
<td>4.45</td>
</tr>
<tr>
<td></td>
<td>S2*</td>
<td>136</td>
<td>Badgerys Creek</td>
<td>8.63</td>
</tr>
<tr>
<td></td>
<td>S3</td>
<td>111</td>
<td>Duncans Creek</td>
<td>1.88</td>
</tr>
<tr>
<td></td>
<td>S4</td>
<td>62</td>
<td>Duncans Creek</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>S5*</td>
<td>83</td>
<td>Unnamed Creek</td>
<td>3.17</td>
</tr>
<tr>
<td></td>
<td>S6*</td>
<td>38</td>
<td>Unnamed Creek</td>
<td>3.32</td>
</tr>
<tr>
<td></td>
<td>S7*</td>
<td>65</td>
<td>Narro Dam</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td>S8*</td>
<td>40</td>
<td>Narro Dam</td>
<td>4.42</td>
</tr>
<tr>
<td>Between Eaton Road, Luddenham and Littlefields Road, Luddenham</td>
<td>S9</td>
<td>70</td>
<td>Adams Road Culvert</td>
<td>3.18</td>
</tr>
<tr>
<td></td>
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<td>160</td>
<td>Adams Road Culvert</td>
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<td></td>
<td>S13*</td>
<td>80</td>
<td>Cosgroves Creek</td>
<td>4.64</td>
</tr>
<tr>
<td></td>
<td>S14</td>
<td>100</td>
<td>Unnamed Creek</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>S15</td>
<td>80</td>
<td>Unnamed Creek</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>S16</td>
<td>70</td>
<td>Unnamed Creek</td>
<td>3.49</td>
</tr>
<tr>
<td></td>
<td>S17</td>
<td>40</td>
<td>Unnamed Creek</td>
<td>3.49</td>
</tr>
<tr>
<td></td>
<td>S18</td>
<td>75</td>
<td>Unnamed Creek</td>
<td>2.53</td>
</tr>
<tr>
<td></td>
<td>S19</td>
<td>80</td>
<td>Unnamed Creek</td>
<td>3.22</td>
</tr>
<tr>
<td></td>
<td>S20</td>
<td>90</td>
<td>Unnamed Creek</td>
<td>0.36</td>
</tr>
<tr>
<td>Between Littlefields Road, Luddenham and Glenmore Parkway, Glenmore Park</td>
<td>S21</td>
<td>75</td>
<td>Unnamed Creek</td>
<td>3.40</td>
</tr>
<tr>
<td></td>
<td>S22*</td>
<td>57</td>
<td>Surveyors Creek</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>S23*</td>
<td>85</td>
<td>Surveyors Creek</td>
<td>0.41</td>
</tr>
</tbody>
</table>

*represents sensitive receiving waterway or creek
In addition to the 23 swales outlined above, two detention basins have been proposed to mitigate hydrological and flooding impacts (refer to Table 5-15 and Figure 5-4). The primary purpose of the detention basins is to provide peak flow mitigation for hydrology purposes, however an opportunity was presented to utilise the same area to also provide water quality treatment over the same footprint. This was achieved by creating a wet basin below the normally dry detention space. Therefore, these basins also provide pollution load reductions. No detention basins were originally proposed as part of the draft EIS.

Table 5-15 Water quality design refinements – Detention basins

<table>
<thead>
<tr>
<th>Stage</th>
<th>Swale name</th>
<th>Swale length (m)</th>
<th>Receiving Creek</th>
<th>Catchment area to swale (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Littlefields Road, Luddenham and Glenmore Parkway, Glenmore Park</td>
<td>P2140R</td>
<td>3775</td>
<td>Unnamed Creek</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>P3650R</td>
<td>1170</td>
<td>Unnamed Creek</td>
<td>3.90</td>
</tr>
</tbody>
</table>
Figure 5.4  |  Water quality controls
The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
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Figure 5-4 | Water quality controls
The result of the MUSIC modelling for the 23 swales (S1-S23) (refer to Table 5-16) indicates that pollutant load reductions can be achieved as follows:

- Total suspended solids (ranged from 31 per cent to 93 per cent)
- Total phosphorous ranged from (17.2 per cent to 75 per cent)
- Total nitrogen (range from 5.3 per cent to 49 per cent).

Table 5-16 Annual average pollutant load reduction for the proposed vegetated swales

<table>
<thead>
<tr>
<th>Swales</th>
<th>Total suspended solids (%)</th>
<th>Total phosphorous (%)</th>
<th>Total nitrogen (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>82</td>
<td>55</td>
<td>19</td>
</tr>
<tr>
<td>S2</td>
<td>70</td>
<td>45</td>
<td>13</td>
</tr>
<tr>
<td>S3</td>
<td>87</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>S4</td>
<td>74</td>
<td>46</td>
<td>15</td>
</tr>
<tr>
<td>S5</td>
<td>86</td>
<td>67</td>
<td>37</td>
</tr>
<tr>
<td>S6</td>
<td>92</td>
<td>75</td>
<td>49</td>
</tr>
<tr>
<td>S7</td>
<td>88</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>S8</td>
<td>56</td>
<td>39</td>
<td>12</td>
</tr>
<tr>
<td>S9</td>
<td>80.1</td>
<td>58.1</td>
<td>17.8</td>
</tr>
<tr>
<td>S10</td>
<td>66.1</td>
<td>32.1</td>
<td>23.1</td>
</tr>
<tr>
<td>S11</td>
<td>67.1</td>
<td>35.1</td>
<td>11.8</td>
</tr>
<tr>
<td>S12</td>
<td>92.9</td>
<td>73.1</td>
<td>48.6</td>
</tr>
<tr>
<td>S13</td>
<td>71.3</td>
<td>50.3</td>
<td>12.9</td>
</tr>
<tr>
<td>S14</td>
<td>21.8</td>
<td>20.6</td>
<td>31.7</td>
</tr>
<tr>
<td>S15</td>
<td>73.6</td>
<td>73.6</td>
<td>48.7</td>
</tr>
<tr>
<td>S16</td>
<td>62.3</td>
<td>42.7</td>
<td>9.5</td>
</tr>
<tr>
<td>S17</td>
<td>31</td>
<td>17.2</td>
<td>5.3</td>
</tr>
<tr>
<td>S18</td>
<td>76.3</td>
<td>54.6</td>
<td>15.7</td>
</tr>
<tr>
<td>S19</td>
<td>78.5</td>
<td>56.1</td>
<td>16.7</td>
</tr>
<tr>
<td>S20</td>
<td>91.3</td>
<td>67.9</td>
<td>29.5</td>
</tr>
<tr>
<td>S21</td>
<td>67</td>
<td>47</td>
<td>14</td>
</tr>
<tr>
<td>S22</td>
<td>78</td>
<td>59</td>
<td>21</td>
</tr>
<tr>
<td>S23</td>
<td>93</td>
<td>72</td>
<td>42</td>
</tr>
</tbody>
</table>

The results of the MUSIC modelling for the two proposed basins (P2140R and P3650R) are outlined in Table 5-17.
Table 5-17 Annual average pollutant load reduction for the proposed basins

<table>
<thead>
<tr>
<th>Basin</th>
<th>Total suspended solids (%)</th>
<th>Total phosphorous (%)</th>
<th>Total nitrogen (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2140R</td>
<td>89</td>
<td>76</td>
<td>56</td>
</tr>
<tr>
<td>P3650R</td>
<td>77</td>
<td>64</td>
<td>40</td>
</tr>
</tbody>
</table>

The results of the MUSIC modelling, which are measured in annual pollutant load reductions, indicate that the refined road and pavement drainage would generally result in an improvement in water quality compared to that which was previously achieved (and assessed within the draft EIS).

The Water Management Policy of Liverpool City Council (section 4.1j) refers to pollutant load reductions for suspended solids, total phosphorus and total nitrogen. General policy pollutant load reductions are not available in the latest Council General DCPs, however a previous DCP 2008, Part 1, General Controls for all Development (section 6.4) indicates that post development water quality shall be reduced by 45 per cent for TP and TN and by 80 per cent for TSS.

The Penrith City Council Water Sensitive Urban Design Policy (section 3.2) indicates that pollutant load reductions should be 45 per cent for TN, 65 per cent for TP, 85 per cent for TSS and 90 per cent for gross pollutants.

The percentage reductions that are achieved by the proposed controls indicate that those reductions are not always achieved. This is due to site constraints that do not allow the provision of additional permanent water quality controls.

The proposed design refinements would not result in any additional impacts to soils or contamination during operation beyond that which was assessed in the draft EIS.

The construction of water quality infrastructure has been considered in the revised biodiversity assessment presented in Section 5.3 in relation to potential aquatic biodiversity impacts and footprint changes.

Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6. This includes the following new and revised measures in relation to soils, water and contamination management during construction:

- The proposed farm dam dewatering plan would include a map showing locations of farm dams to be dewatered as well as the selected relocation sites, fisheries Permit and Animal Care and Ethics requirements, methodology for the capture, storage, relocation, release of fish and other aquatic fauna, and a euthanisation procedure (as required).
- The permanent stabilisation measures would consist of soft engineering solutions where reasonable and feasible and the realigned creek would mimic a natural creek system of the local area.
- The riparian corridor along either side of the realigned creek would be rehabilitated in accordance with the Vegetation Management Plan to be developed for the project in accordance with the DPI Water guidelines.
- Appropriately sized sediment basins would be designed, implemented and managed during construction in accordance with the requirements of the Blue Book.
- The refuelling of plant and maintenance machinery would be undertaken at least 50m from waterways with appropriate spill containment mechanisms in place such as impervious bunding and the provision of spill kits nearby.
- There would be no stockpiling of soil or construction materials within utility easement corridors.

Additionally, during operation the following revised measures is proposed:
• Water quality swales will be implemented for the proposal, including upstream of identified sensitive receiving waterways

Consistent with the draft EIS, an Operational Water Quality Management Plan would be established which would outline monitoring and reporting requirements to confirm the effectiveness of these water quality measures, and identify if any additional measures are required.

5.2.3 Aboriginal heritage

Section 8.3 of the draft EIS identifies the potential Aboriginal heritage impacts from construction and operation of the project. This chapter also recommends environmental management measures to reduce the impacts of the project.

The working paper, Aboriginal Cultural Heritage Assessment Report (CHAR) (Appendix M), of the draft EIS has been used to inform this assessment.

Assessment approach

Kelleher Nightingale Consulting (KNC) carried out the Aboriginal heritage assessment as part of the draft EIS. The assessment included a review of background information, including identification of previously recorded Aboriginal sites registered on the Aboriginal Heritage Information Management System (AHIMS) database, predictive modelling, Aboriginal community consultation and a full coverage archaeological field survey.

The full coverage survey was carried out in 2015 and 2016 by a team comprising representatives from the Deerubbin Local Aboriginal Land Council, Gandangara Local Aboriginal Land Council and archaeologists from Kelleher Nightingale Consulting.

Consultation with Aboriginal communities, including Deerubbin Local Aboriginal Land Council, Gundungarra Local Aboriginal Land Council and registered Aboriginal stakeholders for the project was carried out in accordance with Aboriginal cultural heritage consultation requirements for proponents, 2010 (DECCW, 2010).

Existing environment

Section 8.3.2 of the draft EIS outlines the existing environmental conditions relevant to Aboriginal heritage. This is considered to provide a baseline of existing conditions from which potential impacts from the project have been assessed. It outlines the historical Aboriginal cultural heritage context of the project and the results of background research.

Aboriginal heritage sites were recorded on AHIMS within the search area. Of the 60 sites, one (B6, AHIMS # 45-5-2636) was found within the project area. The subsequent archaeological survey (see below) identified 28 sites within the project area (this includes site B6). The locations of these sites are shown on Table 8-19 and Figure 8-8 of the draft EIS.

The draft EIS also outlines the consultation with Aboriginal communities regarding the project activities and their potential for impact on Aboriginal cultural heritage. In the case of the project, stages one through three of PACHCI have been initiated, with the CHAR (Appendix M of the draft EIS) satisfying Stage 3 of the PACHCI having been prepared in consultation with the registered Aboriginal stakeholders for the project. Stage 4 of the PACHCI would be initiated during construction through the implementation of the management measures, including salvage (refer to Chapter 6).

Main impacts as documented in the draft EIS

The project area was identified as containing 28 identified Aboriginal archaeological sites containing Aboriginal objects as defined under the National Parks and Wildlife Act, 1974. The significance of recorded Aboriginal archaeological sites within the project area was identified in the draft EIS as ranging from low to moderate, with the majority (20 Aboriginal archaeological sites) having been assessed as being of moderate significance.
This assessment was based on a consideration of the research potential, connectivity (association with other sites), representativeness, intactness and rarity. Specific Aboriginal stakeholder comments and cultural values were incorporated into the overall significance assessment as obtained during the consultation process.

Collectively, the group of archaeological sites has a greater scientific and socio-cultural assessment value than individual site assessments. In this regard the projects’ collection of impacted archaeological sites are rare as an assessment group, offering a statistically significant level of information about an area (the south west Cumberland Plain) where little large scale, connectable or representative information exists. Information obtained through the proposed salvaging of artefacts at key locations along this road corridor would greatly enhance our cultural and archaeological understanding of the area and allow for significant interpretation of past events and better management of Aboriginal heritage in the future.

The draft EIS evaluated the potential harm of the project on the 28 potentially impacted Aboriginal archaeological heritage sites as follows:

- 16 archaeological sites would be partially impacted (ie partial impact) by the project, including 6 on Commonwealth land
- 12 archaeological sites would be wholly impacted by the project (ie total impact), including 6 on Commonwealth land.

Twenty of these archaeological sites were identified as requiring mitigation through archaeological salvage excavation because they exhibit at least moderately intact archaeological deposit, relatively intact soil structure, information bearing archaeological objects and Aboriginal cultural value. Recovery of information through archaeological salvage excavation would offset the loss caused by the upgrade works by increasing the understanding, strengthening the interpretation and improve the recognition of Aboriginal heritage within an area where little previous documented information exists.

Additionally, for these sites which would only be partially impacted by the project, the portion of the site outside the project boundary would be fenced off prior to the commencement of construction works to ensure that the area is not inadvertently affected as a result of construction work.

No archaeological salvage excavation would be required for the remaining eight sites as they have been assessed as being of low significance because they are only partially impacted by construction, highly disturbed or contain no secondary archaeological information.

The project offers an opportunity to significantly advance the interpretation and management of Aboriginal heritage of the surrounding area by providing a baseline foundation for future heritage assessments. Moreover, the information recovered during the s program would allow for informed management of the partially impacted sites, thereby achieving a positive result for Aboriginal heritage. However while the proposed mitigation for impacted sites will contribute to our understanding, strengthen the interpretations and improve ongoing and future management of Aboriginal heritage in the surrounding area, the salvage work would have a residual impact to the heritage value of sites by physically removing artefacts.

There are no operational related impacts to Aboriginal heritage identified for the project.

Implications of the revised design on the project

As outlined in section 4.2, there have been a number of design refinements since exhibition of the draft EIS for the project which have resulted in changes to the construction footprint (ie the area of disturbance). The assessment of these changes in relation to Aboriginal heritage is outlined below.

The assessment concluded that the proposed design refinements would not result in any additional impact on Aboriginal cultural heritage and are consistent with the impacts identified in the draft EIS. That is, a total of 28 Aboriginal archaeological sites would be impacted by the project as identified in the draft EIS, with 12 sites totally impacted and 16 sites partially impacted by the project.
Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6. Due to there being no change in impact, the design refinements would not result in any revised or additional environmental management measures for the project. The management measures identified in the draft EIS for Aboriginal cultural heritage would be implemented for the project. However, the following additional consultation measure has been added:

- Council would be provided copies of heritage reports and photo archival results. Release of sensitive information would be carried out in accordance with the wishes of Aboriginal stakeholders.

5.2.4 Non-Aboriginal heritage

Section 8.4 of the draft EIS identifies the potential non-Aboriginal heritage impacts from construction and operation of the project. This chapter also recommends environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, non-Aboriginal Heritage Assessment (Appendix N), of the draft EIS and Appendix D – Technical Memorandum: Non-Aboriginal Heritage has been used to inform this chapter.

Assessment approach

Section 8.4.1 of the draft EIS outlines in detail the assessment approach used in assessing the construction and operational impacts of the project.

In summary, the desktop assessment for the draft EIS was based on previous studies carried out in the area, as well as, a search radius of 500 m for all online database searches of heritage registers. This desktop assessment and a review of aerial imagery informed the identification of locations for the field survey carried out to ground truth known and potential heritage items identified during the desktop assessment, and to identify any new heritage items or areas of archaeological potential. This informed the baseline upon which impacts were assessed. The assessment of impacts was based on areas where the construction footprint overlaps with the curtilage of identified heritage items.

The non-Aboriginal heritage impact assessment addresses archaeology, heritage items and conservation areas, in accordance with NSW Heritage Branch guidelines, and the Australia ICOMOS Charter for Places of Cultural Significance (Burra Charter).

For projects situated on Commonwealth land or which may impact on Commonwealth land, the guidelines Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies (Significant Impact Guidelines 1.2) have been applied.

A site survey was conducted on 23-26 February and 5-6 April 2016 to ground truth the desktop assessment. A further field survey was carried out of four additional areas relating to drainage works in the vicinity of the WaterNSW supply pipeline on 20 September 2016.

Based on the findings of the desktop assessment and site survey, known or potential heritage items were assessed for significance against the relevant criteria adopted by the NSW Heritage Council pursuant to the Heritage Act, 1977 as well as guidelines under the NSW Heritage Manual. Additionally, for places on Commonwealth land, or owned or managed by the Commonwealth Government the Australian Heritage Council, these have been assessed against the relevant Australian Heritage Council guidelines and its ‘significance threshold’ test where relevant.

As outlined in section 4.2, there have been a number of design refinements since exhibition of the draft EIS for the project which have resulted in changes to the construction footprint (ie the area of disturbance). The assessment of these changes in relation to non-Aboriginal heritage is outlined below.

For the purpose of the Final EIS, a staged desktop assessment was carried out between June and September 2017 to assess the potential impact of the proposed design refinements on non-
Aboriginal heritage in comparison to the draft EIS design. Additionally, a non-Aboriginal heritage technical memorandum was prepared in response to community and agency submissions, which reflected the refined design (refer to Appendix D). This assessment incorporates the findings of additional historical research undertaken for the project by JCIS consultants, as well as additional archaeological assessments and research designs prepared by EMM consulting for a number of the heritage items. This included additional field survey by Pamela Kottaras of EMM consulting on 15 and again on 18 September 2017. The results of this assessment are outlined below.

Existing environment

Section 8.4.2 of the draft EIS outlines the historical context of the project as well as identifying registered and potential heritage items.

Previous studies and heritage register searches indicated that there are two registered heritage items located within the project area as described in Table 8-26 of the draft EIS. This includes the Commonwealth Heritage listed Orchard Hills Cumberland Plain Woodland, and the locally listed Lawson’s Inn site (former ‘The Thistle’ site). No items listed on the SHR, section 170 registers, National Trust register, NHL or World Heritage List, were identified within or adjacent to the project.

During the field survey, an additional eight potential heritage items were identified as outlined in Table 8-27 of the draft EIS. Of the ten items assessed, only four were identified as having heritage significance as summarised in Table 8-28 of the draft EIS and summarised below.

Revised impact assessment

As outlined in the response to community and agency submissions, further historical research has been carried out and the associated assessments of heritage significance of some items assessed in the draft EIS have been updated. Although the statements of heritage significance for some items were updated to reflect increased knowledge of these sites, there was no change to whether or not an item satisfied the criteria for local or State heritage listing, with no items of State heritage significance identified for the project.

In summary, a total of 10 items potentially impacted by the project were assessed for heritage significance as part of the draft EIS including two registered heritage items and eight ‘potential’ heritage items identified as follows:

- Item 1: Remnant of The Northern Road – no potential heritage significance
- Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (in relation to Chaffey Brothers Irrigation Scheme Canal) – Commonwealth heritage significance
- Item 3: Warragamba Dam to Prospect Reservoir pipeline – local heritage significance
- Item 4: Fruit Orchard, Luddenham – no potential heritage significance
- Item 5: Weatherboard House, Slab Hut and Old Dairy, Luddenham – no potential heritage significance
- Item 6: Weatherboard House and Sheds, Luddenham – no potential heritage significance
- Item 7: ‘Pleasantview’ House 1, Luddenham – no potential heritage significance
- Item 8: Luddenham Village area: Chapel and School Site and Adams Road House – no potential heritage significance
- Item 9: Miss Lawson’s Guesthouse site – local heritage significance
- Item 10: Lawson’s Inn site – local heritage significance.

The desktop assessment of the revised design did not identify any new areas that overlap with registered historical heritage items, and did not identify any new impacted areas as having the potential for heritage items. However, the assessment identified a number of revised impacts to heritage items previously identified and assessed as part of the draft EIS as follows:
• Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (including the Chaffey Brothers Irrigation Scheme Canal) – the revised construction footprint has resulted in changes to the impacts on land within the DEOH site. This has resulted in changes to impacts to the Orchard Hill Cumberland Plain Woodland site (contained within the DEOH site) in relation to its natural heritage and to historic heritage associated with the Chaffey Brothers Irrigation Scheme Canal located within the site. An assessment of the area of the heritage features directly impacted by the revised footprint has been carried out and is presented below in comparison to the impact assessed as part of the draft EIS:
  - About 9.28 ha of native vegetation within the Orchard Hills Cumberland Plain Woodland site would be impacted based on the refined design construction footprint (refer to Figure 5-5), a reduction in comparison to the previously identified 9.68 ha identified in the draft EIS. The revised footprint would not change the outcome of the draft EIS, with areas of low to moderate natural heritage significance being impacted, no areas of high significance are impacted as a result of the proposed design refinements. Additionally, there is no change to the tolerance for change of areas proposed to be impacted as a result of the proposed design refinements.
  - About 2.36 per cent of the northern part of the canal would be impacted based on the refined design construction footprint (refer to Figure 5-6), a slight reduction in comparison to the previously identified 2.43 per cent assessed in the draft EIS.

A research design and excavation methodology has been prepared for the Canal (refer to Appendix D) which has identified further details about the site.

• Item 3: Warragamba Dam to Prospect Reservoir pipeline (local heritage significance) – an extension of the construction footprint in the location of the WaterNSW pipelines is located adjacent to an area of potential heritage significance not previously identified as part of the draft EIS. This area includes four concrete building foundations associated with the pipeline depot building (refer to Figure 5-7). The area was previously identified and surveyed by Jacobs in September 2016, however did not overlap with the design at the time and was therefore not further assessed or documented as part of the draft EIS. The design refinements have resulted in a change to the construction footprint at this location, with impacts to these heritage features avoided. A low risk remains that unknown potential heritage items associated with the pipeline may be located within this new impact area. With the implementation of the revised environmental management measures (see below), no additional heritage impacts are expected.

• Item 9: Miss Lawson’s Guesthouse site (local heritage significance) – a research design and excavation methodology has been prepared for the site (refer to Appendix D) which has identified further details about the site and associated features (refer to Figure 5-8).

• Item 10: Lawson’s Inn Site (local heritage significance) – a research design and excavation methodology has been prepared for the site (refer to Appendix D) which has identified through historical photographs and maps that the location of the Inn site is expected to be outside the project footprint. This has further informed the proposed management of the site. Where the draft EIS predicted about a third of the site would be impacted by the project, it is now expected that the main Inn site can be avoided and about one quarter of the curtilage of the site is expected to be impacted. This part of the site has been identified as being of low archaeological significance based on further archaeological research (refer to Figure 5-9). If during testing significant archaeological resources are identified within these areas of low archaeological potential to be impacted by the project, then the design would be reviewed and where reasonable and feasible adjusted to avoid where possible or minimise these impacts.

No new potential heritage items were identified as part of this desktop assessment.
Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6. Several new and revised measures have been developed in response to submissions received during exhibition of the draft EIS and in relation to the revised design, including those summarised below.

Item 2: Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (including the Chaffey Brothers Irrigation Scheme Canal)
- Archaeological investigation of the portion of the canal to be impacted by the project, including test excavation in accordance with the research design and excavation methodology for the item

Item 3: Warragamba Dam to Prospect Reservoir pipeline (local heritage significance):
- The construction contractor would identify suitable measures to be incorporated into the CEMP to prevent physical damage to the pipeline in accordance with The Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines (Sydney Catchment Authority 2012). These measures would be developed in consultation with Roads and Maritime and the Sydney Catchment Authority and include measures for the management of potential vibration impacts, erosion and sediment controls and agreed site access protocols.
- An exclusion zone would be established to protect the depot building footings associated with the pipelines (Item 3), which are immediately adjacent to the proposed drainage infrastructure works within WaterNSW land.
- Roads and Maritime would consult with WaterNSW with all aspects of construction near the pipeline corridor during detailed design and construction of the project.

Item 9: Miss Lawson’s Guesthouse site (local heritage significance)
- Archaeological investigation of the item including test excavation in accordance with the research design and excavation methodology.

Item 10: Lawson’s Inn Site (local heritage significance)
- Archaeological investigation of the item including test and salvage excavation in accordance with the research design and excavation methodology. If during testing significant archaeological resources are identified within these areas of low archaeological potential to be impacted by the project, then the design would be reviewed and where reasonable and feasible adjusted to avoid where possible or minimise these impacts.

These measures have been incorporated into the revised environmental management measure for the project, as outlined in Chapter 6.
Figure 5-5 | Location of Orchard Hills Cumberland Plain Woodland (Item 2) in relation to proposed works
Figure 5-6 | Location of Orchard Hills Cumberland Plain Woodland showing extent of Chaffey Brothers Irrigation Scheme Canal (item 2) in relation to proposed works
Figure 5.7 | Location of Warragamba Dam to Prospect Reservoir Pipeline (Item 3) in relation to proposed works
Figure 5-8 | Location of Miss Lawson’s Guesthouse Site (item 9) in relation to proposed works
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Figure 5-9 | Location of Lawson’s Inn Site (Item 10) in relation to proposed works
5.2.5 Urban design and visual impacts

Section 8.5 of the draft EIS provides an assessment of the urban design, landscape character and visual amenity implications associated with the project. This chapter also recommends environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Urban Design and Visual Impact Assessment (Appendix O), of the draft EIS has been used to inform this chapter.

Assessment approach

The impact assessment and finalisation of the design for the draft EIS was an iterative process which enabled the concepts to be refined as they were developed, thereby reducing and mitigating the potential visual impact of the project wherever possible. The approach to the assessment follows the Roads and Maritime Services Guideline for Landscape Character and Visual Impact Assessment EIA-N04 (RMS, 2013) and involved the following sequence of activities:

- Reviewing relevant literature, analysing aerial photographs and topographic maps to understand the study area
- Undertaking an initial site visit and field investigation, to verify assumptions made through literature/photography review and gain a better understanding of site conditions
- Reviewing the initial engineering concept design and supporting material to gain an appreciation of the project
- Defining landscape character through a contextual analysis. The contextual analysis has been used to set the overall baseline for the visual impact assessment
- Identifying and describing landscape character zones and evaluating the project's impact on them
- Identifying the visual catchment of the proposed works
- Selecting viewpoints within the visual catchment representing a range of different land uses
- Evaluating the project’s visual impact by comparing the sensitivity of viewpoints and the magnitude of the impact of the upgrade upon them
- Identifying urban design and landscape opportunities and methods of mitigating adverse visual impacts for consideration during future design phases.

A total of five Landscape Character Zones (LCZ) were identified during the contextual analysis. The impact of the proposed upgrade on each LCZ was assessed based on the sensitivity of the zone, and the magnitude of the proposed upgrade in that zone to determine the landscape character impact.

Within the LCZs, a number of viewpoints and groups of viewpoints were identified at varying locations and view directions. The visual impact of the project has been assessed by considering both the sensitivity of the view and the magnitude of the proposed works within that view to determine the visual impact.

Existing environment

Section 8.5.2 of the draft EIS provides a contextual analysis of the project site and surrounding area. This is considered to provide a baseline of existing conditions from which potential impacts from the project have been assessed. A number of LCZs are identified through the contextual analysis. They are generally based on the study area’s surrounding land use, vegetation cover and topography to identify areas of distinct characteristics identified in the following sections.

The project is located within a rural setting around the periphery of the Western Sydney Airport, partly within the Western Sydney Priority Growth Area (WSPGA). The Northern Road is an important urban arterial road skirting the west of the Sydney metropolitan area. It would function as the main north–south connecting route between Camden and Campbelltown, and Penrith and...
Windsor. The DEOH, while representing a different land use, nevertheless is consistent in character with surrounding land uses, containing a similar mix of open and vegetated areas.

The landscape of the study area is typical of the Cumberland Plain and defined by its situation along a well-defined ridge that constitutes the watershed between the South Creek and Nepean River catchment. For the most part of the study area the existing alignment of The Northern Road closely follows this ridge as it gradually descends in elevation from a high point south of Luddenham to Glenmore Park.

Section 8.5.2 of the draft EIS also provides a detailed description of five different Landscape Character Zones (LCZ) that have been defined based on the interplay of natural and built features.

Main impacts as documented in the draft EIS

Construction impacts

Potential impacts to each of the LCZs would mostly be associated with the establishment and use of ancillary facilities during construction as summarised in section 8.5.4 of the draft EIS as follows:

- LCZ 1: The use of the areas within this LCZ would temporarily alter its character, with the exception of the site around the proposed new intersection to the Western Sydney Airport which would be located adjacent to The Northern Road and would be highly visible by the large numbers of people travelling along that route. Ancillary facilities would have a temporary impact on the landscape character of LCZ 1.
- LCZ 2: The majority of the area within this LCZ proposed for use as a compound site is currently cleared. While use of the site as a construction compound would temporarily alter the character of the landscape, the site is not readily visible from surrounding areas. It would have little impact on the landscape character of LCZ 2.
- LCZ 3: The sites identified for ancillary facilities within this LCZ are generally cleared areas, with the exception of the Christmas tree farm near the intersection of The Northern Road and Elizabeth Drive. These sites would be situated in prominent locations along existing major road corridors and the use of the site for construction compounds or other ancillary facilities would temporarily alter the character of the landscape.
- LCZ 4: The proposed ancillary facilities within this LCZ are extensively cleared areas. However, they would be situated in prominent locations on the ridge tops and slopes adjoining existing road corridors and would therefore be highly visible from surrounding areas which would temporarily alter the character of the landscape.
- LCZ 5: The proposed ancillary facilities in this LCZ are generally cleared areas, with the exception of the site north of the WaterNSW Supply Pipelines which retains a larger number of scattered remnant trees. These sites would be situated in prominent locations along The Northern Road and would therefore be highly visible to large numbers of potential viewers and which would temporarily alter the character of the landscape.

This includes impacts to Commonwealth land associated with LCZs 1 and 2 associated with the Western Sydney Airport site and parcels of Commonwealth land at Willowdene Avenue, as well as LCZ 5 associated with the DEOH.

Other construction works resulting in visual impacts would include vegetation removal. This would alter the character of each LCZ, in particular vegetation removal around creeks and the road interface with adjoining properties.

Additionally, construction would involve some night-time works which would require installation and use of temporary lighting. If unmanaged, light spill from these activities may impact on the health and wellbeing of some residents and occupants of buildings nearest to construction works at night-time.

Impacts as a result of typical construction activities would generally be temporary short-term, direct and indirect impacts. The removal of vegetation during construction would result in long-term
impacts, which would be reduced in some areas during operation of the project as vegetation becomes established.

**Operational impacts**

Landscape character impacts

A qualitative assessment of landscape character impacts across the five identified LCZs for the project is summarised in Table 8-33 of the draft EIS, ranging from moderate to high. This includes impacts to Commonwealth land associated with LCZs 1 and 2 associated with the Western Sydney Airport site and parcels of Commonwealth land at Willowdene Avenue, as well as LCZ 5 associated with the DEOH. In summary, the project would fundamentally alter the character of the existing road north of Elizabeth Drive, and introduce a new road alignment into greenfield areas south of Elizabeth Drive. The change in road character, in particular the width of the road, combined with extensive earthworks and removal of vegetation and farm dams would have a considerable impact on the existing rural landscape along the route. The project would impact on all LCZs, due to the scale of the proposed works and the high sensitivity of surrounding areas.

Visual impacts

The potential visual impact of the project was assessed in relation to a number of key viewpoints and groups of viewpoints as summarised in Table 8-34 of the draft EIS. A total 19 viewpoints form the basis of the visual impact assessment for the draft EIS. In summary, the assessment indicates that the project would have a high visual impact on two thirds of the assessed views. Remaining visual impacts would be in the high to moderate and moderate range, indicating that the project would notably affect the views and visual qualities within the study area.

This includes visual impacts on or to Commonwealth land associated with the following viewpoints:

- Viewpoints 1 and 2 assessed as being of moderate to high impact, with potential to impact views to and from the Western Sydney Airport site and the land at Willowdene Avenue
- Viewpoint 18 assessed as being of high impact, with potential to impact views to and from the adjacent DEOH site.

Urban Design Concept

An urban design strategy and concept plan is outlined in Appendix O of the draft EIS. The concept plan was based on the urban design and objectives and principles established for the project.

The urban and landscape concept design developed as part of the draft EIS consists of several components:

- An urban design strategy outlining the overall approach to the design
- Recommendations for road design elements including embankments, structures such as bridges and walls, hydrological features and roadside elements and furniture
- A landscape planting concept including recommended species
- Urban and landscape design concept plans at 1:5,000 describing main treatments and outcomes
- A series of cross sections through proposed work illustrating the outcomes and treatments in the third dimension, including interfaces with adjoining areas and the local road network
- An elevation of the proposed Adams Road bridge to illustrate the relationship with the proposed upgrade and the local road network.
Implications of the revised design on the project

The findings of the LC VIA presented in the draft EIS have been reviewed considering the project design refinements presented in Table 4-1.

The design refinements are located entirely within the area assessed during the draft EIS investigations, and further site investigations were not required. The design refinements have also not resulted in the development of new LCZs or viewpoints.

Construction impacts

The proposed design refinements would not alter the construction impacts presented in the draft EIS.

Operational impacts

Landscape character impacts

The five LCZs and the visual environment presented in the draft EIS remain unchanged. Sensitivity of the zone, and the magnitude of the proposed upgrade in that zone also remain unchanged. The proposed design refinements would not alter the landscape character zone impact ratings presented in the draft EIS however the following has been considered:

- Geometry and alignment refinements such as changes to batter slopes, vertical alignments and super elevation adjustments would occur within all five LCZs. Changes to intersection configurations would also occur within all five LCZs. Refinements are generally minor and would not impact the existing landscape character impact rating.
- Changes to batter slopes would occur within all five LCZs. Steeping of some batters to a maximum of 1:2 slope has occurred to minimise property impacts but could result in minor changes to the existing landscape character impact rating presented in the draft EIS, however ratings were already assessed as Moderate to High.
- The removal of VMS would occur within LCZ 3 (Luddenham Plateau) and LCZ 4 Cosgrove Creek. The removal of VMS is likely to result in less impact to the landscape character in these areas. Despite this, the impact rating for both LCZ remains unchanged.
- Removal of the northbound heavy vehicle inspection bay (at Grover Crescent) would occur within LCZ 5 (Mulgoa-Orchard Hills). The removal is likely to result in less impact to the landscape character in these areas. Despite this, the impact rating for both LCZ remains unchanged.
- Local road upgrades at Kings Hill Road, Vineyard Road extension and Gates Link Road would all occur within LCZ 5. LCZ 5 is a largely linear zone along the existing road corridor. Due to the variable topography and tree cover, proposed changes would be more easily absorbed and not widely visible beyond the road corridor. The changes to alignments of the local roads in this LCZ are relatively minor and would not impact the existing landscape character impact rating of Moderate.

Visual impacts

A total of 19 viewpoints form the basis of the visual impact assessment in the draft EIS and this has not changed due to design refinements. The viewpoints are generally focused on locations that would be commonly viewed by the local community. The assessment indicates that the proposed upgrade of The Northern Road would have a high visual impact on two thirds of the assessed views.

The installation of VMS contributed to high visual impact ratings at Viewpoints 13, 15 and 18. At these locations it was noted that each VMS would be a large built structure that would be inconsistent with the surrounding rural environment. Removal of VMS is likely to reduce the visual impact at those viewpoints, including viewpoint 18 on Commonwealth land.
Minor refinements such as geometry changes, intersection changes and kerb and median refinements would be unlikely to affect the visual impact assessment provided in the draft EIS.

**Urban Design Concept**

Roads and Maritime has reviewed design refinements against the urban design principles and advised additional assessment of the refined design by urban design specialist is not required. The urban design concept would be further refined during detailed design in conjunction with the construction contractors for the project and in consultation with relevant stakeholders such as Penrith and Liverpool City Councils.

**Environmental management measures**

A consolidated list of environmental management measures for the project is provided in Chapter 6. The following new mitigation measure has been added in relation to the detailed design and operation of the project:

- Development of the landscaping plan would include consultation with Council regarding its maintenance requirements.

### 5.2.6 Air quality

Section 8.6 of the draft EIS summarises the existing environment and assesses the potential changes to air quality at a local and regional scale that would potentially result from the construction and operation of the project. This chapter also identifies environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Air Quality (Appendix P), of the draft EIS has been used to inform this chapter.

**Assessment approach**

The approach used in assessing the construction and operational impacts of the project on air quality is detailed in Sections 8.6.1 to 8.6.3 of the draft EIS. A detailed description of the existing environment, including meteorology, ambient air quality and potentially impacted sensitive receivers is described in Section 8.6.4 of the draft EIS.

The assessment of construction related air quality impacts involves a review of the proposed location, duration, staging and intensity of construction activities proposed against existing environment conditions. The assessment used a qualitative risk assessment to inform mitigation and management measures to minimise impacts proposed.

Potential operational air quality impacts were determined using the Roads and Maritime Tool for Roadside Air Quality (TRAQ) prediction model. TRAQ, which uses the CALINE4 air dispersion model for predicting air pollutant concentrations near roadways. The assessment considered concept upgrade arrangements, measured and forecast traffic data and worst case meteorological conditions.

The operational air quality assessment considered the following scenarios:

- Scenario 1: Do minimum, year of opening (2021)
- Scenario 2: Proposed upgrade, year of opening (2021)
- Scenario 3: Do minimum, future year (2031)
- Scenario 4: Proposed upgrade, future year (2031).

Predicted roadside operational contributions of typical air pollutants related to roadways were added to background concentrations and compared to EPA ambient air quality assessment criteria (Section 8.6.3 of the draft EIS). The relative difference in predicted impacts between each scenario was also assessed. Mitigation measures were recommended, as required, to manage any identified operational impacts.
Predicted impacts at a local level were also used to inform potential operational impacts at a wider regional scale.

The design refinements since exhibition of the draft EIS have been reviewed and considered against the findings of the draft EIS. No further modelling has been carried out.

**Existing environment**

Section 8.6.4 of the draft EIS outlines the existing environmental conditions relevant to local and regional air quality. This is considered to provide a baseline of existing conditions from which potential impacts from the project have been assessed.

Existing, or ambient air quality is measured by a metric known as the ‘air quality index’ (AQI). The AQI provides an indication of the overall air quality by considering pollutant data measurements for ozone (O3), nitrogen dioxide (NO2), carbon monoxide (CO), sulphur dioxide (SO2) and PM10, as well as visibility against criteria presented in the *Variation to the National Environment Protection (Ambient Air Quality) Measure and OEH standard for visibility*. Statistics generated from daily AQI values calculated at the nearest OEH air quality monitoring (St Marys – northern portion of the project Bringelly – southern portion) indicate that daily AQI values are generally ‘good’ with occasional days of ‘poor’ air quality or worse, usually driven by particulate matter concentrations.

Further detail is provided in the draft EIS summarising the ambient concentrations of PM10, PM2.5, NO2 and CO measured at the nearest air quality stations from 2013 to 2015.

**Main impacts as documented in the draft EIS**

**Construction impacts**

Construction activities have the potential to increase airborne particulate matter and cause nuisance impacts where construction is in proximity to sensitive receivers such as residential dwelling and community areas. Potential impacts could include:

- Temporary increase in air emissions from dust and products of combustion (from equipment operations)
- Temporary increased windborne dust emanating from disturbed/exposed surfaces
- Increased dust and debris arising from haulage of materials during construction
- Odours arising from uncovered contaminated and/or hazardous materials.
- Deposition of dust on vegetation or natural surfaces (dependent on soil moisture, prevailing weather conditions, and duration and type of activities).

The draft EIS evaluated potential air quality impacts during construction using the risk-based approach. The following activities are considered to be high risk before the implementation of environmental management measures:

- Establishment and operation of construction compound sites and storage facilities
- Vegetation clearing, grubbing and removal
- Earthworks - Stripping, stockpiling and management of topsoil and unsuitable materials
- Road widening and re-alignment works, intersection works - Placement and compaction of sub-base course and base course.

The following activities are considered to be moderate risk before the implementation of environmental management measures at local receivers:

- Road widening and re-alignment works, intersection works - Excavation and preparation of subgrade
- Pavement construction – development of pavement and median
- Landscaping and demobilisation from the site.
The following activities are considered to present a low risk at local receivers before the implementation of environmental management measures:

- Early works including installation of construction signage and environmental controls, ground surveys, geotechnical and soil investigations, dilapidation and building surveys and protection of utilities
- Drainage and utilities works
- Bridge preparation and installation activities
- Installation of permanent traffic control signals and road furnishings; line marking and street lights.

Any potential air quality impacts during construction would be temporary and effectively mitigated through the measures outlined in Section 8.6.8 of the draft EIS.

**Operational impacts**

Potential impacts to air quality during the operational phase of the project are generally associated with motor vehicle emissions arising from changes in the volumes of motor vehicles, model of travel (such as free flow or congestion), and proximity to sensitive receivers.

Key pollutants associated with exhaust fumes include carbon monoxide (CO) and nitrogen dioxide (NO₂). Other pollutants include Particulate Matter (PM10 and PM2.5) and Volatile Organic Compounds (VOCs).

Considering the predicted concentrations of exhaust emissions from the four scenarios in relation to the nearest and typical setback distances from the project, the following conclusions have been made:

- Criteria for PM₁₀, NO₂, CO, VOCs and 24 hour-averaged PM₂.₅ are expected to be met at surrounding nearby receivers for all four assessment scenarios, therefore the intent of each of the criteria in terms of managing health impacts to nearby receivers is expected to be achieved.
- The PM₂.₅ annual criterion was predicted to be exceeded along each segment for each assessment scenario. This is a result of the adopted annual PM₂.₅ background concentration (8.7 µg/m³) already exceeding the 8 µg/m³ criterion. However, comparisons between the predicted concentrations for the do minimum and proposed upgrade options were similar, indicating that the upgrade would not materially change annually averaged roadside PM2.5 concentrations from conditions if the ‘do minimum’ option was to be implemented.

As such, for the year of opening (2021) and design year (2031) time frames assessed and based on the presently available data, the proposed upgrade is not expected to result in unacceptable concentrations at surrounding receivers (i.e. at a local scale). Noting this, impacts at a regional scale were also assessed to be minimal.

The potential air quality impacts to the environment of Commonwealth land during both construction and operation are not anticipated to be greater or different to those outside of Commonwealth land.

Safeguards and management measures identified in Section 8.6.8 of the draft EIS have been developed to specifically manage potential impacts which have been predicted as a result of the proposed works.

**Implications of the revised design on the project**

The design refinements outlined in Section 4 have been considered against the outcomes of the air quality assessment carried out for the draft EIS.

The potential air quality related impacts associated with the refined design for the project are considered consistent with those presented in the draft EIS. This is due to the fact that, in general, the design refinements have only marginally altered the design of the road when compared to the draft EIS design including no substantial increase in distance to sensitive receivers. Additionally,
construction plant and equipment, timings, haulage routes and operational traffic conditions would not substantially differ from that outlined in the draft EIS.

Environmental management measures
A consolidated list of environmental management measures for the project is provided in Chapter 6. No additional environmental management measures have been proposed beyond those identified in the draft EIS.

5.2.7 Resources and waste management
Section 8.7 of the draft EIS assesses resources usage and waste management impacts during construction and operation of the project. This chapter also identifies environmental management measures to avoid, minimise and mitigate the impacts of the project. No working paper was prepared as part of the draft EIS.

Assessment approach
Resource use for the project was assessed by reviewing existing information and estimating the resources required for construction and their likely sources (including energy, materials and water resources).

Quantities and types of wastes that would be generated from the project were identified from the resource estimates and were used as the basis for the preliminary classification in accordance with the Waste Classification Guidelines (EPA, 2011).

The design refinements since exhibition of the draft EIS have been reviewed and considered against the findings of the draft EIS. The refinements would not result in any material change of impacts in relation to waste and resource use, and as such no further assessment was deemed to be required.

Policy Setting
Section 8.7.1 of the draft EIS outlines the policy setting for waste management in NSW. The Protection of the Environment Operations Act 1997 (NSW) (POEO Act) covers the requirements for waste generators in terms of storage and correct disposal of waste and their responsibility for the correct management of waste and these have been considered in the assessment of waste generated by the project, including the development of environmental management measures. The Protection of the Environment Operations (Waste) Regulation 2014, in particular Part 7 outlines requirements for the transportation and management of asbestos waste.

The Waste Avoidance and Resource Recovery Act 2001 (WARR Act) promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs and provides a waste management hierarchy as a guide for prioritising waste management practices.

In addition to managing waste in accordance with the relevant legislation, Roads and Maritime manages waste according to the NSW Waste Avoidance and Resources Recovery Strategy 2014-21 (EPA, 2015) and the NSW Waste Classification Guidelines (EPA, 2014).

Main impacts as documented in the draft EIS

Construction impacts
The draft EIS identified the following key construction related impacts:

- Waste generated during construction would primarily be from works associated with site preparation, relocation of utilities, and construction of road infrastructure and landscaping
- There is a potential for contaminated material to be disturbed through construction activities. The majority of AEIs identified are likely to pose a low potential of exposure to site users and environmental receptors to contamination during construction of the...
upgrade. A detailed assessment of potential contamination impacts associated with the project is provided in Section 8.2 of the draft EIS

- For construction activities on the DEOH site there is the potential for UXO and other contaminated materials such as asbestos to be encountered during earthworks. As described in Section 8.2.3 of the draft EIS and summarised in the revised environmental management measures as outlined in this Final EIS (refer to Chapter 6), the discovery of unexpected contaminated material would be managed through the implementation of an unexpected finds procedure.

- Earthworks would be required across the project area including for road widening, bridge construction and drainage. Based on estimates drawn from the concept design, it is predicted that about 400 000 m³ of imported fill would be required for construction of the project. It is predicted that there would be about 240 000 m³ of excavation material that could be beneficially reused as fill for the project. Imported fill would either be virgin excavated natural material (VENM) or would comply with the conditions for reuse attached to a relevant resource recovery exemption.

- Surplus spoil that is unable to be reused on-site would be transported for beneficial reuse off-site in accordance with a relevant EPA resource recovery exemption or disposed of at a licensed waste facility.

- Construction of the project would require various materials and pre-cast elements. Materials would be sourced from appropriately licensed facilities and commercial suppliers in nearby areas. None of the materials proposed to be used are considered to be in short supply. Material quantities would be determined throughout the detailed design phase prior to commencement of construction and reduced where possible through efficient design, construction and procurement processes.

- Equipment and vehicles on the construction site would consume a large quantity of fuel. It is estimated that up to 3.5 million litres of fuel (diesel and petrol) would be used to construct the project.

- Electricity needs on the site would be minor, and connection of the office to the local power grid would be sufficient. It is estimated that up to 26 million kilowatt hours of power would be used to construct the project. Some generators may be necessary for emergency power supply.

- It is estimated that up to 50 mega litres of water (non-potable and potable) would be used to construct the project. This would be sourced from reusable non-potable water onsite where possible (eg treated site water from sediment basins, harvested rainwater), or from local potable water sources (eg water mains via metered standpipes or temporary piped water supply). No surface or groundwater would be extracted for construction.

- Water would also be required during establishment of landscaped areas. The landscape establishment period is typically 12 weeks, with weekly watering of landscaped areas required during this period to assist growth and establishment.

- For construction activities on the DEOH site there is the potential for UXO and other contaminated materials such as asbestos to be encountered during earthworks.

**Operational impacts**

The draft EIS identified the following key operational related impacts:

- Wastes would be generated during maintenance of the road including vegetation, litter, sediment and hydrocarbons.

- Resource use during operation is generally limited to fuel usage for road maintenance activities and electricity for road lighting and signals.
The potential waste and resource use impacts to the environment of Commonwealth land during both construction and operation are not anticipated to be greater or different to those outside of Commonwealth land.

**Implications of the revised design on the project**

The typical waste streams generated will not change as a result of the revised design as the key components and land-uses remain largely unchanged.

During construction, earthworks would be required across the project area including for road widening, bridge construction and drainage. These works would generate spoil in surplus to that which can be reused on site. The proposed design refinements, including the changes to the batter slopes, would have only a negligible increase in surplus spoil.

It is unlikely that the proposed design refinements would result in any other increase in waste generation or resource use during construction or operation.

**Environmental management measures**

A consolidated list of environmental management measures for the project is provided in Chapter 6. The following additional environmental management measures has been added:

- Where water is sourced from farm dams, it would be done so in consultation with landowners.

Additionally, the project sustainability strategy describes how sustainability will be integrated into the design, construction and operation of the project (see Section 5.2.11).

**5.2.8 Climate change and greenhouse gas**

Section 8.8 of the draft EIS provides an assessment of potential greenhouse gas (GHG) emissions during the construction and operation stages of the project and establishes the current and potential future climatic context for an assessment of key climate change risks to which the project may be exposed. This chapter also recommends environmental management measures to avoid, minimise and mitigate the impacts of the project.

The working paper, Climate Change and Greenhouse gas working papers (Appendix Q), of the draft EIS has been used to inform this chapter.

**Assessment approach**

The methodology for this Climate Change and GHG assessment as part of the draft EIS was based on the legislative and policy framework for the control of GHG emissions and minimisation of climate change.

The information sources used in carrying out the assessment comprise Government policies, mapping, and previous assessments. A complete list of information sources used in the assessment is provided in the working papers. The assessment methodologies described below identify where those sources of information have been verified. Where used, specific tools such as ‘Carbon Gauge’ and TRAQ are discussed and described with regard to their use in assessing potential impacts.

The methodology for conducting the climate change risk assessment has been based on the Australian Standard AS 5334-2013 Climate change adaptation for settlements and infrastructure – A risk based approach.

**Existing environment**

Section 8.8.2 of the draft EIS outlines the policy context for climate change and greenhouse gas management including Australia’s commitments to meeting its Kyoto Protocol long-term target and international agreements made under the 2015 Paris Climate Conference.

Over the course of the 21st Century, western Sydney’s climate is expected to become:
• Warmer: with increased average and extreme high temperatures, but fewer extreme cold temperatures
• Drier: rainfall is projected to decline. Reduced annual rainfall and increased evaporation is anticipated to result in drier soil conditions, less run-off in water supply catchments and reduced average river flows and groundwater recharge
• Subject to more extreme weather conditions: hydrological cycles are projected to intensify with atmospheric warming, leading to more intense extreme rainfall events. Heatwaves will become more frequent, intense and prolonged. While extreme weather conditions may become more extreme, they may become less frequent.

Projected changes in climate over the course of the 21st century may be disruptive to the operations of the project and users of western Sydney’s road network, increase operations and maintenance costs and shorten its operating life. While climate change projections are uncertain, the opportunity exists to assess its implications for the project and to incorporate appropriate, proportional measures to help ensure its resilience under the climate it will experience over its operating life.

Main impacts as documented in the draft EIS

Construction impacts

During construction, the greatest sources of greenhouse gas emissions are associated with the combustion of fuel by plant and equipment, the use of bitumen as part of the asphalting process and the removal of vegetation.

The GHG emissions associated with construction of the project are presented in Table 8-47 of the draft EIS. In total, the construction of the project is expected to generate about 89 ktCO2e. Of this, the greatest proportion is related to the combustion of fuel in on-site construction plant and equipment. The use of bitumen as part of the asphalting process is the second largest contributor, followed by fuel used during demolition and earthworks activities. Impacts associated with fuel consumption for vegetation removal were not included as they do not trip the materiality threshold within CarbonGauge, however emissions associated with the loss of the vegetation itself was included in the assessment.

The potential impacts of climate change would be negligible during the construction phase due to its relatively short timeframe.

Operational impacts

During operation, greenhouse gas emissions are generally attributed to the combustion of fuel for road transport. Table 8-48 of the draft EIS provides a comparison of the two cases assessed in relation to potential operational impacts, traffic numbers (both directions) for 'do minimum' and 'with project' cases for the year of opening (2021) and future year (2031).

The results show that a small increase in GHG emissions from the ‘Do Nothing’ scenario is expected on year of opening, and a large increase in GHG emissions is expected from the future year scenario. This is directly associated with the significant increase in traffic numbers using the project.

Regardless, under the ‘with project’ scenario, GHG efficiency is projected to stay relatively similar to the ‘do minimum’ scenario at year of opening, both in 2021 and 2031. This represents traffic which is able to flow freely, greatly improving fuel efficiency.

Road traffic usage of the project is, as expected, the greatest contributor to the operational GHG inventory, forming 97 per cent of emissions. The total emissions from road traffic of the ‘with project’ over 50 years post year of opening are 1,736 ktCO2e, which compares to 1,326 ktCO2e for the ‘do minimum’ scenario. This is as a result of the greater number of vehicles moving through the road network in comparison to the ‘do minimum’ scenario.
The detailed risk assessment carried out for the project did not identify any climate change risks rated as high or extreme. A number of climate change risks identified as 'medium' are identified in Table 8-50 of the draft EIS along with the associated mitigation measures to be implemented. These 'medium' risks include:

- Increased temperatures and the more frequent incidence and severity of heatwaves
- More severe extreme flood events
- Increase in the frequency and intensity of severe rainfall events
- More severe fire weather and elevated fire weather conditions
- Increased concentration of carbon dioxide in the atmosphere.

The remaining risks were classified as ‘Low’ or ‘Negligible’. For these risks, no risk treatment is proposed at this stage – although some of the risks would be followed up upon at detailed design stage.

The potential greenhouse gas impacts to the environment of Commonwealth land during both construction and operation are not anticipated to be greater or different to those outside of Commonwealth land and the residual impacts are considered to be consistent with those outlined in Section 8.8 of the draft EIS.

Implications of the revised design on the project

The design refinements would not result in any significant changes to these emission generating activities and therefore would be unlikely to result in more than a negligible increase in the greenhouse gas emissions.

The design refinements would not result in a substantial change in traffic volumes, congestion (level of service), or average speeds and therefore would be unlikely to result in more than a negligible increase in greenhouse gas emissions.

The design refinements would not result in a change to the climate change risks assessment outlined in the draft EIS.

Environmental management measures

A consolidated list of environmental management measures for the project is provided in Chapter 6. No additional environmental management measures have been proposed beyond those identified in the draft EIS.

Additionally, the project sustainability strategy describes how sustainability will be integrated into the design, construction and operation of the project (see Section 5.2.11).

5.2.9 Hazard and risk

Section 8.9 of draft EIS summarises the environmental hazards that would potentially result from the construction and operation of the project, and the identification of measures to avoid, minimise and mitigate these risks.

Assessment approach

A preliminary scoping assessment determined that the design refinements would not materially change the outcome of the draft EIS in relation to hazards and risks of the project. Therefore, this section of the report summarises the key findings of the draft EIS and the implications of the revised design on the outcomes of this assessment, based on a qualitative desktop assessment of the changes.
Main impacts as documented in the draft EIS

**Construction impacts**

The following hazards and risks may be associated with the project during construction of the project without effective mitigation:

- Potential short and long-term impacts resulting from the accidental release or improper handling and storage of dangerous goods and hazardous substances within temporary ancillary facilities
- Potential short and long-term hazards resulting from the accidental release of dangerous goods or hazardous substances from vehicles transporting those materials to and from construction compounds in the event of a crash
- Potential short-term workplace and public health and safety hazards, such as dangers to construction workers, road users and the general public as a result of rock falls and steep slopes, rupture or interference with underground services, potential hazardous materials such as asbestos encountered during construction and demolition works
- Potential short-term hazards associated with bushfires.

Potential construction related impacts relevant to Commonwealth Land may arise from the use of hazardous substances as a result of accidental release or improper management; the discovery of hazardous material such as UXO or asbestos, potential interface with underground services and bushfires on or adjacent to Commonwealth land.

Overall, the hazards and risks associated with construction of the project were identified in the draft EIS as being low and would be managed with the implementation of the proposed environmental management measures for the project.

Potential operational hazards and risks would be related to the transport of dangerous goods on The Northern Road during operation, and the potential risk of vehicle collision which could result in the accidental spill of dangerous goods. This would have the potential to adversely affect the quality of the local environment and impact human safety, with potential hazards including toxic effects, fire and explosions. However, these were identified in the draft EIS as being low and would be managed with the implementation of the proposed environmental management measures for the project.

**Implications of the revised design on the project**

The proposed design refinements would not result in any additional hazards or risks during the construction and operation of the project. Further, several of the design refinements were specifically designed to reduce potential safety risks including:

- The removal of the left turn onto The Northern Road from the existing Elizabeth Drive due to safety concerns about the proximity to the signalised intersection.
- The removal of left out Grover Crescent (south) access to increase safety of vehicles entering The Northern Road from Grover Crescent.

**Environmental management measures**

A consolidated list of environmental management measures for the project is provided in Chapter 6. Several new measures have been developed in response to submissions received during exhibition of the draft EIS. In summary, the new hazard and risk management measures relate to:

- The CEMP would include contingency and emergency response plans as required
- Measures to mitigate and manage bushfire would be developed and included as part of site-specific hazard and risk management measures within the CEMP. The road is to be designed with consideration to the requirements of the Planning for Bush Fire Protection 2006
• Roads and Maritime would notify WaterNSW of any incident such as vehicle accident, discovery of any heritage items, spill or fire that affects or could affect the Warragamba Pipelines including the corridor.

5.2.10 Cumulative impacts

Chapter 9 of draft EIS provides a summary of the cumulative impacts associated with the project, based on the most current and publicly available information. Typical cumulative impact associated with transport and infrastructure projects include:

• Impact on traffic, transport and road users
• Changes to local and regional amenity, including noise, visual quality and air quality
• Social and economic effects, including changes to land use, access and businesses
• Environmental changes including effects on water quality, hydrology and biodiversity.

Chapter 9 of the draft EIS also recommends environmental management measures to avoid, minimise and mitigate the impacts to and of the project.

Assessment approach

This assessment of cumulative impact focused on the key environmental issues that are assessed in detail in Chapter 7 and Chapter 8 of the draft EIS.

The assessment of cumulative impact addressed potential construction phase interfaces with other significant infrastructure and development projects as well as the operational relationship of the project to other projects.

The identification of projects for consideration was based on the following criteria:

• Other projects part of the overall The Northern Road Upgrade were considered
• Project size – given the extent of development within Sydney, major projects (as determined by the NSW DPE) were considered
• The Western Sydney Airport project
• Project boundary – only projects located within LGAs intersected by or adjacent to the project areas (Penrith and Liverpool LGA) were considered
• Project timeframe – projects likely to be undertaken at some point during the construction period of the project were considered
• Projects where cumulative operational impacts would be a consideration.

Main impacts as documented in the draft EIS

The potential cumulative impacts of these projects are considered as follows in relation to:

• Concurrent impacts, ie potential cumulative impacts as a result of projects being constructed at the same time
• Consecutive impacts, ie potential cumulative impacts as a result of a project being constructed before and after the construction of the project.

Section 9.2.1 of the draft EIS provides a detailed discussion of the construction and operational cumulative impacts of the project with other relevant projects.

Implications of the revised design on the project

The draft EIS assessed the cumulative impact of potential construction and operational phase interfaces of the project with other projects in the vicinity.

As identified in the draft EIS, the construction timeframes of the other components of The Northern Road Upgrade would overlap with that proposed for the project and therefore are likely to result in
cumulative impacts during those periods. As indicated in section 4.2.3, the project start and finish date would be delayed from what was assessed in the draft EIS, however this is not expected to significantly change the outcome of cumulative impacts of the project with this or other projects.

The draft EIS also identified potential cumulative impacts with other nearby developments that are not related to The Northern Road Upgrade program of work and which are likely to be under construction at a similar time to the project including:

- Western Sydney Airport
- Urban growth areas in western Sydney
- M12 Motorway
- M4 Smart Motorway civil work
- Other State Significant Developments proposed within the Penrith and Liverpool LGAs and in proximity to the project.

With regard to the Western Sydney Airport, the draft EIS stated that aviation infrastructure works are scheduled to overlap with the project's construction schedule by about one year – starting in mid-2019. Site preparation activities associated with the Western Sydney Airport, including substantial earthworks are scheduled to commence in 2018 ahead of the aviation infrastructure works. The overlap of impacts would be larger than identified in the draft EIS, about two years rather than one.

Key cumulative impact considerations assessed as part of the draft EIS in relation to potential cumulative impacts associated with these projects included:

- Traffic and transport
- Noise and vibration
- Biodiversity
- Visual amenity, built form and urban design
- Air quality
- Socio-economic.

The outcomes of the draft EIS would generally be consistent with the project changes assessed in this Final EIS, taking into account revised impacts of the project as outlined above.

The additional construction timeframes associated with Western Sydney Airport site preparation activities would result in longer-term traffic and transport related impacts along the Northern Road. Construction traffic generated by the site preparation works would impact primarily on the arterial road network, including The Northern Road, with additional trucks travelling along the key arterials through the surrounding area. This would mean that higher than normal car and truck movements would be expected over a longer timeframe compared to that discussed in the draft EIS.

Construction activities and the additional traffic associated with them are likely to result in lower travel speeds and increased delays at intersections along The Northern Road. Increased heavy vehicle volumes may also result in delays in sections where cars are unable to overtake vehicles along The Northern Road.

The additional timeframes associated with the cumulative impacts of the Western Sydney Airport have not resulted in any additional management measures.

**Environmental management measures**

A consolidated list of environmental management measures for the project is provided in Chapter 6. No additional environmental management measures for the management of cumulative impacts have been proposed beyond those identified in the draft EIS, however one of the existing measures has been revised as follows:
• Construction traffic management plans for this project should be developed in consultation with plans for other projects to assist in spreading the traffic load over the network and to minimise construction traffic being concentrated on any one particular route.

5.2.11 Sustainability

Chapter 10 of the draft EIS explains how sustainability principles relate to the design, construction, and operation of the project.

Section 3A of the EPBC Act outlines principles of ecologically sustainable development. The EPBC Act principles of ecologically sustainable development are summarised below.

a) Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations

b) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation

c) The principle of inter-generational equity – that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations

d) The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making

e) Improved valuation, pricing and incentive mechanisms should be promoted.

These principles were considered and incorporated into the design of the project and have been further considered during design refinements for the project (see Chapter 4).

The project sustainability strategy describes how sustainability will be integrated into the design, construction and operation of the project. The strategy has been prepared to align with the TfNSW Transport Environment and Sustainability Policy Framework and the Roads and Maritime Roads and Maritime Environmental Sustainability Strategy. The project’s sustainability strategy was developed in collaboration with the design teams for each stage of the project and for all design refinements.

The sustainability targets outlined in Table 10-2 of the draft EIS provide a measurable and verifiable framework to drive and track the project’s sustainability performance. Targets constitute benchmarks to be verified through documentary evidence as the project progresses. The targets may be refined as the project scope and design develops.

These targets have not changed as a result of design refinements and Roads and Maritime are committed to achieving stated sustainability targets.
6 Revised environmental management measures

The draft EIS for the project identified a range of environmental outcomes and management measures that would be required to avoid, minimise or mitigate the environmental impacts.

After consideration of the issues raised in the public submissions, the environmental management measures for the project have been revised. Should the project be approved, the environmental management measures in Table 6-1 will guide the subsequent phases of project development. Additional and/or modified environmental management measures to those presented in the draft EIS have been italicised in blue coloured text and deleted measures, or parts of measures, have been struck out.

6.1 Construction safeguards and management measures

These safeguards would minimise potential adverse impacts of the project. All safeguards described in this Final EIS would be incorporated into the contractor’s CEMP. The timing and responsibility for the implementation of the safeguards would also be outlined in the CEMP. Roads and Maritime would retain responsibility for some of the safeguards including those related to detailed design, however the construction contractor would be responsible for implementing the majority of safeguards. The estimated costs of environmental mitigation measures have been captured in project capital costs and, whilst difficult to quantify specifically, would represent less than 10 per cent of project costs.

Table 6-1: Summary of revised environmental management measures

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Ref #</th>
<th>Environmental management measure</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Effectiveness of measures</th>
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<tbody>
<tr>
<td>Construction impacts</td>
<td>T-1</td>
<td>A Construction Traffic Management Plan (CTMP) would be developed, approved, implemented and monitored as part of the project. The TMP would:</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CTMP to confirm effectiveness of measures.</td>
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<td></td>
<td></td>
<td>• Outline the general principles and procedures for the development of specific construction traffic control plan (CTP’s), taking into consideration where possible other construction works utilising similar haulage and access routes</td>
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<td>• Ensure safe and continuous traffic movement for construction workers and the general public</td>
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<td>• Maintain the capacity of existing roads</td>
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<td>Potential impact</td>
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<td>Environmental management measure</td>
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<td>where possible</td>
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<td>• Identify the requirements for temporary speed restrictions where traffic may pose a safety risk to workers</td>
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<td>• Maintain continuity of access to local roads and properties, particularly along the existing alignment of The Northern Road (may require temporary u-turn facilities). Where access is affected, RMS would consult with residents for alternative access arrangements</td>
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<td></td>
<td>• Details of access to construction sites including measures to prevent construction vehicles queuing on public roads</td>
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<td>• Provide temporary traffic control where necessary</td>
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<td>• Provide appropriate warning and signage for traffic in the vicinity of work areas</td>
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<td>• Include methods to minimise road user delays such as undertaking works around live traffic including tie-in and bridge work outside of peak periods</td>
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<td>• Undertake construction activities off-line where possible to minimise the requirement to operate temporary traffic control and reduced speed zones</td>
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<td>• Develop a communication plan to advise local residents and businesses of any changes to traffic conditions during construction.</td>
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<td>• Consult with bus operators regarding temporary bus stop relocations during</td>
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<td>Potential impact</td>
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<tr>
<td>Construction staging</td>
<td>T-2</td>
<td>Staging plans to be prepared in consultation with adjoining contractors and for each stage of the upgrade.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. The requirements for staging plans would be outlined within the TMP. Monitoring and reporting requirements of the TMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Road damage</td>
<td>T-3</td>
<td>Undertake a pre-construction dilapidation survey of local roads used for construction. Defects caused by construction activities would be rectified prior to completion of construction.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
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<tr>
<td>Property access</td>
<td>T-4</td>
<td>Access to properties along affected roads would be maintained during construction. The need for any alternative and/or temporary access arrangements would be agreed with affected property managers/owners.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Access arrangements would be outlined in the TMP, the effectiveness of those arrangements and the need for any alternative and/or temporary access arrangements would be agreed with affected property owners.</td>
</tr>
<tr>
<td>Local road upgrades</td>
<td>T-5</td>
<td>Roads and Maritime will consult with Councils regarding the requirements for upgrade of local roads.</td>
<td>Roads and Maritime</td>
<td>Construction</td>
<td>Expected to be effective.</td>
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<td>Potential impact</td>
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<tr>
<td>Property access</td>
<td>T-6</td>
<td>Roads and Maritime will consult further with all utility providers on required access and consents for utility corridors prior to construction</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>Expected to be effective.</td>
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</tbody>
</table>
| Construction noise impacts               | NV-1  | Construction Noise and Vibration Management Plan (CNVMP) would be prepared during the detailed design stage of the project and applied to all construction processes throughout the project. The CNVMP would be prepared in accordance with the requirements in the ICNG and RMS CNVG. The CNVMP would nominate:  
  - Noise goals at all sensitive receivers  
  - Restrictions on the hours of construction activity including an out-of-hours work procedure  
  - Works programming that has the aim of minimising impacts on sensitive receivers  
  - Noise and vibration mitigation measures consistent with the RMS CNVG  
  - The project’s commitments to noise and vibration monitoring and reporting including:  
    - vibration monitoring of work in the vicinity of the Warragamba Dam pipeline  
    - safe working distances for vibration intensive plant to be adopted in proximity to the Warragamba Dam pipeline  
  - Protocols for engaging with and notifying residents of any work processes that may impact them | Construction contractor     | Construction      | Expected to be effective. Monitoring and reporting to confirm effectiveness of measures. Continuous improvement to be achieved through ongoing evaluation of monitoring results. |
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<tr>
<th>Potential impact</th>
<th>Ref #</th>
<th>Environmental management measure</th>
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<th>Timing</th>
<th>Effectiveness of measures</th>
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<td>• Describe an out-of-hours work procedure (with proforma) to be applied to all construction assessments, which is consistent with the applicable Environmental Protection Licence (EPL) for the project</td>
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<td>NV-2</td>
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<td>• A complaints mechanism so that residents may contact the project manager</td>
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<td>• A protocol to enable the project to respond quickly to non-compliances.</td>
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<td>Viable mitigation measures that would be expected to be deployed by the construction contractor once the final construction sequencing and scheduling is known include:</td>
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<td>• Restricting works to standard construction hours as far as practicable, considering safety and traffic management requirements</td>
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<td></td>
<td></td>
<td>• Selecting quieter plant and equipment</td>
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<td>• Erecting temporary acoustic hoarding to reduce noise from works within a confined area</td>
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<td>• Deploying mobile hoardings (eg, acoustic screen curtains mounted on a wheeled trailer) to track moving, but tightly-contained processes</td>
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<td>• Maximising offset distances between receivers and noisy plant or activities</td>
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<td>• Orientating plant and processes away from residences, where reasonably practicable</td>
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<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting to confirm effectiveness of measures. Continuous improvement to be achieved through ongoing evaluation of monitoring results.</td>
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<td>Potential impact</td>
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<td>• Scheduling works for times outside of heightened sensitivity for the impacted receiver, eg, outside of school hours</td>
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<td>• Scheduling respite periods for noise-intensive processes undertaken near receivers, eg limiting operation of pavement sawing to three hours at a time</td>
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<td>• Planning any OOHW so that noisier works are carried out in the earlier part of the evening or night-time</td>
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<td>• Minimising the number of consecutive nights of works adjacent to any particular set of receivers</td>
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<td>• Restricting heavy vehicle movements, heavy deliveries and loading and unloading processes to daytime periods and to areas well away from receivers</td>
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<td></td>
<td></td>
<td>• Regularly maintaining and monitoring plant and equipment to ensure that their noise emissions are not excessive</td>
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<td>• Minimising the annoyance from reversing alarms by either fitting closed circuit monitors or non-tonal reversing alarms (&quot;quackers&quot;) on vehicles or deploying ‘spotters’ to oversee reversing movements</td>
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<td>• Reducing throttle settings and switching off equipment when it is not being used.</td>
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<td>• <strong>Hoarding (2.4 metres) to be installed at the perimeter of all ancillary facilities except where it can be justified that the acoustic benefit of the hoarding is not warranted</strong></td>
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<td></td>
<td>• <strong>Haulage routes will be located as far away</strong></td>
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<td>Potential impact</td>
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<td>as possible from residential receivers, where this is reasonable and feasible</td>
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<td>• Where it has been identified as necessary (e.g., in response to community complaints or where verification is required), noise monitoring will be undertaken to check that the noise mitigation measures are effective</td>
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<td>• Static noise sources, such as generators, pumps, and lighting towers, will be located as far as possible from sensitive receivers</td>
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<td>• Loading and unloading will be carried out away from sensitive receivers, where practicable</td>
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<td>• Ensure all deliveries occur during standard construction hours where reasonable and feasible.</td>
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<td>NV-3</td>
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<td>Implement operational noise mitigation early in the construction program, where possible, to minimise construction noise impacts</td>
<td>Roads and Maritime</td>
<td>Construction</td>
<td>Proven to be effective</td>
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<tr>
<td>General construction impacts</td>
<td>B-1</td>
<td>A Flora and Fauna Management Plan (FFMP) would be developed for the project. The plan would include procedures for pre-clearance surveys that are consistent with the <em>Roads and Maritime Biodiversity Guidelines</em> (RTA, 2011). The FFMP would outline:</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
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<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
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<td>approach and identification of fauna release areas should fauna be encountered during vegetation removal</td>
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<td>• Updated sensitive aerial vegetation maps based on clearance surveys and previous survey work</td>
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<td>• Exclusion zones and fencing or other means to demarcate vegetation to be retained (endangered ecological communities) in close proximity to the works</td>
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<td>• Clearing of vegetation and removal of bush rock (Guide 7) including implementation of the pre-clearing process (Guide 1) and the associated staged habitat removal process where hollow-bearing trees, habitat trees or bush rock is to be removed</td>
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<td>• Weed management (see Guide 6) through the use of mechanical weed control methods such as slashing or mowing, as well as a range of herbicides</td>
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<td>• Pathogen management (see Guide 7) through the implementation of hygiene protocols such as the provision of vehicle and boot wash down facilities and ensuring vehicles and footwear are free of soil before entering or exiting the site, as well as the establishment of exclusion zones and designated access tracks</td>
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<td>• Mechanism for the monitoring, review and amendment of this sub-plan.</td>
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<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
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<td>Removal of native vegetation, threatened species and threatened species habitat</td>
<td>B-2</td>
<td>Native vegetation removal would be minimised through detailed design.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Expected effective. The design has been optimised throughout design options to minimise impacts to vegetation</td>
</tr>
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<td></td>
<td>B-3</td>
<td>Pre-clearing surveys would be undertaken in accordance with Guide 1: Pre-clearing process of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
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<td>• Identify and locate habitat features on site, and mark those to be protected during clearing.</td>
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<td>• Identify suitable habitat areas for fauna relocation (if encountered during clearing works).</td>
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<td>• 24 hours prior to clearing, licensed wildlife carers and/or ecologists should capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities and relocate to the pre-determined location (as above).</td>
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<td>• Carry out staged habitat removal (Guide 4) where fauna habitat features have been identified and marked.</td>
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<td>Potential impact</td>
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<td>B-4</td>
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<td>Vegetation removal would be undertaken in accordance with <em>Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</em> (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
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<td></td>
<td></td>
<td>• Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation</td>
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<td>• Retain stumps in riparian zones and aquatic habitats to reduce the potential for bank erosion</td>
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<td>• Separate woody vegetation into millable timber, secondary re-use (Guide 5) or exotic (non-native) vegetation</td>
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<td>• Non-woody vegetation should be incorporated into the stripping of topsoil to retain any organic materials and nutrients</td>
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<td>• The staged habitat removal process is to be used when identified habitat is to be removed, with a licensed wildlife carer or ecologist on site</td>
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<td>• Undertake bush rock removal in a way that minimises damage to the bush rock, avoids excessive soil disturbance and avoids climatic seasons when species are utilising this resource</td>
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<td></td>
<td>• The Australian Standard <em>AS 4373 Pruning</em></td>
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<td>B-5</td>
<td>The unexpected species find procedure is to be followed under <em>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</em> (NSW Roads and Traffic Authority, 2011) if threatened ecological communities, flora or fauna not assessed in the biodiversity assessment, are identified in the project site. The procedure is as follows:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Reporting requirements of the FFMP to be adhered to.</td>
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<td>of amenity trees should be followed for all pruning works.</td>
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<td>• Threatened flora or fauna species unexpectedly encountered Stop work</td>
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<td>• Notify the environment manager</td>
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<td>• Environmental manager would arrange for an ecologist to conduct an assessment of significance of the likely impact, develop management options and notify OEH, DPI and DoEE as appropriate</td>
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<td>• If a significant impact is not likely to occur, recommence work and maintain regular inspections,</td>
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<td>• If a significant impact is likely to occur:</td>
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<td></td>
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<td>‒ Consult with OEH, DPI and DoEE as appropriate,</td>
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<td></td>
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<td>‒ Obtain approvals, licenses or permits as required,</td>
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<td></td>
<td></td>
<td>‒ Recomence works once advice is sought and necessary approvals, licences and permits are obtained,</td>
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<td>‒ Include species in subsequent inductions, toolbox talks and update the CEMP.</td>
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<tr>
<td>Removal of native vegetation, threatened species and threatened species habitat</td>
<td>B-6</td>
<td>Native vegetation would be re-established in accordance with <em>Guide 3: Re-establishment of native vegetation of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</em> (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:</td>
<td>Contractor</td>
<td>Post construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
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<td>B-7</td>
<td>Habitat removal would be minimised through detailed design.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines.</td>
</tr>
</tbody>
</table>
|                  | B-8   | Habitat removal would be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:  
  • Carefully clear vegetation so as not to mix topsoil with debris and to avoid impacts to surrounding native vegetation  
  • Retain stumps in riparian zones and aquatic habitats to reduce the potential for bank erosion  
  • Separate woody vegetation into millable timber, secondary re-use (Guide 5) or exotic (non-native) vegetation  
  • Non-woody vegetation should be incorporated into the stripping of topsoil to retain any organic materials and nutrients | Contractor | Construction | Proven to be effective if done in accordance with the Biodiversity Guidelines  
  Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures. |
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</table>
|                  | B-9   | • The staged habitat removal process is to be used when identified habitat is to be removed, with a licensed wildlife carer or ecologist on site  
• Undertake bush rock removal in a way that minimises damage to the bush rock, avoids excessive soil disturbance and avoids climatic seasons when species are utilising this resource  
• The Australian Standard AS 4373 Pruning of amenity trees should be followed for all pruning works.                                                                 | Contractor     | Construction | Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures. |
<table>
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</table>
| Aquatic impacts  | B-10  | Aquatic habitat would be protected in accordance with *Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011) and section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management Update 2013 (Department of Primary Industries, 2013). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:  
  - Avoid activities in aquatic habitats and riparian zones as much as practicable  
  - Establish exclusion zones and set up exclusion fencing around sensitive area  
  - Keep vehicles and machinery away from the banks of a waterway where possible  
  - Refuelling of vehicles and plant, and chemical storage and decanting should not take place within 50 m of aquatic habitats  
  - Avoid clearing within the riparian zone during periods when flooding is likely to occur  
  - Retain the roots of trees on the bank of a waterway in order to maintain bank stability  
  - During rehabilitation, stabilise the banks of the waterway through revegetation and/or armouring according to available landscape plans | Contractor      | Construction | Proven to be effective if done in accordance with the Biodiversity Guidelines.  
  Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures. |
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<tbody>
<tr>
<td>Removal of woody debris</td>
<td>B-11</td>
<td>All large woody debris or snags would be relocated instream (Guide 10).</td>
<td>Contractor</td>
<td>Construction</td>
<td>Expected to be effective.</td>
</tr>
<tr>
<td>Changes to hydrology</td>
<td>B-12</td>
<td>Changes to existing surface water flows would be minimised through detailed design.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Expected to be effective. Drainage upgrades for the project have been designed and optimised to minimise changes to existing flows as much as possible.</td>
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<tr>
<td></td>
<td>B-13</td>
<td>Measures to mitigate potential water quality impacts during construction are outlined in section 8.1 and section 8.2 of the EIS.</td>
<td>Contractor</td>
<td>Construction</td>
<td>N/A</td>
</tr>
<tr>
<td>Fragmentation of identified biodiversity links and habitat corridors</td>
<td>B-14</td>
<td>Identified connectivity measures have been considered at Surveyors Creek and Badgerys Creek to be further considered during design in accordance with the Wildlife Connectivity Guidelines for Road Projects (RMS in prep). In particular, design where connectivity has been considered is to include culvert design, lighting and fencing. Opportunities for increasing the height of culverts proposed to provide fauna underpass at these locations would be investigated during detailed design of the project where reasonable and feasible.</td>
<td>Roads and Maritime and Contractor</td>
<td>Detailed design, during construction and post construction</td>
<td>Expected to be effective if done in accordance with the Wildlife Connectivity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
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<td>Potential impact</td>
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<tr>
<td>Edge effects on adjacent native vegetation and habitat</td>
<td>B-15</td>
<td>Exclusion zones would be set up at the limit of clearing in accordance with Guide 2: Exclusion zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
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<td></td>
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<td>• Identify exclusion zones on a suitable plan as required to prevent damage to native vegetation and fauna habitats and prevent the distribution of pests, weeds and disease</td>
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<td>• Mark out exclusion zones on site with temporary markings such as pegs or paint and where possible use a qualified surveyor</td>
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<td>• Erect signs to inform personnel of the purpose of exclusion zone fencing</td>
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<td>• Ensure all exclusion zones are regularly inspected and repairs to fencing are made where required</td>
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<td>• Maintain exclusion fencing until the risk to disturbance within the excluded zone has been eliminated through other means. Removal of fencing should be undertaken in consultation with environmental staff</td>
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<td>• Communicate the importance of exclusion zones, and any changes to the zones, to all site staff and visitors (eg in toolbox talks and inductions)</td>
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<td></td>
<td></td>
<td>• Exclusion zones would be established around Marsdenia viridiflora subsp. viridiflora plants proposed to be retained in</td>
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<td>Potential impact</td>
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<td>Injury and morta...</td>
<td>B-16</td>
<td>Fauna would be managed in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:</td>
<td>Contractor</td>
<td>Construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.</td>
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- Exclusion zones would be established around the four *Pultenaea parviflora* plants to be retained in the area of the Vineyard Road extension in accordance with Roads and Maritime procedure.
- Roads and Maritime will investigate options for salvage of genetic material and/or translocation of *Marsdenia viridiflora* subsp. *viridiflora* and *Pultenaea parviflora* plants that are to be impacted prior to construction.
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| Invasion and spread of weeds | B-17  | Weed species would be managed in accordance with *Guide 6: Weed management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:  
  - Use an ecologist or person trained in weed management and identification to undertake a site weed assessment to identify and describe or map weed infested areas within the site and adjacent areas  
  - Develop a Weed Management Plan for the site  
  - Map and mark areas that are infested with weeds as an exclusion zone with fencing and signage to limit access by personnel and vehicles  
  - Minimise soil disturbance within weed infested areas  
  - Use mechanical weed control methods such as Contractor | Construction | Proven to be effective if done in accordance with the Biodiversity Guidelines.  
  Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures. |
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| Invasion and spread of pathogens and disease         | B-18  | Pathogens would be managed in accordance with *Guide 7 – Pathogen Management: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority, 2011). These measures would be outlined in the FFMP and would include monitoring and review procedures to be implemented to ensure the effective implementation of these measures, including but not limited to the following:  
  * Ensure vehicles and footwear are free of soil before entering or exiting the site (ie directed to wash down area before entering or exiting the site)  
  * Provide vehicle and boot wash down facilities  
  * Set up exclusion zones with fencing and signage to restrict access into contaminated areas                                                                                                                                                                                                                     | Contractor     | Construction | Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the FFMP to confirm effectiveness of measures.                                                                 |
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| Impacts to riparian corridors | B-19  | - Restrict vehicles to designated tracks, trails and parking areas.  
- A Vegetation Management Plan (VMP) would be prepared in consultation with DPI Water prior to construction commencing, including details on:  
  - The riparian corridor widths along the watercourses in proximity to the project (so that these areas can be avoided where possible)  
  - Riparian areas potentially temporarily or permanently impacted by the project  
  - The rehabilitation of riparian areas temporarily impacted  
  - Riparian offsets for the riparian areas permanently impacted  
  - The VMP would include a scaled map should be provided which identifies:  
    - The riparian corridor widths in proximity to the project so that these areas can be avoided where possible  
    - Riparian areas potentially temporarily or permanently impacted by the project  
    - Riparian offset areas. | Construction contractor | Prior to construction | Proven to be effective if done in accordance with the Biodiversity Guidelines.  
Monitoring and reporting requirements of the VMP to confirm effectiveness of measures. |
<p>| Impacts to riparian corridors | B-20  | All works on waterfront land would be carried out in accordance with the DPI Water Guidelines for Controlled Activities on Waterfront Land (2012). | Construction contractor | Construction | Proven to be effective if done in accordance with the Guidelines. |</p>
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<tr>
<td>Revegetation</td>
<td>B-21</td>
<td>Roads and Maritime would consider reuse of topsoil as part of the Urban Design Landscape Plan (UDLP) for the project.</td>
<td>Roads and Maritime</td>
<td>Prior to construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the UDLP to confirm effectiveness of measures.</td>
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<td>Revegetation</td>
<td>B-22</td>
<td>Roads and Maritime would consider transplanting native species from areas to be cleared into revegetation areas, depending on the type of species being removed and the likely success of transplanting. Plants to be used in revegetation would be sourced from local provenance seed where appropriate and available, and associated seed collection would be undertaken prior to clearing.</td>
<td>Roads and Maritime</td>
<td>Prior to construction</td>
<td>Proven to be effective if done in accordance with the Biodiversity Guidelines. Monitoring and reporting requirements of the UDLP to confirm effectiveness of measures.</td>
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<tr>
<td>Revegetation</td>
<td>B-23</td>
<td>Rehabilitation of the disturbed areas of the site would be undertaken in accordance with Roads and Maritime Batter Stabilisation Guidelines and Roads and Maritime contractor specifications.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective if done in accordance with guidelines</td>
</tr>
<tr>
<td>Biodiversity offsets</td>
<td>B-24</td>
<td>Offsets requirements (including Biobanking credits and additional supplementary measures) would be delivered in accordance with a Biodiversity Offset Strategy and supplementary measures package for the project in consultation with OEH and DoEE.</td>
<td>Roads and Maritime</td>
<td>Construction</td>
<td>Proven to be effective if done in accordance with guidelines</td>
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<tr>
<td>Potential impact</td>
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| General socio-economic impacts             | SE-1  | A Draft Community Involvement Plan would be prepared to guide community engagement during construction of the project and would be updated throughout construction. Communication would be with the local community, stakeholders and the wider region. The Draft Community Involvement Plan includes:  
  - Guiding principles overall approach to community and stakeholder involvement  
  - A comprehensive list of identified stakeholders  
  - A register of specific issue communications strategies  
  - Requirements for the project regarding access to information, complaints and inquiries procedures and community consultation  
  - A range of communication tools applicable to the project  
  - Contact names and details  
  - Complaints procedures. | Roads and Maritime | Construction                                                                 | Proven to be effective.  
To ensure flexibility in the communications approach to the project, communications and engagement activities would be monitored, assessed and reported regularly. |
<p>| SE-2 Areas affected by construction would be reinstated and restored in accordance with the urban design and landscape strategy. | Construction contractor | Construction                                                                 | See Chapter 8.5 of the EIS |
| Noise and vibration during construction and operation | SE-3  | Mitigation measures specific to construction noise and vibration can be found in section 7.2 of the EIS for this project.                                                                                                           | Construction contractor/ Roads and Maritime | Pre-construction and during construction | See Chapter 7.2 of the EIS |</p>
<table>
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<tr>
<td>Air quality during construction and operation</td>
<td>SE-4</td>
<td>Mitigation measures specific to construction air quality can be found in section 8.6 of the EIS for this project.</td>
<td>Construction contractor/ Roads and Maritime</td>
<td>Pre-construction and during construction</td>
<td>See Chapter 8.6 of the EIS</td>
</tr>
<tr>
<td>Property acquisition</td>
<td>SE-5</td>
<td>Provide appropriate compensation in accordance with the <em>NSW Land Acquisition (Just Terms Compensation) Act 1991</em> for properties to be partially or fully acquired for the project.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>N/A</td>
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<td></td>
<td>SE-6</td>
<td>Impact from the acquisition on owners' remaining holdings would be considered in the acquisition process. As required and in consultation with owners, Roads and Maritime would engage the use of appropriately qualified professionals to carry out property assessments and identify alternate opportunities for any remaining land holdings.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>N/A</td>
</tr>
<tr>
<td>Property acquisition</td>
<td>SE-7</td>
<td>Undertake property adjustments and relocation of infrastructure (for example, fencing, dams, property access) in consultation with the property owner.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with consultation requirements</td>
</tr>
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<td></td>
<td>SE-8</td>
<td>Undertake any adjustments to the Orchard Hills golf course, in consultation with the managers of the Orchard Hills Golf Club.</td>
<td>Roads and Maritime/ Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with consultation requirements</td>
</tr>
<tr>
<td>Potential impact</td>
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<td>Business and economic activity</td>
<td>SE-9</td>
<td>On-going consultation with local business owners, including owners of agricultural businesses, located close to construction works about the timing, duration and likely impact of construction activities on their business operations would be carried out.</td>
<td>Construction contractor/ Roads and Maritime</td>
<td>Construction</td>
<td>Expected to be effective. To ensure flexibility in the communications approach to the project, communications and engagement activities would be monitored, assessed and reported regularly.</td>
</tr>
<tr>
<td></td>
<td>SE-10</td>
<td>Relocate and/or remove farm infrastructure, including farm dams, as required and in consultation with affected land owners.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with consultation requirements.</td>
</tr>
<tr>
<td></td>
<td>SE-11</td>
<td>Maintain a business impact risk register to identify and manage the specific impacts associated with construction related works for individual businesses.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting would be required to measure the effectiveness.</td>
</tr>
<tr>
<td></td>
<td>SE-12</td>
<td>Access to existing businesses would be provided on a continuous basis throughout the construction of the project.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Access arrangements would be outlined in the TMP, the effectiveness of those arrangements and the need for any alternative and/or temporary access arrangements would be agreed with affected property owners.</td>
</tr>
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<td>Potential impact</td>
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<td>SE-13</td>
<td>Roads and Maritime would undertake the project in accordance with the <em>NSW Government Policy on Aboriginal Participation in Construction</em> (NSW Finance and Services, 2016).</td>
<td>Roads and Maritime / Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. Contractors for all projects covered by this policy must provide an Aboriginal Participation Plan to the contracting agency within 60 days of the contract being awarded.</td>
</tr>
<tr>
<td>Access and connectivity</td>
<td>SE-14</td>
<td>The Traffic Management Plan would include a signage strategy (consistent with Roads and Maritime policy) to provide guidance to passing patrons on access to shops, services and businesses during construction.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the TMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td></td>
<td>SE-15</td>
<td>Access to properties would be provided on a continuous basis throughout the construction of the project. Where temporary changes to property access are required, alternate access should be determined in consultation with affected property owners and tenants.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Access arrangements would be outlined in the TMP, the effectiveness of those arrangements and the need for any alternative and/or temporary access arrangements would be agreed with affected property owners.</td>
</tr>
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<td>Potential impact</td>
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<tr>
<td>SE-16</td>
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<td>Access for pedestrians and cyclists near construction works would be maintained, including consideration of pedestrian access needs for elderly people, children and people with disability.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the TMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>SE-17</td>
<td></td>
<td>Mitigation measures specific to Traffic and Transport can be found in section 7.1 of the EIS for this project.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>See Chapter 7.1 of the EIS.</td>
</tr>
<tr>
<td>Cumulative impacts</td>
<td>SE-18</td>
<td>Mitigation measures specific to cumulative impacts can be found in Chapter 9.</td>
<td>Refer to Chapter 9</td>
<td>Refer to Chapter 9</td>
<td>See Chapter 9 of the EIS.</td>
</tr>
<tr>
<td>Impacts to utilities</td>
<td>SE-19</td>
<td>Strategies to address impacts to utilities would be developed in consultation with utility providers during detailed design and during construction of the project.</td>
<td>Roads and Maritime Pre-construction Construction</td>
<td></td>
<td>Expected to be effective.</td>
</tr>
<tr>
<td>Impacts on flood behaviour during construction</td>
<td>FH-1</td>
<td>Temporary works would consider flood impacts during construction. Should construction staging require a temporary departure from the design (eg higher embankments for preloading, temporary diversions or temporary crossings), flood impacts would be assessed before finalising the approach.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting requirements of the Soils and Water Management Plan (SWMP) to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>FH-2</td>
<td></td>
<td>Appropriate scour protection measures would be implemented along any temporary drainage lines within the project construction area. Scour protection would be added to the outlets of the upgraded transverse drainage. Scour protection measures would also be</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Expected to be effective. Monitoring and reporting requirements of the SWMP to confirm effectiveness of measures.</td>
</tr>
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<td>Scour protection</td>
<td>FH-3</td>
<td>A contingency plan to be prepared to manage a potential flood event during construction that would outline procedures to reduce the likelihood, including removing plant/equipment and stabilising exposed areas. This plan would consider the likelihood of flooding, evacuation routes, warning times, and potential impacts from the site flooding.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the SWMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Drainage</td>
<td>FH-4</td>
<td>Roads and Maritime will consult further with all utility providers regarding any drainage infrastructure required within their utility corridors prior to construction.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>Proven to be effective.</td>
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</tbody>
</table>
| General          | SWC-1 | A Soil and Water Management Plan (SWMP) would be developed in accordance with the Roads and Maritime specification G38 – Soil and Water Management and the Blue Book – Soils and Construction – Managing Urban Stormwater Volume 1 (Landcom, 2004) and Volume 2D (DEC, 2008a). The SWMP would include but not be limited to:  
  - An erosion and sedimentation control plan and maintenance schedule for ongoing maintenance of temporary erosion and sediment controls  
  - A Sediment Basin Management Plan to guide appropriate management of runoff | Construction contractor | Pre-construction | Proven to be effective. Monitoring and reporting requirements of the SWMP to confirm effectiveness of measures. |
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<td>during construction and operation</td>
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<td>• An incident emergency spill plan which would include measures to avoid spillages of fuels, chemicals and fluids onto any surfaces or into any nearby waterways</td>
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<td>• Preparation of a wet weather rain event which includes a process for monitoring potential wet weather and identification of controls to be implemented in the event of wet weather</td>
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<td></td>
<td></td>
<td>• Provision of a maintenance schedule for ongoing maintenance of erosion and sedimentation controls</td>
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<td>• A review process by a soil conservationist and a process for updating the report to address any recommendations</td>
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<td>• A <em>stream and farm</em> dam dewatering plan to be prepared include:</td>
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<td>- A map showing locations of <em>streams and farm</em> dams to be dewatered and the <em>selected relocation sites</em></td>
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<td>- fisheries Permit and Animal Care and Ethics requirements</td>
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<td>- Methodology for dewatering streams and dams with consideration to aquatic ecology including the capture, storage, relocation, release of fish and other aquatic fauna</td>
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<td>- <em>Euthanisation procedure (as required)</em></td>
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<td>- Location of any offsite discharge points</td>
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<td>- Requirements to manage encounters of contaminated water.</td>
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<tr>
<td>Water quality during construction</td>
<td>SWC-2</td>
<td>A water quality monitoring program would be developed during detailed design which would outline the pre-construction baseline water quality monitoring to be undertaken, as well as the ongoing construction and operational water quality monitoring requirements. The program would be updated once the construction and operational phase water quality monitoring parameters have been determined (based on the results of the baseline water quality monitoring). The program would include specific monitoring locations, frequency, parameters, and relevant procedures to be implemented. This would include a procedure to be followed in the event that monitoring results during construction or operation indicate an exceedance of the specified criteria, including any stop works requirements, relevant non-conformance, corrective and preventative actions, reporting and review procedures. This would include a requirement to review the effectiveness of control measures and identify any potential additional controls or revised work procedures or management measures that may need to be implemented. It is noted that any sample locations or access requirements within the DEOH site would be determined in consultation with Department of Defence.</td>
<td>Construction contractor / Roads and Maritime</td>
<td>Pre-construction / construction / operation</td>
<td>Proven to be effective.</td>
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The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park
Final Environmental Impact Statement
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<tr>
<td>SWC-3</td>
<td>The realignment of the tributary of Surveyors Creek would be progressively stabilised to avoid potential scour and sedimentation and permanent stabilisation measures would be implemented as soon as practicable. The permanent stabilisation measures would consist of soft engineering solutions where reasonable and feasible and the realigned creek would mimic a natural creek system of the local area. The riparian corridor along either side of the realigned creek would be rehabilitated in accordance with the Vegetation Management Plan to be developed for the project in accordance with the DPI Water guidelines.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting to confirm effectiveness of measures. Continuous improvement to be achieved through ongoing evaluation of monitoring results.</td>
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<tr>
<td>SWC-4</td>
<td>50 temporary sediment basins are proposed during construction of the project. Appropriately sized sediment basins would be designed, implemented and managed during construction in accordance with the requirements of the Blue Book. Temporary sediment basins would be located outside of the riparian corridor where possible.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Temporary basins have been designed to provide sufficient volume for settling and storage of sediments.</td>
<td></td>
</tr>
<tr>
<td>Soil salinity impacts</td>
<td>SWC-5</td>
<td>Durability and aggressivity samples of soil material would be collected and analysed prior to the construction phase, to determine potential impacts of soil salinity on pavement infrastructure.</td>
<td>Contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective.</td>
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<tr>
<td>Sedimentation and Erosion</td>
<td>SWC-6</td>
<td>Erosion and sediment controls would be implemented before construction starts in accordance with Blue Book requirements:</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting built into the SWMP to confirm effectiveness of measures.</td>
</tr>
</tbody>
</table>
|                                        |       | • Sediment basins would be regularly serviced and maintained to comply with water quality and capacity requirements  
|                                        |       | • Clearing of vegetation and site stabilisation of disturbed areas would be undertaken progressively to limit the time disturbed areas are exposed to erosion prices  
|                                        |       | • High risk soil and erosion activities such as earthworks would not be undertaken immediately before or during high rainfall or wind events  
|                                        |       | • Stockpiling of topsoil separately for potential reuse in landscaping and rehabilitation works  
|                                        |       | • Permanent catch drains would be installed behind cut faces to act as diversion drains during the construction phase  
<p>|                                        |       | • Erosion and sediment control measures would be maintained until the works are complete and areas are stabilised by revegetation                                                                                     |
| Sedimentation and Erosion              | SWC-7 | A soil conservationist from Roads and Maritime Erosion, Sedimentation and Soil Conservation Consultancy Services would be engaged to review the erosion and sedimentation plans and conduct routine inspections of the construction works. | Roads and Maritime       | Pre-construction | Proven to be effective. Monitoring and reporting requirements of the SWMP to confirm effectiveness of measures. |</p>
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<tr>
<td>Impacts to water pollution (surface water and groundwater)</td>
<td>SWC-8</td>
<td>All fuels, chemicals, and liquids would be stored at least 50 m away from the existing stormwater drainage system and would be stored in an impervious bunded area within the compound site. The refuelling of plant and maintenance machinery would be undertaken at least 50 m from waterways with appropriate spill containment mechanisms in place such as impervious bunding and the provision of spill kits nearby. Vehicle wash downs and/or concrete truck washouts would be undertaken within a designated bunded area of an impervious surface or undertaken off-site. Disposal of dam water would be done in accordance with the stream and farm dam dewatering plan.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting to confirm effectiveness of measures. Continuous improvement to be achieved through ongoing evaluation of monitoring results.</td>
</tr>
<tr>
<td>Impacts to water pollution (surface water and groundwater)</td>
<td>SWC-9</td>
<td>It is not expected that specific controls for groundwater would be required. This is primarily due to the low to very low permeability of Wianamatta Shale and subsequently minor to negligible extent of drawdown and negligible seepage through identified road cuttings. The expected groundwater inflows are anticipated to be in the order of 0.1 L/s/km of cuttings, although probably much less. It is considered prudent that if groundwater is encountered during excavation works the groundwater monitoring plan detailed below should be implemented.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>N/A</td>
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<td>Potential impact</td>
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| Disturbance of contaminated or potentially contaminated land                    | SWC-10     | Intrusive investigations should be undertaken in the vicinity of moderate risk areas including service stations (operational and non-operational), stockpiles and market gardens. A Contaminated Land Management Plan would be prepared in accordance with the *Contaminated Land Management Act 1997*, relevant EPA Guidelines and Roads and Maritime Guideline for Management of Contamination (Roads and Maritime, 2013) and would include at a minimum:  
  - Contaminated land legislation and guidelines including any relevant licences and approvals to be obtained  
  - Identification of locations of known or potential contamination and preparation of a map showing these locations  
  - Identification of rehabilitation requirements, classification, transport and disposal requirements of any contaminated land within the construction footprint  
  - Measures to manage stockpiled potentially contaminated soil in accordance with the requirements of NSW EPA Waste Guidelines  
  - Contamination management measures including waste classification and reuse procedures and unexpected finds procedures for unanticipated discovery of contaminated material during construction  
  - Asbestos handling and disposal requirements in accordance with NSW EPA guidelines | Construction contractor | Construction | Proven to be effective. Monitoring and reporting requirements of the CLMP to confirm effectiveness of measures. |
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<tr>
<td>Excavated material that is not suitable for on-site reuse or recycling would be transported to a site that may legally accept that material for reuse or disposal.</td>
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<td>Encountering UXO</td>
<td>SWC-11</td>
<td>For UXO’s, an investigation should be undertaken to confirm the likelihood of UXO’s being present within the areas of the project within DEOH. The investigation should be undertaken prior to construction activities by a suitably qualified consultant registered on the Commonwealth Department of Defence UXO Panel (DUXOP) now subsumed into the Defence Environment and Heritage Panel (DEHP).</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Soil stockpiling</td>
<td>SWC-12</td>
<td>There would be no stockpiling of soil or construction materials within utility easement corridors.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Aboriginal construction heritage management plan</td>
<td>AH-1</td>
<td>A Construction Cultural Heritage Management Plan (CHMP) would be prepared prior to construction and implemented as part of the CEMP. The CHMP would include details on: The policy basis for management measures. The erection of any temporary fencing for the protection of heritage sites being partially impacted. Unexpected finds procedures. Responsibilities for heritage management. Salvage excavation methodologies. Consultation requirements.</td>
<td>Construction Contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CHMP to confirm effectiveness of measures. Specific measures carried out in accordance with agreed guidelines and by qualified archaeologists.</td>
</tr>
<tr>
<td>Potential impact</td>
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| Archaeological sites partially impacted by the project    | AH-2  | - Procedures for monitoring and reporting on the effectiveness of measures. The location of the portions of these sites to be conserved would be identified in the CHMP, Construction Heritage Sites Map and project inductions to ensure they are not inadvertently damaged as a result of construction works. Archaeological salvage excavation would be undertaken for the impacted portion of the following sites in accordance with the salvage excavation methodology detailed in Appendix M:  
  - B6  
  - TNR AFT 08  
  - TNR AFT 11  
  - TNR AFT 12  
  - TNR AFT 13  
  - TNR AFT 14  
  - TNR AFT 20  
  - TNR AFT 22  
  - TNR AFT 24  
  - TNR AFT 26  
  - TNR AFT 27 | Construction contractor | Construction | Expected to be effective. Salvage excavation activities would be carried out in accordance with the methodology outlined in the Cultural Heritage Assessment Report (CHAR) by a qualified team and in consultation with relevant stakeholder groups. The salvage methodology is considered both efficient and effective. |
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<tr>
<td>Archaeological sites wholly impacted by the project</td>
<td>AH-3</td>
<td>Archaeological salvage excavation would be undertaken for the following wholly impacted sites in accordance with the management procedures outlined in Appendix M: • TNR AFT 06 • TNR AFT 07 • TNR AFT 16 • TNR AFT 17 • TNR AFT 19</td>
<td>Roads and Maritime</td>
<td>Pre-Construction</td>
<td>Expected to be effective. Salvage excavation activities would be carried out in accordance with the methodology outlined in the CHAR by a qualified team and in consultation with relevant stakeholder groups.</td>
</tr>
<tr>
<td>Unexpected identification of skeletal remains</td>
<td>AH-4</td>
<td>In the event of the unexpected discovery of suspected archaeological Aboriginal human remains during the proposed works, in addition to the procedures outlined in the Roads and Maritime Unexpected Heritage Items Procedure (2015a), the CHMP would require that Roads and Maritime immediately notify the identified construction contractor</td>
<td>Construction</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with procedures outlined in CHAR.</td>
</tr>
<tr>
<td>Potential impact</td>
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<td>knowledge holders of the discovery. If the material is confirmed to be archaeological Aboriginal human remains that consultation would occur with the identified knowledge holders. Procedures for Handling Human Remains are detailed in Appendix M and summarised below:</td>
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<td>• As soon as remains are exposed, all work is to halt at that location immediately and the Project environmental manager on site is to be immediately notified to allow assessment and management:</td>
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<td>  - Stop all activities</td>
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<td>  - Secure the site.</td>
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<td>• Contact police as the discovery of human remains triggers a process which assumes that they are associated with a crime. The NSW Police retain carriage of the process until such time as the remains are confirmed to be Aboriginal or historic</td>
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<td>• The relevant approval authority(s) will be notified when human remains are found</td>
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<td>• Once the police process is complete and if remains are not associated with a contemporary crime contact the relevant approval authority(s) who will determine the process in consultation with OEH and/or the Heritage Office as appropriate:</td>
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<td>  - If the remains are identified as Aboriginal, the site is to be secured and the approval authority(s) and all Aboriginal stakeholders are to be notified in writing. The approval authority(s) will act in consultation</td>
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<tr>
<td>Unexpected identification of Aboriginal objects</td>
<td>AH-5</td>
<td>Where there is a proposed change to the project (once approved), this change will be considered in the context of potential impact to Aboriginal cultural heritage, whether increased or reduced. Where a proposed change to the approved project occurs outside of the project boundary, further heritage assessment will be required in consultation with the appointed Archaeologist to determine if there would be an impact on Aboriginal cultural heritage. Where the change is considered to have a neutral or lesser significant impact on Aboriginal cultural heritage than that identified for the approved project (as per this assessment), it would be considered a consistent impact.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with procedures outlined in CHAR.</td>
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<tr>
<td>Where the change to the approved project is considered to have a more significant impact on Aboriginal cultural heritage than that identified in the EIS, it would be considered an inconsistent impact. In this case, Roads and Maritime would require a modification to the approved project, and further consultation with Aboriginal stakeholders would be required to be undertaken.</td>
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<tr>
<td>Consultation</td>
<td>AH-6</td>
<td>Council would be provided copies of heritage reports and photo archival results. Release of sensitive information would be carried out in accordance with the wishes of Aboriginal stakeholders.</td>
<td>Roads and Maritime</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Construction impacts to non-Aboriginal heritage items and places</td>
<td>NAH-1</td>
<td>A Construction Cultural Heritage Management Plan would be prepared as part of the CEMP prior to construction in consultation with the NSW Heritage Division of OEH. As a minimum, the plan would include the following:</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CHMP to confirm effectiveness of measures. Specific measures carried out in accordance with agreed guidelines and by qualified archaeologists.</td>
</tr>
<tr>
<td>• Induction protocols for staff and project personnel to undertake a cultural heritage induction, to assist them in understanding and complying with their legal obligations under the Heritage Act 1977</td>
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<td>• A list, plan and GIS layer showing the location of identified heritage items</td>
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<td>• A significance assessment and statement of significance for each item</td>
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<td>• Detail the mitigation measures identified and when the measures are to be implemented</td>
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<tr>
<td>Orchard Hills</td>
<td>NAH-2</td>
<td>• Archival photographic recording in accordance with the Heritage Division of the OEH guidelines. This would include:</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. An archival photographic recording would be made of the extent of the canal, including the section outside the project area, in accordance with the Heritage Division of the OEH guidelines (Heritage Council of NSW 2006) prior to its demolition</td>
</tr>
<tr>
<td>Cumberland Plain</td>
<td>NAH-3</td>
<td>• Archaeological investigation of the portion of the canal to be impacted by the project, including test excavation in accordance with the research design and excavation methodology for the item.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td></td>
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<tr>
<td>Warragamba Dam to Prospect Reservoir pipeline</td>
<td>NAH-4</td>
<td>The construction contractor would identify suitable measures to be incorporated into the CEMP to prevent physical damage to the pipeline in accordance with The Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines (Sydney Catchment Authority 2012). These measures would be developed in consultation with Roads and Maritime and the Sydney Catchment Authority and include measures for the management of potential vibration impacts, erosion and sediment controls and agreed site access protocols.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with procedures outlined in CEMP.</td>
</tr>
<tr>
<td>NAH-5</td>
<td>An exclusion zone would be established to protect the depot building footings associated with the pipelines (item 3), which are immediately adjacent to the proposed drainage infrastructure works within WaterNSW land.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with procedures outlined in CHMP.</td>
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</tr>
<tr>
<td>NAH-6</td>
<td>Roads and Maritime would consult with WaterNSW with all aspects of construction near the pipeline corridor during detailed design and construction of the project.</td>
<td>Roads and Maritime Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective.</td>
<td></td>
</tr>
<tr>
<td>Miss Lawson’s guesthouse site</td>
<td>NAH-3 NAH-7</td>
<td>Detailed salvage archaeological investigation of the site. Archaeological investigation of the item including test and salvage excavation in accordance with the research design and excavation methodology.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>Expected to be effective. Salvage Test and salvage excavation would be carried out in accordance with the Heritage</td>
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<tr>
<td>Lawson’s Inn site</td>
<td>NAH-4</td>
<td>Detailed salvage archaeological investigation of the site. Archaeological investigation of the item including test excavation in accordance with the research design and excavation methodology. If during testing significant archaeological resources are identified within areas of low archaeological potential to be impacted by the project, then the design would be reviewed and where reasonable and feasible adjusted to avoid where possible or minimise these impacts.</td>
<td>Roads and Maritime</td>
<td>Pre-construction</td>
<td>Division of OEH guidelines including an appropriate research design and methodology for the site in order to best realise the research potential of this area of the site. Salvage Test and salvage excavation would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist in accordance with the Heritage Division of OEH criteria for sites of local significance.</td>
</tr>
<tr>
<td>Unexpected impacts on heritage values</td>
<td>NAH-5</td>
<td>The project’s Construction Environmental Management Plan would include ‘unexpected finds’ procedures to guide the management of any archaeological sites identified during construction. The management response would vary depending on the nature of the find, its significance and likely impacts.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective if carried out in accordance with procedures outlined in CHMP.</td>
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</table>
| Urban design                                          | UD-1    | The urban design and landscape concept developed for the project would be adopted during detailed design. This would include design treatments for:  
- Location and identification of existing vegetation and proposed landscaped areas, including species to be used  
- Built elements including retaining walls and Adams Road Bridge  
- Design’ treatments for stormwater quality | Contractor | Detailed Design / Construction / Operation | Expected to be effective. Urban design outcomes have been incorporated into concept design and would be further refined during detailed design of the project in consultation with a range of stakeholders including State Government agencies, Penrith City Council, Liverpool City Council and the local community. |
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<tr>
<td>Lighting impacts</td>
<td>UD-2</td>
<td>The design of temporary lighting must avoid unnecessary light spill on adjacent residents or sensitive receivers and be designed in accordance with AS 1158.1-1986.</td>
<td>Contractor</td>
<td>Detailed Design / Construction</td>
<td>Proven effective if carried out in accordance with AS 1158.1-1986.</td>
</tr>
<tr>
<td>Visual impacts from construction sites</td>
<td>UD-3</td>
<td>Consider the provision of barriers to screen views from visually sensitive nearby areas such as rural dwellings, residential and recreational areas.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Visual impacts from construction sites</td>
<td>UD-4</td>
<td>Contain construction activities within the construction works zone boundary and occupy the minimum area practicable for limiting impacts on adjoining areas, including the extent of native vegetation clearing.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures.</td>
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<tr>
<td>Visual impacts as a result of vegetation loss</td>
<td>UD-5</td>
<td>Construction programming must show how progressive rehabilitation of disturbed areas would be undertaken to minimise the duration and extent of temporary visual and landscape character impacts and to minimise soils exposure and the potential for erosion and dust generation.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Visual impacts as a result of vegetation loss</td>
<td>UD-6</td>
<td>Existing trees to be retained within construction areas are to be identified, protected and maintained in accordance with AS4970 Trees on Development Sites, or as otherwise directed by a qualified ecologist or arborist.</td>
<td>Contractor</td>
<td>Construction</td>
<td>Proven effective if carried out in accordance with AS4970 Trees on Development Sites.</td>
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</tbody>
</table>
| Excessive exhaust emissions arising from plant and equipment | AQ-1  | Plant and equipment would be operated in a proper and efficient manner by:  
  - Inspecting the plant/equipment prior to commencement of works on site  
  - Conducting routine servicing and maintenance, and subsequent inspections to ensure that equipment continues to operate efficiently. | Construction contractor | Construction | Expected to be effective. Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures. |
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| Dust generation and emissions at compound locations  | AQ-2  | *Dust and emissions generation at compounds would be managed by:*  
  • Installation of perimeter screening around compound sites  
  • Impose low speeds limits around compound sites to limit the generation of dust from vehicle movements  
  • Apply wheel-wash or rumble grid facilities at access points to limit the tracking of materials beyond the site boundary  
  • Ensure that compound area surfaces are well compacted or sealed to limit the potential for dust generation  
  • Regularly water stockpiles and limit the amount of materials stockpiled around the site  
  • Position stockpiling areas as far as possible from surrounding receivers  
  • Limit stockpiling activities during conditions where winds are blowing strongly in the direction(s) from the stockpiling location to nearby receivers  
  • Consultation would be carried out consistent with the Community Consultation Framework in relation to air quality near ancillary sites and relevant incident management process during construction. | Construction contractor  | Construction | Expected to be effective.  
  Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures. |
| Dust generation and emissions from construction activities and materials haulage | AQ-3  | *Dust generation and emissions from construction activities and materials haulage would be managed by:*  
  • Impose low speeds limits across all site                                                                                                                                                                                      | Construction contractor  | Construction | Expected to be effective.  
  Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures. |
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<td>haulage routes</td>
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<td>• Ensure that all loads are covered when materials are being hauled to and from site</td>
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<td>• Wherever possible, position internal haulage routes away from surrounding receivers</td>
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<td>• Regular watering of exposed and disturbed areas especially during inclement weather conditions</td>
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<td>• Wherever possible, minimise the extent of disturbed and exposed surfaces, and restore as soon as possible</td>
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<td>• Adjust the intensity of activities based on measured dust levels, weather forecasts and the proximity of and direction of the works in relation to the nearest surrounding receivers</td>
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<td>• Ensure that any material exposed areas are secured during project shutdown periods to prevent any dust emanating over adjacent roads</td>
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<td></td>
<td>• Install depositional dust gauges to quantify dust levels and determine whether control measures are adequate or whether further actions are required</td>
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<td>• These gauges should be installed at regular intervals along the project alignment at representative receiver locations. Gauges should also be installed around major construction compound and stockpiling locations.</td>
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| Windborne dust emanating from non-vegetated surfaces                | AQ-4  | *Windborne dust emanating from non-vegetated surfaces would be managed by:*  
  - Stage work to ensure that finished areas are revegetated as soon as possible  
  - Regularly maintain and water revegetation areas to aid the establishment of adequate vegetation cover. | Construction contractor             | Construction              | Expected to be effective.  
  Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures. |
| Odours arising from uncovered contaminated and/or hazardous materials | AQ-5  | Application of odour suppressing agents to materials as necessary to minimise related impacts should any contaminated or hazardous materials be uncovered during the works.                                                                                       | Construction contractor             | Construction              | Expected to be effective.  
  Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures. |
| Cumulative dust impacts arising from con-current construction of the proposed upgrade and the Western Sydney Airport | AQ-6  | Develop construction program in consultation with the contractor(s) developing the Western Sydney Airport site.  
  Maintain consultation through the course of both projects to plan activities in a manner which limits potential air quality-related impacts.  
  Wherever possible and practical, co-ordinate activities with a high potential to generate dust so that they do not occur at the same time.  
  Stop activities if dust is observed to be emanating from the airport.                                                                 | Construction contractor             | Prior to and during construction | Expected to be effective.  
  Monitoring and reporting requirements of the Operational Environmental Management Plan (OEMP) to confirm effectiveness of measures. |
<p>| Inappropriate handling and/ or disposal of waste                    | WR-1  | The waste minimisation hierarchy principles of avoid/reduce/reuse/ recycle/dispose would be used                                                                                                                                   | Construction contractor             | Construction              | Proven to be effective                                                                 |</p>
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| WR-2             |      | A project-specific *Construction Waste and Energy Management sub-plan* (CWEMP) would be prepared before construction. The plan would adopt the Resources Management Hierarchy principles of the WARR Act and include:  
  - The major construction related waste streams expected to be generated from the project  
  - The major sources of construction related energy consumption (fuel and power)  
  - Classification of waste streams  
  - Waste orders and exemptions  
  - Re-use and recycling practices to be implemented  
  - Measures to be applied where waste is required to be handled and stored onsite prior to onsite reuse or offsite recycling/disposal  
  - Specific measures to manage vegetation waste  
  - Energy conservation best practice and the reduction of greenhouse gases by adopting energy efficient work practices  
  - A resource management strategy detailing beneficial reuse options for surplus and/or unsuitable material  
  - Procedures for the identification, handling and disposal of hazardous materials including potential asbestos waste  
  - Protocols for engaging with and notifying | Construction contractor | Pre-Construction | Proven to be effective.  
  Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures. |
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<tr>
<td>Inappropriate handling and/or disposal of waste</td>
<td>WR-3</td>
<td>All wastes, including contaminated wastes, would be identified and classified in accordance with the Waste Classification Guidelines: Part 1 Classifying Waste.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
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<tr>
<td></td>
<td>WR-4</td>
<td>Disposal of any non-recyclable waste would be in accordance with the POEO Act and <em>Waste Classification Guidelines: Part 1 Classifying Waste</em>.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
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<td></td>
<td>WR-5</td>
<td>Trees and plant material would be mulched or chipped on-site and used in landscaping where practicable to stabilise disturbed soils where possible.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
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<tr>
<td>Inappropriate disposal of excavated material that cannot be reused in the project</td>
<td>WR-6</td>
<td>Where possible and fit for purpose, spoil would be beneficially reused within the project before off-site reuse of disposal options is pursued.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
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<td></td>
<td>WR-7</td>
<td>Excavated material that is not suitable for on-site reuse or recycling would be transported to a site that may legally accept that material for reuse or disposal.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
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<td>WR-8</td>
<td>Before being transported from construction sites, excavated spoil would be classified in accordance with the <em>Waste Classification Guidelines: Part 1 Classifying Waste</em> (EPA, 2014) to ensure appropriate reuse of disposal.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
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<td>WR-9</td>
<td>A Spoil Management Strategy would be developed prior to the commencement of construction and implement during construction. The strategy would identify spoil disposal site(s) and describe the management of spoil on-site and during off-site transport.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Resource use</td>
<td>WR-10</td>
<td>Wherever feasible and reasonable, construction material would be sourced from within the Sydney region.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Water use</td>
<td>WR-11</td>
<td><em>Where water is sourced from farm dams, it would be done so in consultation with landowners</em></td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
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<tr>
<td>Emissions of greenhouse gases during construction</td>
<td>GHGC-1</td>
<td>Identify recycled materials (such as recycled aggregates in road pavement and surfacing; steel with recycled content) for use in construction or operation of the project where they are cost, quality and performance competitive.</td>
<td>Construction contractor</td>
<td>Detailed design</td>
<td>Expected to be effective if carried out in accordance with the project-specific Construction Waste and Energy Management sub-plan (CWEMP)</td>
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<td></td>
<td>GHGC-2</td>
<td>Use of modern diesel engine equipment, to ensure highest fuel efficiency ratings.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
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<td>GHGC-3</td>
<td>Specification of the use of biofuels, or biofuel blends in construction plant and equipment.</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective.</td>
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<td>GHGC-4</td>
<td>Provision of clear guidance to construction staff on equipment start up and shut down procedures to ensure that they are not left idling when not in use.</td>
<td>Construction contractor</td>
<td>Pre-construction</td>
<td>Proven to be effective.                                          Induction and training requirements of the CEMP to confirm effectiveness of measures.</td>
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<td></td>
<td>GHGC-5</td>
<td>Review of cut and fill balances for earthworks to ensure material is transported the least possible distances.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. To be confirmed during detailed design</td>
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<td></td>
<td>GHGC-6</td>
<td>Review of local options for import and export of fill materials as needed to reduce excess fuel used during transport.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Expected to be effective. To be confirmed during detailed design</td>
</tr>
<tr>
<td></td>
<td>GHGC-7</td>
<td>Specification and certification of steel from recycled sources where suitable for offsetting virgin steel.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
<td>Responsibility</td>
<td>Timing</td>
<td>Effectiveness of measures</td>
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</table>
| Emissions of greenhouse gases during construction         | GHGC-8  | Specification of materials with low embodied energy / embodied GHG content, such as:  
- Replacement of Portland cement in concrete mixes with low carbon alternatives such as fly-ash  
- Use of warm mix asphalt versus hot mix.                                                                 | Construction contractor | Detailed design | Proven to be effective.                                                                    |
|                                                           | GHGC-9  | A project-specific *Construction Waste and Energy Management sub-plan* (CWEMP) would be prepared before construction. The plan would adopt the Resources Management Hierarchy principles of the WARR Act and include:  
- The major construction related waste streams expected to be generated from the project  
- The major sources of construction related energy consumption (fuel and power)  
- Classification of waste streams  
- Waste orders and exemptions  
- Re-use and recycling practices to be implemented  
- Specific measures to manage vegetation waste  
- Energy conservation best practice and the reduction of greenhouse gases by adopting energy efficient work practices  
- A resource management strategy detailing beneficial reuse options for surplus and/or unsuitable material  
- Procedures for the identification, handling | Construction contractor | Pre-construction | Proven to be effective.  
Monitoring and reporting requirements of the CWEMP to confirm effectiveness of measures. |
<table>
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<tr>
<th>Potential impact</th>
<th>Ref #</th>
<th>Environmental management measure</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Effectiveness of measures</th>
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</thead>
</table>
| General          | HR-1  | Hazard and risk management planning would be incorporated throughout the CEMP, which may include items such as:  
|                  |       | • Details of the hazards and risks associated with construction activities  
|                  |       | • Risk management measures, including those identified in Chapters 7 and 8 of this EIS  
|                  |       | • Procedures to comply with all legislative and industry standard requirements  
|                  |       | • Contingency and emergency response plans, as required  
|                  |       | • Site-specific Work, Health and Safety plans and activity specific Safe Work Method Statements  
|                  |       | • Training for all personnel (including subcontractors) in site inductions, including the recognition and awareness of site hazards and the locations of relevant equipment to protect themselves and manage any spills. | Construction contractor | Construction | Proven to be effective.  
<p>|                  |       | Monitoring of safety measures would occur daily as part of routine site management procedures, for movement of hazardous goods, safe workplace practices, and regular testing and monitoring of any fire and life safety systems. | | | |</p>
<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Ref #</th>
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<th>Timing</th>
<th>Effectiveness of measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage of dangerous goods and hazardous substances</td>
<td>HR-2</td>
<td>Storage of dangerous goods and hazardous materials would occur in accordance with suppliers’ instructions and relevant Australian Standards and may include bulk storage tanks, chemical storage cabinets / containers or impervious bunds.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring of safety measures would occur daily as part of routine site management procedures, for movement of hazardous goods, safe workplace practices, and regular testing and monitoring of any fire and life safety systems.</td>
</tr>
<tr>
<td>Storage of dangerous goods and hazardous substances</td>
<td>HR-4</td>
<td>Secure, bunded areas would be provided around storage areas for oils, fuels and other hazardous liquids.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring of safety measures would occur daily as part of routine site management procedures, for movement of hazardous goods, safe workplace practices, and regular testing and monitoring of any fire and life safety systems.</td>
</tr>
<tr>
<td>HR-5</td>
<td></td>
<td>Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.</td>
<td>Construction contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
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<tr>
<td>Contamination from transportation of hazardous goods</td>
<td>HR-6</td>
<td>Transport all hazardous substances in accordance with relevant legislation and codes, including the Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998 and the ‘Australian Code for the Transport of Dangerous Goods by Road and Rail’ (National Transport Commission, 2008).</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring of safety measures would occur daily as part of routine site management procedures, for movement of hazardous goods, safe workplace practices, and regular testing and monitoring of any fire and life safety systems.</td>
</tr>
<tr>
<td>Bushfire</td>
<td>HR-7</td>
<td>Measures to mitigate and manage bushfire would be developed and included as part of site-specific hazard and risk management measures within the CEMP The road is to be designed with consideration to the requirements of the Planning for Bush Fire Protection 2006.</td>
<td>Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective.</td>
</tr>
<tr>
<td>Warragamba Pipelines</td>
<td>HR-8</td>
<td>Roads and Maritime would notify WaterNSW of any incident such as vehicle accident, discovery of any heritage items, spill or fire that affects or could affect the Warragamba Pipelines including the corridor.</td>
<td>Roads and Maritime</td>
<td>Construction</td>
<td>Expected to be effective. Monitoring and reporting requirements of the CEMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Cumulative impacts</td>
<td>CI-1</td>
<td>Consultation would be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the project.</td>
<td>Roads and Maritime / Construction Contractor</td>
<td>Construction</td>
<td>Expected to be effective. To ensure flexibility in the communications approach to the project, communications and engagement activities would be monitored, assessed and reported regularly.</td>
</tr>
<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
<td>Responsibility</td>
<td>Timing</td>
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</tr>
<tr>
<td>Cumulative impacts</td>
<td>CI-2</td>
<td>Where relevant, consultation would be undertaken with proponents of other nearby developments to increase the overall awareness of project timeframes and impacts.</td>
<td>Roads and Maritime / Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. To ensure flexibility in the communications approach to the project, communications and engagement activities would be monitored, assessed and reported regularly.</td>
</tr>
<tr>
<td>CI-3</td>
<td></td>
<td>Construction traffic management plans for this project should be developed in consultation with plans for these projects so that increased traffic on the local road network would be spread over the road network to ensure that construction traffic is not concentrated on any one particular route if there are alternatives available other projects to assist in spreading the traffic load over the network and to minimise construction traffic being concentrated on any one particular route.</td>
<td>Roads and Maritime / Construction Contractor</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the TMP to confirm effectiveness of measures.</td>
</tr>
</tbody>
</table>
6.2 Operational environmental management

Once construction on The Northern Road upgrade has been completed, the responsibility for ongoing operational management would be handed back to Roads and Maritime from the construction contractor.

The maintenance and management of the Roads and Maritime road asset network in the Sydney region has been vested to private organisations that carry out all operational aspects of the network on behalf of Roads and Maritime in the form of Stewardship Maintenance Contracts. The obligations under the Roads Act 1993, the Environmental Planning and Assessment Act 1979 and the State Infrastructure Planning Policy (Infrastructure) 2007 and all other relevant legislation is the responsibility of the private organisations as an agent of Roads and Maritime. In addition, organisations contracted to provide operational maintenance for Roads and Maritime are bound to address any operational requirements provided by the Minister through the Conditions of Approval for the project.

Roads and Maritime manage their legislative and environmental management obligations through the use of a number of procedures, guidelines, guidance notes, and technical notes to provide guidance and set expectations in environmental planning and management of the road network and assets. Specifications, including, but not limited to Routine Services Specification (M3); General Specification – Environmental Protection (Management Systems) Maintenance (G36M); General Specification – Soil and Water Management (G38) are used to outline the environmental planning and management expectations and requirements of the Stewardship Maintenance Contractors. The Stewardship Maintenance Contractors are also required to operate under an Environmental Management System, have a program Environmental Management Plan and have specific Construction Environmental Management Plans activities that are carried out on the network.

The iterative design and EIS process has enabled Roads and Maritime to avoid and minimise environmental impacts from the project where possible. Where environmental controls have been incorporated into the design there is a program of monitoring and review including independent auditing, to ensure the controls comply with stated objectives (refer Table 6-2).

Specific monitoring that would be considered during operation of the project may include:

- Noise monitoring to compare actual noise performance of the project against predicted noise performance
- Monitoring and maintaining landscaped or rehabilitated areas
- Monitoring of surface water quality in order to:
  - assess and manage impacts on the receiving waters as the site stabilises
  - assist in deciding when the site has stabilised
  - identify water quality conditions after development.
Table 6-2 Summary of operational environmental safeguards and management measures

<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Ref #</th>
<th>Environmental management measure</th>
<th>Responsibility</th>
<th>Timing</th>
<th>Effectiveness of measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational noise impacts</td>
<td>NV-4</td>
<td>Where noise barriers and/or low noise pavements are not considered feasible and/or reasonable, noise impacts at affected dwellings would be mitigated by at-property treatments.</td>
<td>Roads and Maritime</td>
<td>Operation</td>
<td>Proven to be effective</td>
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<tr>
<td></td>
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<td></td>
<td>To be carried out in consultation with affected residents</td>
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<td>NV-5</td>
<td></td>
<td>Within 12 months of the commencement of operation of the project an operational noise review would be undertaken. This would include:</td>
<td>Roads and Maritime</td>
<td>Operation</td>
<td>Proven to be effective</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitoring to compare actual noise performance of the project against predicted noise performance</td>
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<tr>
<td></td>
<td></td>
<td>• An assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of all feasible and reasonable mitigation measures</td>
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<td></td>
<td></td>
<td>• Identification of any additional feasible and reasonable measures that would be implemented with the objective of meeting the criteria in the NSW Road Noise Policy (DECCW, 2011), when these measures would be implemented and how their effectiveness would be measured and reported.</td>
<td></td>
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</tr>
<tr>
<td>Noise, light and vibration</td>
<td>B-25</td>
<td>Shading and artificial light impacts would be minimised through detailed design. Measures to mitigate potential noise and vibration impacts are provided in section 7.2 of the EIS.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Expected to be effective.</td>
</tr>
<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
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<td>Timing</td>
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<tr>
<td>Operational socio-economic impacts</td>
<td>SE-20</td>
<td>Appropriate road signage would be provided in accordance with the Roads and Maritime Services Guidelines Tourist Signposting (2012) to provide guidance to passing patrons on access to shops and services, including within Luddenham town centre. <em>Liverpool Council as well as Penrith City Council would be consulted in the preparation of plans to revitalise Luddenham town centre and appropriate gateway signage or other features.</em></td>
<td>Construction contractor Roads and Maritime</td>
<td>Construction</td>
<td>Proven to be effective. Monitoring and reporting requirements of the TMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Operational socio-economic impacts</td>
<td>SE-21</td>
<td>Roads and Maritime will, in consultation with Liverpool Council and Penrith City Council, provide appropriate monetary support for preparation of plans to revitalise Luddenham town centre, for the purpose of encouraging motorists to continue to pass through or visit the town. Any streetscape and landscape treatments would be determined after finalisation of any town centre revitalisation plans.</td>
<td>Roads and Maritime</td>
<td>Pre-construction and construction</td>
<td>Expected to be effective. Roads and Maritime have experience with similar by-pass projects in NSW.</td>
</tr>
</tbody>
</table>
| Impacts on flood behaviour during operation | FH-5  | The transverse drainage and flood mitigation strategy would continue to be refined during detailed design. If the properties are still impacted, and if mitigation is required, this would be investigated in consultation with the landowners. It would include but not be limited to:  
  - Identification of potential flood impacts to the project and adjoining areas, including consideration of local land ownership.                                                                                                                                                                                                                                                                                                                                                                                                 | Roads and Maritime                    | Detailed design | Proven to be effective. Further design development would be carried out at detailed design stage to reduce the potential for flood attributable to the project in the affected properties.                                                                                                                                                                                                                                                                                                                                                                               |
<table>
<thead>
<tr>
<th>Potential impact</th>
<th>Ref #</th>
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<tr>
<td></td>
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<td>drainage catchment assessments and climate change implications on rainfall, drainage</td>
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<td></td>
<td></td>
<td>• Design and mitigation measures to protect proposed operations and not worsen existing flooding characteristics during construction and operation, including soil erosion and scouring</td>
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<tr>
<td></td>
<td></td>
<td>• Drainage system upgrades and preparation of a Flood and Emergency Management Plan.</td>
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<tr>
<td>FH-6</td>
<td>The 100 year ARI flood level is to be adopted in the assessment of measures which are required to mitigate any adverse impacts attributable to the project. Changes in flood behaviour under PMF conditions would also be assessed in order to identify impacts on critical infrastructure and substantial changes in flood hazards as a result of the project.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Proven to be effective. Further design development would be carried out at detailed design stage to reduce the potential for flood attributable to the project in the affected properties</td>
<td></td>
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<tr>
<td>FH-7</td>
<td>A floor level survey would be undertaken in affected areas to determine whether the project would increase flood damages in adjacent developments (ie in properties where there is a potential for increases in peak flood levels for events up to the 100 year ARI flood).</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Proven to be effective. Further design development would be carried out at detailed design stage to reduce the potential for flood attributable to the project in the affected properties</td>
<td></td>
</tr>
<tr>
<td>Potential impact</td>
<td>Ref #</td>
<td>Environmental management measure</td>
<td>Responsibility</td>
<td>Timing</td>
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<tr>
<td>Reductions in water volumes</td>
<td>FH-8</td>
<td>Consultation would be carried out with each affected landholder where reductions in the volume of flow would cause existing dams to fill less frequently, reducing the available yield.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Expected to be effective if carried out in accordance with consultation requirements</td>
</tr>
<tr>
<td>Operational water quality</td>
<td>SWC-13</td>
<td>24 water quality swales are proposed, including those upstream of identified sensitive receiving waterways. Water quality swales will be implemented for the proposal, including upstream of identified sensitive receiving waterways.</td>
<td>Roads and Maritime</td>
<td>Detailed Design</td>
<td>Expected to be effective. Monitoring and reporting requirements of the Water Quality Management Plan (WQMP) to confirm effectiveness of measures and if any additional measures are required.</td>
</tr>
</tbody>
</table>
| Roadside air quality during operations   | AQ-7  | • Post-construction traffic measurements should be collected to verify that traffic volumes and characteristics are not materially different from the forecast numbers considered in this assessment.  
  • Where material differences are identified, further assessment should be completed to confirm that the level of impacts remain consistent with the predictions of this study. | Roads and Maritime Services     | Operation             | Expected to be effective. Monitoring and reporting requirements of the OEMP to confirm effectiveness of measures.                                                                                                            |
<table>
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<tr>
<th>Potential impact</th>
<th>Ref #</th>
<th>Environmental management measure</th>
<th>Responsibility</th>
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<th>Effectiveness of measures</th>
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</thead>
<tbody>
<tr>
<td>Landscaping</td>
<td>UD-7</td>
<td>Development of the landscaping plan would include consultation with Council regarding its maintenance requirements.</td>
<td>Construction contractor</td>
<td>Detailed Design Operation</td>
<td>Expected to be effective. Monitoring and reporting requirements of the OEMP to confirm effectiveness of measures.</td>
</tr>
<tr>
<td>Emissions of greenhouse gases during operation</td>
<td>GHGC-10</td>
<td>Opportunities to use renewable energy for road operation would be investigated.</td>
<td>Roads and Maritime</td>
<td>Detailed design</td>
<td>Expected to be effective. To be confirmed during detailed design</td>
</tr>
<tr>
<td>Incident response</td>
<td>HR-9</td>
<td>An Incident Response Management Plan would be developed and implemented.</td>
<td>Roads and Maritime</td>
<td>Operation</td>
<td>Proven to be effective. Monitoring of safety measures would occur daily as part of routine site management procedures, for movement of hazardous goods, safe workplace, and regular testing and monitoring of any fire and life safety systems.</td>
</tr>
</tbody>
</table>
7  Project justification and conclusion

This chapter presents a justification of the project and a revised conclusion to the Final EIS. The justification considers how the project, including all design refinements, balances strategic and project needs against the protection of the environment and planning outcomes outlined in the objects of the EPBC Act and EP&A Act.

7.1  Justification

The project is located within the western Sydney region with a current population of about two million people. The population of the Sydney metropolitan area is expected to grow by around 1.6 million people by 2031 with the majority of this growth expected to be in western Sydney, which is expected to experience a population increase of around one million people (NSW DPE, 2014).

The upgrade of The Northern Road is part of the Australian and NSW government funded Western Sydney Infrastructure Plan (WSIP). The WSIP is a 10 year, $3.6 billion plan which involves major road and transport linkages that will capitalise on the economic gains from developing the Western Sydney Airport at Badgerys Creek, the Western Sydney Priority Growth Area (WSPGA) and the South West Priority Growth Area (SWPGA) whilst boosting the local economy and liveability of western Sydney.

These major land use changes, together with natural growth in the regional centres of Penrith and Campbelltown, will drive a dramatic increase in traffic demand in the region. The pressures placed on the surrounding road network by the planned development in the region as well as the associated passenger and freight traffic generated by the Western Sydney Airport will exceed the capacity of the current The Northern Road, particularly at existing priority intersections along the corridor.

Traffic modelling carried out for the project indicates that traffic volumes along The Northern Road (north of Bringelly Road) are anticipated to reach and exceed carrying capacity in peak hours by 2021. This is consistent with The Northern Road Corridor Strategy (RTA 2009), which forecast the majority of intersections to provide inadequate service by 2026, resulting in severe local congestion.

This forecast indicated the need for substantial upgrades along The Northern Road to provide sufficient capacity to serve the forecast traffic demand. In addition to the need to serve increased traffic demand, the construction of both the Western Sydney Airport and the proposed M12 Motorway create the need for a high-capacity route to and from the Sydney Motorway Network for construction traffic generated by these developments.

Additionally, a three kilometre section of the existing The Northern Road alignment bisects the Western Sydney Airport site south-east of the Luddenham town centre. This section of road requires realignment around land identified by the DIRD as required for operation of the Western Sydney Airport. The realignment would allow for the construction of the airport, while ensuring the road maintains north–south connectivity for communities in western Sydney.

As a key component of overall upgrade of The Northern Road Upgrade and the WSIP, the project would provide greater connectivity within the region and cater for future traffic from planned residential and commercial developments in time for the Western Sydney Airport.

The project also supports the implementation of a number of other key transport and infrastructure plans in NSW, such as NSW 2021, the State Infrastructure Strategy 2012–2032, the NSW Long Term Transport Master Plan and A Plan for Growing Sydney. Broadly, the project supports these plans by enhancing western Sydney’s sustainable transport network to support jobs growth in the area, the Western Sydney Airport and directly improving transport connections to key development and growth areas.

Overall, the project is considered to be in the public interest because it would provide the following benefits:
- Facilitate the construction and ongoing operation of the Western Sydney Airport
- Address existing road safety and intersection performance
- Accommodate future traffic growth and improve accessibility for road users accessing the WSPGA, SWPGA and other development projects in western Sydney
- Develop new infrastructure for public and active transport modes
- Support regional benefits related to the broader program of upgrades proposed under WSIP, such as the provision of high capacity traffic and freight links
- Support the development and operation of the Western Sydney Airport and WSPGA
- Support the potential benefits and operational viability of the Western Sydney Airport and WSPGA.

### 7.1.1 Project justification

Program objectives for the WSIP were developed in February 2015 by representatives of Roads and Maritime, Transport for NSW and the Department of Infrastructure and Regional Development (DIRD). As a key part of the WSIP, the project would deliver a combination of new, additional and renewed infrastructure. In consideration of the broader objectives for WSIP, specific objectives were developed for the project. The project and WISP objectives are listed in Section 3.4 of the draft EIS. A summary of how the project complies with the WSIP and project objectives is provided in Table 7-1.

#### Table 7-1 Project compliance with WSIP and project objectives

<table>
<thead>
<tr>
<th>WSIP and project objectives</th>
<th>Response</th>
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</thead>
<tbody>
<tr>
<td><strong>WSIP program objectives</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Development and demand</strong></td>
<td>The project would meet this objective by:</td>
</tr>
<tr>
<td></td>
<td>• Providing a safe modern high capacity road corridor to support future increased traffic generation from the construction and operation of a Western Sydney Airport at Badgerys Creek, and land use changes in the region</td>
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<tr>
<td></td>
<td>• Linking with other proposed road upgrades in the region to provide a high capacity integrated road network</td>
</tr>
<tr>
<td></td>
<td>• Minimising environmental and social impacts through design and development of appropriate environmental management measures</td>
</tr>
<tr>
<td></td>
<td>• Providing value for money by servicing both a Western Sydney Airport and land use changes in the region.</td>
</tr>
<tr>
<td>WSIP and project objectives</td>
<td>Response</td>
</tr>
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</table>
| **Connectivity to airport** – Provide a resilient connection to the Western Sydney Airport site for freight and people | The preferred alternative would meet this objective by:  
- Linking with other proposed road upgrades in the region (eg the proposed M12 Motorway) to provide a high capacity link to a Western Sydney Airport at Badgerys Creek  
- Providing high capacity freight access to the south-west section of the Western Sydney Airport site  
- Providing dedicated bus lanes, which would form part of the initial main public transport link to a Western Sydney Airport at Badgerys Creek. Provision of bus lanes would be staged as demand requires. |
| **Integrated network** – Provide road improvements to support and integrate with the broader transport network | The preferred alternative would meet this objective by:  
- Integrating with other planned road upgrades (including The Northern Road upgrades to the south of Mersey Road, Bringelly and to the north of Glenmore Parkway, Glenmore Park and the proposed M12 Motorway)  
- Providing dedicated bus lanes which would integrate with existing and new bus routes in the region. Provision of bus lanes would be staged as demand requires. |
| **Customer focus** – Provide meaningful engagement with customers and stakeholders throughout the program life | All project development activities have and would be undertaken to comply with this objective. For example, substantial and meaningful engagement with customers, the community and other stakeholders has been undertaken to identify the route for the section of The Northern Road that needs to be realigned – refer to Section 6 for further detail. Engagement activities would continue throughout the EIS, design, construction and operational phases. |

| The Northern Road Upgrade project objectives | The preferred alternative would meet this objective by:  
- Realigning the section of The Northern Road that currently bisects the Western Sydney Airport site  
- Providing a high capacity road corridor and direct links to the Western Sydney Airport site to support airport related construction. |
<table>
<thead>
<tr>
<th>WSIP and project objectives</th>
<th>Response</th>
</tr>
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</table>
| Cater for future traffic demand to improve the flow of traffic to provide reliable journeys | The preferred alternative would meet this objective by:  
• Providing three lanes northbound and southbound (two general traffic lanes and one bus lane each way) between Mersey road and Bradley Street and upgrading to four lanes (three general traffic lanes and one bus lane) between Bradley Street and Glenmore Parkway to cater for future traffic demand. In some sections, the provision of four lanes may be staged to occur after 2019. The provision of bus lanes would be staged as demand requires.  
• Upgrading intersections and associated traffic controls to provide more reliable journeys and reduce crashes  
• Providing Intelligent Transport Systems (ITS) infrastructure to provide information on traffic conditions and incidents to road users. |
| Improve the transport connections from the Penrith region and M4 Western Motorway to the Western Sydney Airport and surrounding developments including the SWPGA and WSPGA | The preferred alternative would meet this objective by:  
• Integrating with other planned road upgrades (including The Northern Road upgrades to the south of Mersey Road, Bringelly and to the north of Glenmore Parkway, Glenmore Park and the proposed M12 Motorway)  
• Providing new or upgraded intersections with other arterial and local roads. |
| Improve facilities for public and active transport to promote sustainable and efficient journeys | The preferred alternative would meet this objective by:  
• Providing bus priority lanes at intersections initially and providing dedicated southbound and northbound bus lanes as demand requires  
• Providing upgraded bus stops and supporting possible new bus routes  
• Providing a shared path along the western side of the upgrade and a footpath along the eastern side as required. |
## 7.1.2 Objects of the EP&A Act

The objects of the EP&A Act provide a framework within which the justification of the project can be considered. A summary of how the project relates to these objectives is provided in Table 7-2.

### Table 7-2 Objectives of the EP&A Act

<table>
<thead>
<tr>
<th>EP&amp;A Act objective</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, waters, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.</td>
<td>The project would manage, develop and conserve natural and artificial resources appropriately and result in social and economic benefits to the community. The project would promote social and economic welfare by reducing congestion and improving transport efficiency along The Northern Road corridor for both people and freight. The project would also make efficient use of land by utilising an existing transport corridor where possible, minimising acquisition of private properties and maximising use of government land. Where new road corridor is proposed, the route options process has sought to minimise the impacts of the project on residential and agricultural land and ecologically sensitive areas. A range of safeguards and management measures are proposed to address potential environmental impacts, including biodiversity offsets under the NSW Government Framework for Biodiversity Assessment.</td>
</tr>
<tr>
<td>To encourage the promotion and coordination of the orderly and economic use and development of land.</td>
<td>The project promotes the orderly development of the region through being an integral element in the many changes either planned or already under way, in western Sydney. The upgrade of The Northern Road is needed to support not only the development of the Western Sydney Airport at Badgerys Creek, but also to support the planned expansion of the South West Priority Growth Area (SWPGA) and the Western Sydney Priority Growth Area (WSPGA). In doing so, the project would help to capitalise on the economic gains from developing surrounding land uses.</td>
</tr>
<tr>
<td>To encourage the protection, provision and coordination of communication and utility services.</td>
<td>The project is designed to minimise impacts on communication and utility services within the corridor. Where relocation is required this would preferably be undertaken within the footpath or shared user path to enable greater access for maintenance activities wherever possible. However some relocation in the road corridor may be required, including on local side streets, in order to minimise disruption. The required works would be confirmed during detailed design in consultation with utility providers, taking into consideration tie in with local streets as required.</td>
</tr>
<tr>
<td>EP&amp;A Act objective</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>To encourage the provision of land for public purposes,</td>
<td>The project would provide a public road.</td>
</tr>
<tr>
<td>To encourage the provision and coordination of community services and facilities.</td>
<td>The project would improve the transport network of the area providing improved access and connectivity to community services and facilities within western Sydney region and locally within Luddenham.</td>
</tr>
<tr>
<td>To encourage the protection of the environment, including the protection and</td>
<td>The process of selecting the preferred route alignment considered ways to avoid and minimise impacts to the environment. In particular, maximising the use of existing road corridor in the northern segment of the project and undertaking environmental assessments during concept design development has reduced the potential impact of the project where possible. In accordance with the requirements of the Framework for Biodiversity Assessment, the process for identifying and evaluating biodiversity offsets has been documented in the Biodiversity Offset Strategy appended to the Biodiversity Assessment Report. A range of management measures have been developed to further minimise impact on biodiversity through the detailed design and construction phases of the project.</td>
</tr>
<tr>
<td>conservation of native animals and plants, including threatened species, populations</td>
<td></td>
</tr>
<tr>
<td>and ecological communities, and their habitats.</td>
<td></td>
</tr>
<tr>
<td>To encourage ecologically sustainable development.</td>
<td>Ecologically sustainable development has been considered throughout project planning, including alternatives and route options development as detailed in Chapter 4. The way the four tenets of ESD have been recognised and applied during the development and assessment of the project is considered in detail in Chapter 10.</td>
</tr>
<tr>
<td>To encourage the provision and maintenance of affordable housing.</td>
<td>Not relevant to the project.</td>
</tr>
<tr>
<td>To promote the sharing of the responsibility for environmental planning between</td>
<td>Not relevant to the project.</td>
</tr>
<tr>
<td>different levels of government in the State.</td>
<td></td>
</tr>
<tr>
<td>To provide increased opportunity for public involvement and participation in</td>
<td>The project development process has involved extensive consultation with relevant stakeholders and the community. Consultation carried out to date and proposed ongoing consultation is outlined in Chapter 6 of the draft EIS. Additionally, the route options development process involved community and stakeholder consultation (Chapter 4 of the draft EIS).</td>
</tr>
<tr>
<td>environmental planning and assessment.</td>
<td></td>
</tr>
</tbody>
</table>
7.1.3 Objects of the EPBC Act

The objectives and principles of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are outlined in Sections 3 and Section 3A of the EPBC Act. A summary of how the project relates to these objectives is provided in Table 7-3.

Table 7-3 Objectives of the EPBC Act

<table>
<thead>
<tr>
<th>EPBC Act objective</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) To provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance</td>
<td>The process of selecting the preferred route alignment considered ways to avoid and minimise impacts to the environment, including matters of national environmental significance. Project impacts on matters of national environmental significance relate to listed species and ecological communities. All practicable steps to avoid or minimise impacts to biodiversity would be implemented during the detailed design phase to reduce the scope of the overall impact. This would include the application of measures such as road design refinements to reduce the project footprint and incorporating design features to minimise impacts, where practical. The EIS also considers the impacts to the environment of Commonwealth land. In accordance with the requirements of the Framework for Biodiversity Assessment, the process for identifying and evaluating biodiversity offsets has been documented in the Biodiversity Offset Strategy appended to the Biodiversity Assessment Report. A range of management measures have been developed to further minimise impact on biodiversity through the detailed design and construction phases of the project.</td>
</tr>
<tr>
<td>(b) To promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources</td>
<td>Ecologically sustainable development has been considered throughout project planning, including alternatives and route options development as detailed in Chapter 4. The way the four tenets of ESD have been recognised and applied during the development and assessment of the project is considered in detail in Chapter 10 of the draft EIS.</td>
</tr>
<tr>
<td>(c) To promote the conservation of biodiversity</td>
<td>The implementation of mitigation measures outlined in this EIS and the Biodiversity Offset Package would support the viability of threatened species and communities that are impacted by the project.</td>
</tr>
<tr>
<td>(d) To promote a cooperative approach to the protection and management of the environment involving governments, the community, land-holders and indigenous peoples</td>
<td>The project development process has involved extensive consultation with relevant stakeholders, indigenous groups and the community. Consultation carried out to date and proposed ongoing consultation is outlined in Chapter 6 of the draft EIS. Additionally, the route options development process involved community and stakeholder consultation (Chapter 4 of the draft EIS).</td>
</tr>
<tr>
<td>EPBC Act objective</td>
<td>Comment</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>(e) To assist in the cooperative implementation of Australia's international environmental responsibilities</td>
<td>The EPBC Act provides a framework for protection of the Australian environment, including its biodiversity and its natural and culturally significant places. Through assessing potential impacts and developing appropriate mitigation measures or offset strategies, the project supports Australia's international environmental responsibilities.</td>
</tr>
<tr>
<td>(f) To recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity</td>
<td>Roads and Maritime is committed to effective consultation with Aboriginal communities regarding their activities and their potential for impact on Aboriginal cultural heritage. The Roads and Maritime PACHCI was developed to provide a consistent means of effective consultation with Aboriginal communities regarding activities which may impact on Aboriginal cultural heritage and a consistent assessment process for Roads and Maritime activities across NSW. The aim of consultation is to integrate cultural and archaeological knowledge and ensure registered stakeholders have information to make decisions on Aboriginal cultural heritage. Consultation with Aboriginal people has also been carried out in accordance with the OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (OEH 2010a) and the requirements of Clause 80C of the National Parks and Wildlife Regulation 2009. Roads and Maritime invited Aboriginal people who hold knowledge relevant to determining the cultural heritage significance of Aboriginal objects and Aboriginal places in the project area to register an interest in a process of community consultation</td>
</tr>
<tr>
<td>(g) To promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.</td>
<td></td>
</tr>
</tbody>
</table>

### 7.2 Conclusion

This environmental assessment has addressed the key issues identified in the Secretary’s environmental assessment requirements (SEARs) issued under Part 5.1 of the EP&A Act and the Commonwealth EIS Guidelines issued under Part 8 of the EPBC Act. A checklist showing where the SEARs and Commonwealth EIS Guidelines are addressed in this environmental assessment is provided in Appendix B and Appendix C of the draft EIS.

Roads and Maritime has refined aspects of the project as presented in the draft EIS in order to minimise impacts, where possible and carried out additional desktop and field assessments. A number of revised supporting technical reports have been prepared to respond to submissions received and to assess the impacts of design refinements.

The merits of the project were considered in the context of other alternatives and a detailed route options development process was carried out early in project planning to avoid or minimise potential environmental impacts from the project where possible. The preferred option outlined in this EIS was deemed to be in the public interest by providing the best outcome of supporting the Western Sydney Airport and catering for the growth in travel demand as a result of the planned land use changes in the region.

Notwithstanding, the project would result in impacts during construction and operation.

During construction, key adverse outcomes expected include:
Up to 40.79 ha of remnant native vegetation as assessed under the Framework for Biodiversity Assessment (FBA) would be cleared, including about:

- 30.87 ha of the *Threatened Species Conservation Act 1995 (TSC Act)* listed, critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community
- 3.86 ha of the TSC Act listed River-Flat Eucalypt Forest on Coastal Floodplains

About 15.08 ha of the critically endangered EPBC Act listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community

Removal of about 37 threatened plants consisting of:
- Six individuals of *Pultenaea parviflora* (EPBC Act and TSC Act)
- 31 individuals of *Marsdenia viridiflora* subsp *viridiflora* (*Endangered population under TSC Act*)

Removal of about 9.28 ha of native vegetation associated with the Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (this is equivalent to 1.3 per cent of the native vegetation on the Heritage Place). However, these impacts would be limited to areas of low to moderate natural heritage significance with a reasonable to low tolerance for change. No areas of high natural heritage significance would be impacted by the project

Removal of threatened fauna species habitat and habitat features, minor edging effects and the potential for the spread of weeds, pests, pathogens and disease.

During construction, the other key adverse outcomes expected include:

- Generation of additional traffic to support construction of the project. Based on arrivals to and departures from site at peak periods each working day, traffic generation is likely to be in the order of 230 additional light vehicle movements per day and about 12-13 truck movements per hour in the peak hours. The likely increase in average daily traffic volume as a result of construction activities would be less than five per cent, which is likely to have a negligible impact on the LoS along The Northern Road and Elizabeth Drive
- Temporary adverse changes to traffic conditions such as active traffic controls and temporary lane closures reducing traffic speeds and increasing travel times
- Access to some properties may be temporarily affected by the construction activities, particularly in areas where construction would be occurring along the existing The Northern Road corridor. Where access is affected, alternative arrangements would be made in consultation with land owners
- Temporary, adverse changes to local amenity from construction related air emissions such as dust from stockpiles and construction plant and vehicle emissions
- The NML will not be exceeded at any time for most receivers (>60 per cent) within NCAs 1, 6 and 8
- Across the entire study area, noise from even the loudest works will comply with the NML at 80 per cent of all residences
- Across the entire study area, noise from even the loudest works will comply with the NML at 80 per cent of all residences
- At 29 residences within the study area (2 per cent) the worst case exceedance may be more than 20 dB(A). At such times of peak impact, construction noise would be highly intrusive
- Temporary leases of land would be required during construction to accommodate ancillary construction facilities such as worksites, compounds and laydown areas. Properties identified for temporary lease mainly comprise areas of rural or vacant land, but also
includes residential and commercial uses. Use and access to those areas affected by temporary leases would be temporarily disrupted during construction

- Impact to 28 Aboriginal archaeological heritage sites (20 sites assessed as having moderate significance to be salvaged and the remaining eight sites assessed as having low significance to be destroyed)
- Direct impacts to three Non-Aboriginal heritage sites including Miss Lawson’s Guesthouse, Lawson’s Inn and the Chaffey Brothers Irrigation Scheme Canal.

During operation, adverse impacts would include:

- The acquisition of 8 houses, and the partial acquisition of land from 76 owners across 121 lots. Generally, affected properties would be partially acquired by Roads and Maritime where only part of the property would be directly impacted by the project. In some instances Roads and Maritime would give consideration to total acquisition (dual offer) or acquisition of any residual parcels created by the location and design of the project
- Changes to some land-use including the transfer of about 46 ha of land currently owned by the Commonwealth consisting of:
  - About 24 ha of land within the Defence Establishment, Orchard Hills (DEOH)
  - About 22 ha of land purchased for the Western Sydney Airport
- The project would include a wide central median that would remove existing right turns at some intersections and property accesses. In general, the removal of right turns would increase some travel times in the order of two to three minutes. Design refinements at Elizabeth Drive would result in additional, small increases in travel distance for trips accessing the properties on the cul-de-sac
- The bypassing of Luddenham town centre may impact on local businesses that rely on passing trade
- At-property treatments are considered the most reasonable form of noise mitigation for the 78 receivers (housed within 75 buildings) for which exceedances of operational noise criteria have been predicted by this assessment
- The project would result in an increase in both the rate and volume of runoff discharging to a number of receiving drainage lines. Changes in catchment hydrology are attributable to:
  - the increase in impervious area associated with the construction of the new northbound and southbound carriageways
  - the provision of an efficient pavement drainage system which would control runoff discharging from the new carriageways
  - the diversion of surface runoff toward adjacent drainage lines
- While peak flood levels would be increased as a result of the project for events up to 100 year ARI, affected areas are limited to undeveloped pastoral land.

**Impacts to MNES and Commonwealth land**

In accordance with the requirements of the EPBC Act and the Commonwealth EIS Guidelines, impacts to MNES and Commonwealth land have been assessed. The potential construction and operational impacts to MNES and Commonwealth land is discussed throughout Chapter 5 and in more detail throughout Chapter 7 and Chapter 8 of the draft EIS.

During construction, key impacts to MNES and Commonwealth land include:

- Traffic switches and temporary changes to access would be managed in accordance with the overall staging of construction, with DEOH access being maintained continuously through each stage of construction. Overall, the project’s construction would have little or
no impact on traffic and transport on Commonwealth land, over and above the impacts already described and assessed

- Predicted worst case construction noise levels from out-of-hours work would exceed night-time NMLs at most receivers within Commonwealth land. During worst case night-time works, exceedances of night-time NMLs of up to 15-28 dB(A) may result for many receivers. These worst case impacts would occur for only limited periods while works passed at their nearest point to these receivers

- Up to 12.46 ha of remnant native vegetation on Commonwealth land, including about:
  - 9.67 ha of the TSC Act listed, critically endangered Cumberland Plain Woodland in the Sydney Basin Bioregion ecological community
  - 2.79 ha of the TSC Act listed River-Flat Eucalypt Forest on Coastal Floodplains

- About 9.27 ha of the critically endangered Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community

- Potential impact to aquatic ecosystems due to potential temporary changes in water quality, habitat loss and instream barriers associated with works in and around waterways identified as Key Fish Habitat

- Localised fragmentation of local wildlife corridors between The Northern Road and Willowdene Avenue where some intact habitat patches would be fragmented and a new barrier introduced by the project would restrict fauna movement. The widening of the existing The Northern Road in the north of the study area would further the barrier effects of the road where it bisects Regional Corridor 17 as identified in the OEH BIOMAP, although this is already occurring through the via the existing fence that borders the DEOH site

- Potential injury or death of fauna on Commonwealth land, for example during vegetation clearing

- Potential for the invasion and spread of weeds, pests, pathogens and disease which would potentially impact on the environment of Commonwealth land

- General construction and operational related impacts associated with noise, vibration, dust, light and contaminants as outlined above where they impact the environment of Commonwealth land

- Disturbance of around 20.27 ha of the CHP including clearing of around 9.15 ha of a particularly outstanding example and unusually long-term (~50 years) unburned extent of the Cumberland Plains Woodland (critically endangered EPBC Act). As well as modification of particularly outstanding examples of little-disturbed creek lines and riparian habitat of the Cumberland Plain region (within the Blaxland Creek catchment). As well as potential degradation of ecological condition by proliferation of weed species, introduction / disturbance of pathogen and/or disease vectors, and potential light pollution (during construction and operation).

During operation, key impacts to MNES and Commonwealth land include:

- The project’s long-term operational impacts on traffic and transport on Commonwealth land would be positive. Access to the DEOH site would be improved through the upgrading and signalising of the intersection at the site’s main entrance. Further, the project’s design includes formalising access to the site of the Western Sydney Airport, which would facilitate access for service vehicles and deliveries

- Six receivers located on Commonwealth land have been identified as being eligible for mitigation of the project’s operational noise impacts. Of the six receivers, five are located on Commonwealth owned land at the Western Sydney Airport site. One other receiver is located on Commonwealth land located west of Willowdene Avenue. At-property treatments are considered the most reasonable form of mitigation for all six receivers
During the project’s operation, acquisition of Commonwealth land within the DEOH (including the Orchard Hills Golf Club) and the site of the Western Sydney Airport would result in permanent change to the use of the affected land, most of which is currently used for either rural or recreational (golf club) purposes. Within the DEOH land, land acquisition would comprise strips of land of varying width. In the long-term the project’s operation would result in little or no impact to the socio-economic environment of Commonwealth land, as the current uses (Defence, recreation) would continue and the planned future use of land for the Western Sydney Airport would not be affected or compromised.

The project would increase the scour potential in the drainage lines which run through DEOH site on Commonwealth land. The increase in scour potential would extend only a short distance from the corridor as the increase in peak flow attributable to the project as a percentage of the total flow reduces in the downstream direction due to the discharge of additional catchment runoff to the affected drainage line.

About 9.15 ha of the Orchard Hills Cumberland Plains Woodland Commonwealth Heritage Place (CHP) would be removed by the project at the western edge of the DEOH site. The total area of the listing is on the CHP is 610.60 ha. As such, the area removed would be equivalent to 1.5 per cent of the total amount within the CHP. The vegetation clearance would permanently remove some of the structural elements upon which the Orchard Hills Cumberland Plain Woodland Listed Place is based. However the impacted areas have been identified as being of moderate to low natural heritage value being regenerating patches of vegetation occurring within largely cleared grasslands with a mixture of native and introduced species (Godden Mackay Logan, 2013).
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