Submissions and Preferred Infrastructure Report

Newcastle Inner City Bypass
Rankin Park to Jesmond

June 2018

NSW GOVERNMENT

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Roads and Maritime Services

Newcastle Inner City Bypass – Rankin Park to Jesmond

Submissions and preferred infrastructure report

June 2018

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Executive summary

Background

Roads and Maritime Services (Roads and Maritime) is seeking approval to construct the fifth section of the Newcastle Inner City Bypass between Rankin Park and Jesmond (the project). The project would involve the construction of 3.4 kilometres of new four lane divided road between Lookout Road, New Lambton Heights and Newcastle Road, Jesmond.

The approval is sought under Division 5.2 (State significant infrastructure) of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In accordance with the Secretary's Environmental Assessment Requirements (SEARs) and Supplementary SEARs, an environmental impact statement (EIS) was prepared by Roads and Maritime Services in November 2016 (*Newcastle Inner City Bypass – Rankin Park to Jesmond Environmental Impact Statement*) to assess the potential impacts of the project. The EIS was exhibited by the Department of Planning and Environment (DP&E) for 30 days from 16 November 2016 to 16 December 2016. A total of 180 submissions were received for the project.

Purpose of this report

In accordance with section 5.17 of the EP&A Act, the Secretary requires Roads and Maritime to provide a response to the issues raised in the submissions received for the project.

Following exhibition of the EIS, receipt of submissions and further consultation with stakeholders a number of design refinements have been made to the project to address the issues raised during the exhibition and to minimise environmental impact. The Secretary has advised that a preferred infrastructure report is required to address the proposed design refinements.

Roads and Maritime, as the proponent of the project, has prepared this submissions and preferred infrastructure report to respond to issues raised in submissions and describe and assess design refinements made since the exhibition of the EIS.

Key issues raised by submissions to the EIS

Of the 180 submissions received for the project, 172 were submissions from the community, interest groups or businesses and eight were from government agencies.

The most common issues raised were:

- Loss of continuity for the Jesmond Park shared path
- Support for the provision of a new shared path bridge over Newcastle Road near Steel Street
- Concerns about potential impacts associated with truck movements near quarries which may supply construction materials to the project (if the proposed extended construction hours were approved)
- Lack of north-facing ramps at McCaffrey Drive
- Lack of south-facing ramps at the hospital interchange.

The main issues raised by government agencies about the environmental assessment were:

- Additional archaeological investigations and Aboriginal community consultation required to further inform the Aboriginal heritage assessment
- Additional biodiversity investigations required to further refine the vegetation mapping and BioBanking credit calculations
- Additional operational water quality treatment measures required to further minimise impacts to water quality.

Response to submissions and proposed design refinements

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

- Consultation with the community during the EIS exhibition
- Submissions received during the EIS exhibition
- Stakeholder discussions during and after EIS exhibition
- Further review of the EIS concept design.

The key design refinements include:

- The hospital interchange would now be a full interchange with both north and south-facing ramps
- Improved pedestrian and cyclist facilities including east-west grade separation of the Jesmond Park shared path with an overpass bridge and underpass arrangement at the northern interchange
- Refinement and inclusion of additional water quality treatment measures with permanent operational water quality structures increased from five to eight
- New/adjusted construction compounds including access and utility connections.

The traffic and transport assessment for the project determined that north-facing ramps at McCaffrey Drive were not justified. The investigations found that while design and construction of the ramps is technically possible, the low forecast usage of the ramps and their high cost to build meant the ramps were not economically viable. As a result, north-facing ramps were not included as part of the concept design for the project.

The potential sources of construction materials identified in the EIS are indicative only and would be determined by the construction contractor. The construction contractor will be responsible for ensuring only legally operating suppliers are used. Individual suppliers, such as quarries, are responsible for ensuring they operate within their consent conditions, including haulage and hours of operation, to minimise impacts to the environment.

Assessment updates

The proposed design refinements were assessed against each of the key issues and other issues, as set out in the SEARs and Supplementary SEARs issued for the project by DP&E. The assessment process involved desktop and field investigations (where required). Supporting technical reports were prepared and are included as appendices to this report (where required).

Key potential impacts identified which are additional or different to those in the EIS include:

- Biodiversity – mostly as a result of the revised vegetation mapping the project would now involve clearing of about 43.5 hectares of native vegetation (an increase of 4.3 hectares compared with the EIS) including about 7.1 hectares (4.1 hectares in the EIS) of Lower Hunter Spotted Gum Ironbark Forest endangered ecological community (EEC) listed under the former *Threatened Species Conservation Act 1995* (TSC Act) (now replaced by the *Biodiversity Conservation Act 2016* (BC Act)). Additional biodiversity offsets have been included in the Biodiversity Offset Strategy for the project. There is no change to the potential impacts to other threatened flora or fauna species listed under the former TSC Act or matters of national environmental significance listed under the EPBC Act
- Traffic and transport – the refined full hospital interchange layout would result in a minor redistribution of traffic on some surrounding roads. It is predicted in 2030 an additional 2500 vehicles per day would use the interchange to access the hospital precinct, with a corresponding decrease in the number of vehicles using Lookout Road and Kookaburra Circuit. The proposed changes to pedestrian and cyclist facilities, in particular the grade separation of the Jesmond Park shared path, would further improve connectivity to existing facilities
- Noise and vibration – the updated construction assessment has identified additional receivers would be impacted by construction activities and this would be managed in accordance with a construction noise and vibration management plan including community consultation. In order to minimise potential impacts, Roads and Maritime has also revised its approach to the

proposed extended hours to limit construction activities carried out in the morning period to generate noise that is no greater than 5 dB(A) above the rated background noise level. The updated operational assessment has identified a slight adjustment in the number of receivers which qualify for consideration for noise mitigation from 50 in the EIS to 49 in the updated assessment. However, the overall preliminary mitigation scenario is still valid and would include noise barriers and at-property treatments (subject to refinement during detailed design)

- Water quality – the proposed additional operational water quality treatment structures would achieve further substantial reductions in pollutants entering Dark Creek, Ironbark Creek and the downstream sensitive wetlands
- Aboriginal heritage – additional investigations have identified the presence of four Aboriginal heritage sites of low to moderate scientific significance within the construction footprint. In consultation with the Aboriginal community a program of archaeological collection and/or salvage will be carried out
- Visual impact – due to the proposed grade separation of the Jesmond Park shared path, viewpoint 16 has a slightly increased visual impact of high (moderate to high in the EIS). A new viewpoint (viewpoint 2) at the southern end of the project has also been assessed. The assessment has identified that until the proposed landscaping becomes established the visual impact to adjacent residences would be moderate to high during the day and high at night. When the vegetation has become established and matured, the impact would reduce to moderate during the day and moderate to high at night.

Revised environmental management measures

The EIS identified a range of environmental outcomes and management measures proposed to avoid or reduce the environmental impacts. After consideration of submissions, additional environmental assessment and further consultation with stakeholders, Roads and Maritime has identified minor amendments to the environmental management measures for the project where appropriate. These environmental management measures will guide the detailed design and construction phases of the project.

The key changes include property access and pedestrian and cyclist access during construction, opportunities to revise the layout of the northern interchange to minimise impacts to nearby residences and an Aboriginal heritage archaeological collection and/or salvage program.

Next steps

DP&E will consider this submissions and preferred infrastructure report during its assessment of the project. The Secretary will prepare an environmental assessment report in accordance with section 5.18 of the EP&A Act. The Minister for Planning will then decide whether or not to approve the project and identify any conditions of approval which would apply. If approved, Roads and Maritime will continue to consult with community members, government agencies and other stakeholders during the detailed design and construction phases of the project.

Contents

Appendices

1 Introduction and background

1.1 The EIS project

1.1.1 EIS project overview

Roads and Maritime Services (Roads and Maritime) is seeking approval to construct the fifth section of the Newcastle Inner City Bypass between Rankin Park and Jesmond (the project).

The project would involve the construction of 3.4 kilometres of new four lane divided road between Lookout Road, New Lambton Heights and Newcastle Road, Jesmond. The project is located in the Newcastle local government area, about 11 kilometres west of the Newcastle central business district and about 160 kilometres north of Sydney (Figure 1-1).

An environmental impact statement (EIS) was prepared by Roads and Maritime Services in November 2016 (*Newcastle Inner City Bypass – Rankin Park to Jesmond Environmental Impact Statement*) (Roads and Maritime Services 2016e) for the project.

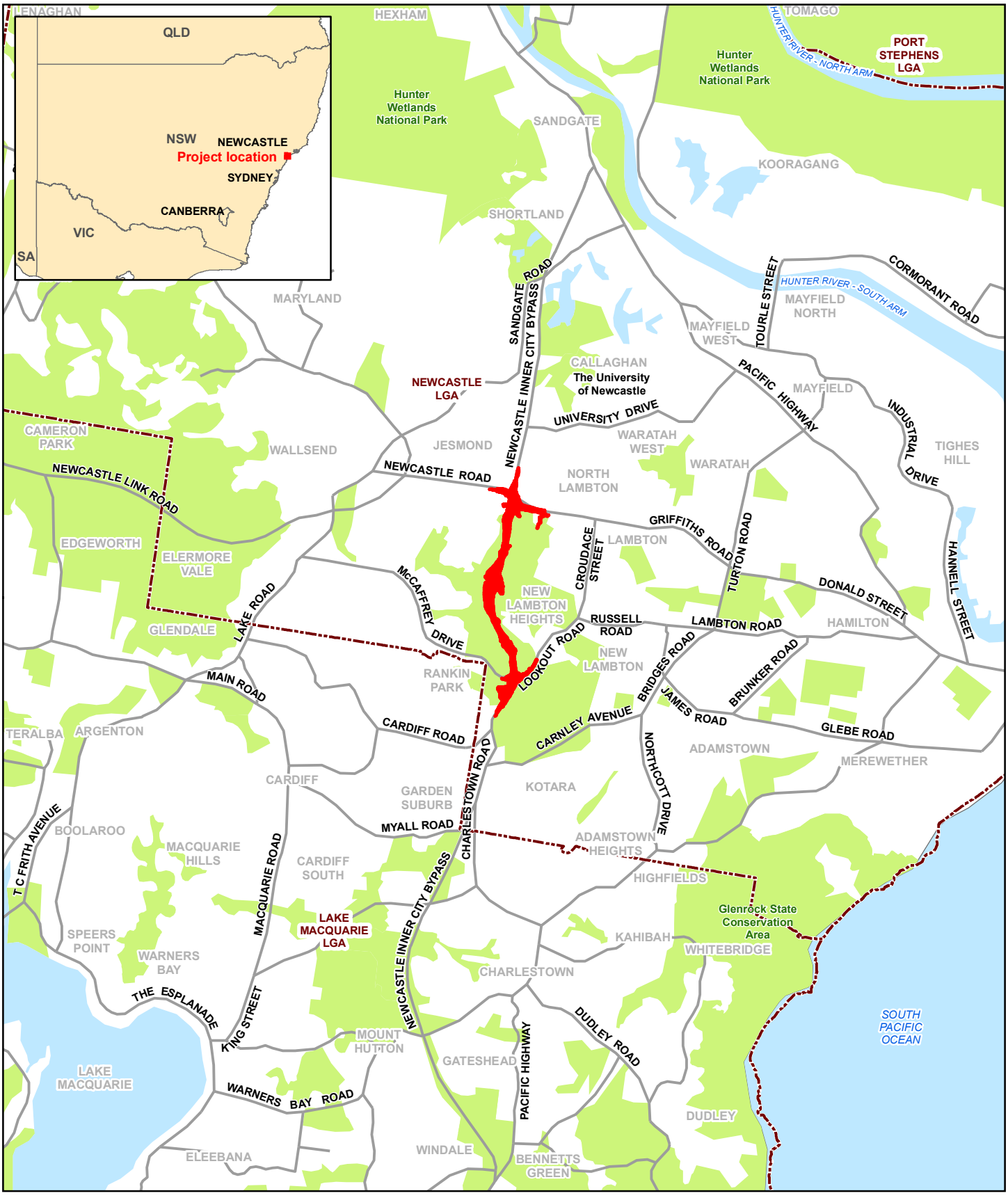
1.1.2 EIS project features

Key features of the project as presented in the EIS include (Figure 1-2):

- New road with two lanes in each direction, separated by a median
- Three interchanges, consisting of:
  - Northern interchange providing access to Newcastle Road and the existing Jesmond to Shortland section of the Newcastle Inner City Bypass. The full interchange provides all movements to/from the bypass and Newcastle Road
  - Hospital interchange providing access between the John Hunter Hospital precinct and the bypass. The half interchange provides access to/from the north
  - Southern interchange providing access to Lookout Road and the existing Kotara to Rankin Park section of the Newcastle Inner City Bypass. The bypass would travel under McCaffrey Drive. The half interchange provides connection in both directions on Lookout Road
- Structures along the road to allow for drainage, animal and bushwalker access
- Tie in and upgrades to connecting roads, including Lookout Road, McCaffrey Drive and Newcastle Road
- Large cut and fill embankments due to steep and undulating terrain
- Pedestrian and cycling facilities, including a shared path bridge over Newcastle Road
- Noise barriers and/or architectural treatment, as required
- Permanent operational water quality treatment measures.

A more detailed description of the project is found in Chapter 5 of the EIS.

Following exhibition of the EIS, receipt of submissions and further consultation with stakeholders a number of design refinements have been made to the project and are detailed in Chapter 5 of this report.



LEGEND

- The Project
- Road
- Local government area
- National Parks and Wildlife Service Estate and bushland reserves
- Watercourse area

Paper Size A4

0 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 1-1
Project locality

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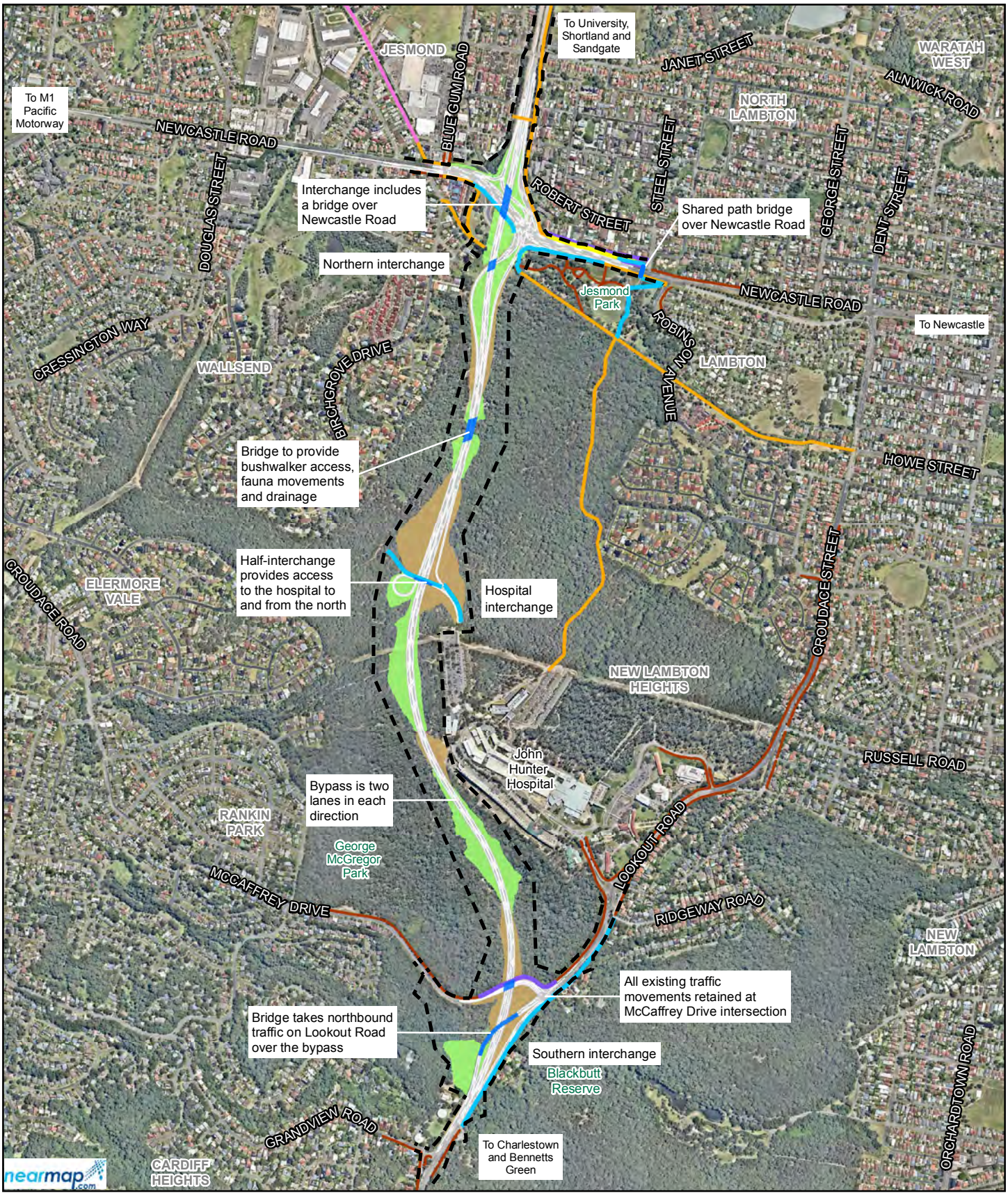
Data source: Aurecon: The Project, 2016 : Geoscience Australia: 250k Topographic Series 3, 2006.



LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Proposed road corridor
- Existing on-road cycleway
- Existing shared path
- Proposed shared path
- Proposed on-road cycleway
- Existing footpath
- Proposed footpath

Paper Size A4

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 1-2
EIS project overview

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH01_SR002_EISProjectOverview_0.mxd
Data source: RMS: Project corridor, 2016; Aurecon: Design / cycleways, 2016; Nearmap: Aerial Imagery, 20160331; LPI: DTDB, 2012

1.2 Statutory context

Roads and Maritime formed the opinion the project would likely significantly affect the environment and required an EIS to be prepared under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project does not require development consent under Part 4 of the EP&A Act. Accordingly as per clause 14 and Schedule 3 of State Environmental Planning Policy (State and Regional Development) 2011 the project is State significant infrastructure under Division 5.2 of the EP&A Act and requires the approval of the Minister for Planning.

An application report was prepared to support a State significant infrastructure application under section 5.15 of the EP&A Act. This application was submitted to the Department of Planning and Environment (DP&E) in December 2014.

The project was considered against potential Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) triggers and was referred to the Commonwealth Department of the Environment (now Department of the Environment and Energy) on 7 September 2015. On 15 October 2015, the Australian Minister for the Environment confirmed the project would be a controlled action requiring the approval of that Minister in accordance with the bi-lateral assessment agreement between the Australian Government and the NSW State Government.

In accordance with the requirements of the EP&A Act and EPBC Act, an EIS was prepared to assess the potential impacts of the project.

The *Biodiversity Conservation Act 2016* (BC Act) and its supporting regulations started on 25 August 2017. The BC Act repeals the *Threatened Species Conservation Act 1995* along with other natural resource management legislation.

The BC Act sets out the environmental impact assessment framework for threatened species, threatened ecological communities and Areas of Outstanding Biodiversity Value (formerly critical habitat) for Division 5.2 development (amongst other types of development).

However, the transitional provisions of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 apply to the project because the EIS is part of a pending or interim application which began before the start of the new Act (clauses 27 and 28(1)). Consequently the project has been assessed in accordance with the *Threatened Species Conservation Act 1995*.

State Environmental Planning Policy (Coastal Management) 2018 started on 3 April 2018. This repeals State Environmental Planning Policy No 14 – Coastal Wetlands along with other coastal management planning policies.

State Environmental Planning Policy (Coastal Management) 2018 manages development within the coastal zone and specifically regulates development within and near to areas mapped as coastal wetlands, littoral rainforests, coastal vulnerability areas, coastal environment areas and coastal use areas.

However, the transitional provisions of the State Environmental Planning Policy (Coastal Management) 2018 apply to the project because the EIS had commenced before the start of the new policy (clause 21(2)(b)(ii)). Consequently the project has been assessed in accordance with State Environmental Planning Policy No 14 – Coastal Wetlands.

While there are no direct impacts to SEPP 14 wetlands, potential indirect impacts have been considered as part of the water quality modelling for the project (Section 6.8).

Further information on the assessment process is provided in Chapter 2 of the EIS (Roads and Maritime 2016e).

1.3 EIS exhibition

The EIS was publicly exhibited by DP&E for 30 days from 16 November 2016 to 16 December 2016. The exhibition was advertised in the Newcastle Herald on 19, 26 and 30 November 2016. A copy of the advertisement is provided in Appendix A.

The EIS was exhibited at:

- Department of Planning and Environment, 320 Pitt Street, Sydney
- Department of Planning and Environment, 26 Honeysuckle Drive, Newcastle
- Roads and Maritime Services, 59 Darby Street, Newcastle
- Newcastle City Council, 282 King Street, Newcastle
- Newcastle Library, 15 Laman Street Newcastle
- Lambton Library, Morehead Street, Lambton
- New Lambton Library, 93 Regent Street, New Lambton
- Wallsend Library, 30 Bunn Street, Wallsend
- Nature Conservation Council of NSW, 338 Pitt Street, Sydney
- Roads and Maritime Services website
- Department of Planning and Environment website.

1.3.1 Exhibition activities

As part of the exhibition a number of activities were carried out by Roads and Maritime to engage with the community. A postcard was distributed to around 20,000 households in Rankin Park, New Lambton Heights, New Lambton, Lambton, Jesmond, North Lambton, Garden Suburb, Cardiff Heights, Elermore Vale, Birmingham Gardens, Waratah West and Kotara. Postcards were also available at Service NSW Centres at Newcastle, Wallsend and Warners Bay, the Roads and Maritime regional office in Newcastle, John Hunter Hospital, Newcastle City Council and Lake Macquarie City Council. The postcards included information on how to make a submission, details on community drop-in sessions and where to go for further information.

All registered stakeholders were notified of the public exhibition of the EIS by email on 16 November 2016.

All property owners likely to be affected by property acquisition were notified by mail on 22 November 2016.

A free call project information line (1800 818 433) and project email address (rp2j.community@aurecongroup.com) were available during the exhibition.

A 3D visualisation showing the key features and benefits of the project was made available to view on the Roads and Maritime project webpage (www.rms.nsw.gov.au/rp2j).

Community drop-in sessions were held during the exhibition period to allow community members to ask the project team questions and get further information. The sessions were advertised in the Newcastle Herald, on the postcard, the EIS overview document and the project webpage. The community drop-in sessions were held at Silver Ridge Community Cottage, Wallsend on Saturday 26 November 2016 (9am-2pm) and Thursday 1 December (3pm-6pm). More than 125 interested community members attended these sessions.

The following materials were made available during the community drop-in sessions:

- The EIS and technical papers
- The EIS overview document
- The postcard with information on how to make a submission
- Information posters displaying the concept design, interchanges, artist's impressions of the interchanges and how to make a submission

- A 3D visualisation shown on several screens and used to engage during one-on-one discussions with community members to get a better idea of visual impacts and the look and feel of the proposed bypass.

A meeting was held with the Roads and Maritime Hunter Cycling Forum on 7 December 2016 at the RMS Hunter Region Office, with representatives from Newcastle City Council, Newcastle Cycleways Movement, Bicycle NSW and Kooragang Open Cycle Club.

1.3.2 Stakeholder engagement

Stakeholder engagement during the exhibition period included:

- An overview document of the EIS, which was published on the Roads and Maritime project webpage, distributed to key stakeholders and made available at community drop-in sessions
- Face-to-face or telephone meetings with individual businesses, property owners, residents and special interest groups
- Emails to freight industry contacts
- Briefings with key stakeholders and organisations such as Newcastle City Council, NSW Health and NRMA
- Briefings with local members of parliament.

1.4 Post-EIS consultation

Following exhibition of the EIS, Roads and Maritime has made a number of project design refinements (Chapter 5), primarily in response to issues raised during the EIS exhibition period. Design refinements have also arisen through the ongoing review of the concept design and consultation with other government agencies.

In order to provide an opportunity for additional community and government stakeholder consultation prior to finalisation of this report, Roads and Maritime released a project update providing information about the design refinements.

1.4.1 Consultation activities

As part of the update a number of activities were carried out by Roads and Maritime to engage with the community. A postcard was distributed to around 20,000 households in Rankin Park, New Lambton Heights, New Lambton, Lambton, Jesmond, North Lambton, Garden Suburb, Cardiff Heights, Elermore Vale, Birmingham Gardens, Waratah West and Kotara.

Project updates were made available at Service NSW Centres at Newcastle, Wallsend and Warners Bay and at Newcastle City Council and Lake Macquarie City Council. The postcards included information on the design refinements and where to go for further information.

All registered stakeholders were notified of the project update by email on 2 May 2018.

A free call project information line (1800 818 433) and project email address (rp2j.community@aurecongroup.com) were available for project enquiries.

An updated 3D visualisation (http://www.rms.nsw.gov.au/projects/hunter/newcastle-inner-city-bypass/rankin-park-to-jesmond/video.html) showing the key features and benefits of the project was made available to view on the Roads and Maritime project webpage.

A social post was published on NSW Roads Facebook on 3 May 2018 informing the community of the design refinements and a link to view them online, together with an extract of the 3D visualisation.

A community drop-in session was held to allow community members to ask the project team questions and get further information. The session was advertised in the Newcastle Herald, on the project webpage and via a social post on NSW Roads Facebook. The community drop-in session was held at Silver Ridge Community Cottage, Wallsend on Saturday 16 June 2018 (9am - 12pm) and was attended by 12 interested community members.

1.4.2 Consultation feedback

Following release of the project update, Roads and Maritime received 17 project enquiries.

The most common comments raised by all respondents in relation to the design refinements were:

- Support for the provision of a new grade separation of the Jesmond Park cycleway at the northern interchange
- Support for south-facing ramps at the hospital interchange.

Overall, the feedback received was positive with general support for the design refinements and overall need for the project. In addition, there were no major concerns or issues raised in relation to the design refinements.

1.5 Purpose of the document

The Secretary of DP&E received 180 submissions during the exhibition of the EIS, and provided copies of the submissions to Roads and Maritime.

In accordance with section 5.17 of the EP&A Act, the Secretary required Roads and Maritime to provide a response to the issues raised in the submissions.

This report identifies the issues raised during exhibition of the EIS as summarised in Chapter 2 and provides responses to those issues from government agencies (Chapter 3) and the community (Chapter 4). It includes information regarding a description of the project design refinements (Chapter 5) and additional assessments carried out since the exhibition of the EIS (Chapter 6). Revised environmental management measures for the project are also included (Chapter 7).

2 Submissions received

2.1 Respondents

Submissions in response to the EIS were accepted by DP&E during the public exhibition period (16 November 2016 to 16 December 2016).

A total of 180 submissions were received for the project as summarised in Table 2-1. Of these, 172 were submissions from the community, while eight were from government agencies.

Each submission was assigned an individual number by DP&E. These numbers are used throughout this report.

Three different form letters were received, representing eight separate submissions.

Table 2-1 Summary of submissions received

Submission group type	Number of separate respondents [1]
Government agencies	
State government agencies	6
Local councils	1
Elected representatives	1
Community	
Individual	163
Interest groups/organisations	8
Business	1

1 A number of respondents provided more than one separate submission. DP&E allocates a single submission number to these. A number of respondents also requested their details be withheld by DP&E. In the absence of being able to identify each respondent, these have been considered as unique submissions and may overestimate the actual number of respondents.

2.2 Overview of issues raised

Each submission was examined individually to identify and understand the issues raised. The content of each submission was reviewed and categorised according to the key issues (such as traffic and transport) and sub-issues (such as parking).

The issues in each submission were extracted and collated, enabling the grouping and summarising of similar submissions to help prepare this submissions and preferred infrastructure report. This means while the exact wording of a particular submission may not be presented in the issue summary in this report, the intent of each individual issue raised is captured and responded to. Where similar issues were raised in different submissions, only one response is provided. The issues raised and Roads and Maritime's responses to these issues forms the basis of Chapters 3 and 4.

The most common issues raised by all respondents were (Figure 2-1):

- Loss of continuity for the Jesmond Park shared path
- Support for the provision of a new shared path bridge over Newcastle Road near Steel Street
- Concerns about potential impacts associated with truck movements near quarries which may supply construction materials to the project if the proposed extended construction hours were approved
- Lack of north-facing ramps at McCaffrey Drive
- Lack of south-facing ramps at the hospital interchange.

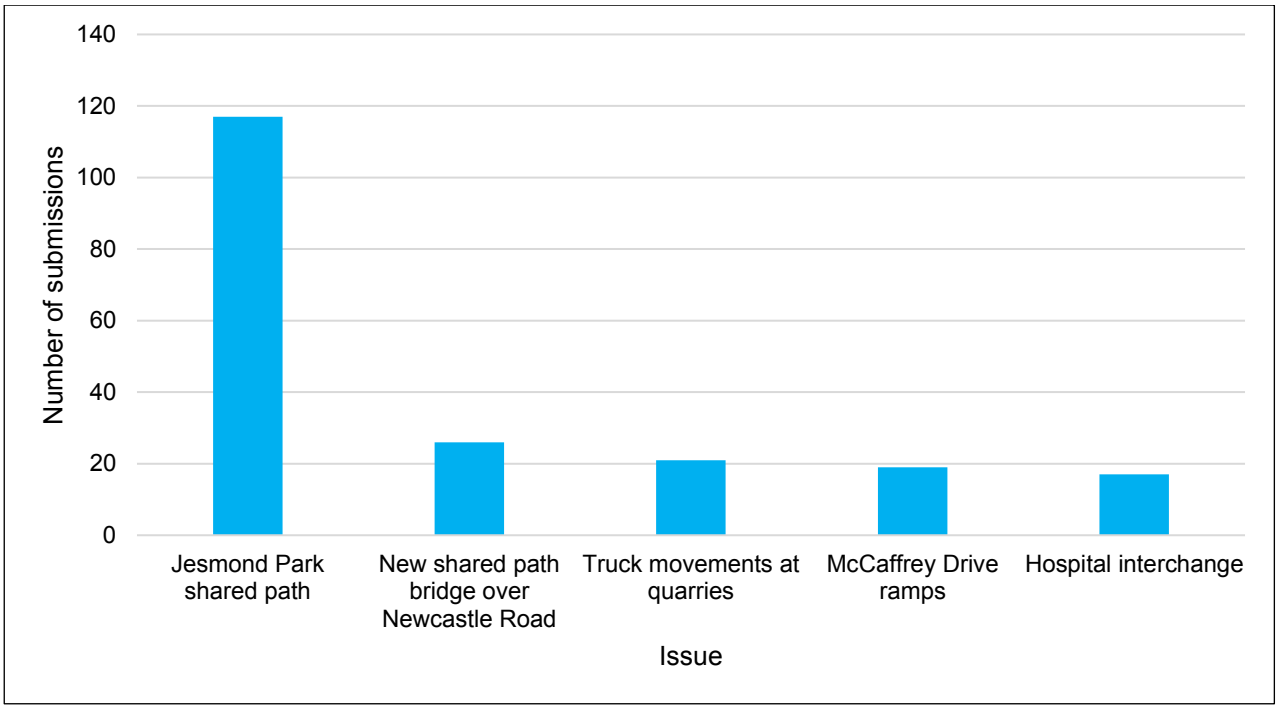


Figure 2-1 Summary of most commonly raised issues

When making a submission respondents were able to identify if their submission was an objection to the project, support for the project or comments only, as follows (Figure 2-2):

- Object – 133
- Support – four
- Comments only – 37
- Not indicated – six.

While most of the submissions identified they objected to the project, many indicated they supported the project overall (or elements of the project) and/or most stated that they only objected to specific elements of the project.

Of those which offered support for the project or an element of the project, the key reasons were:

- Support for the provision of a new shared path bridge over Newcastle Road near Steel Street
- Need for the overall project to address existing congestion issues.

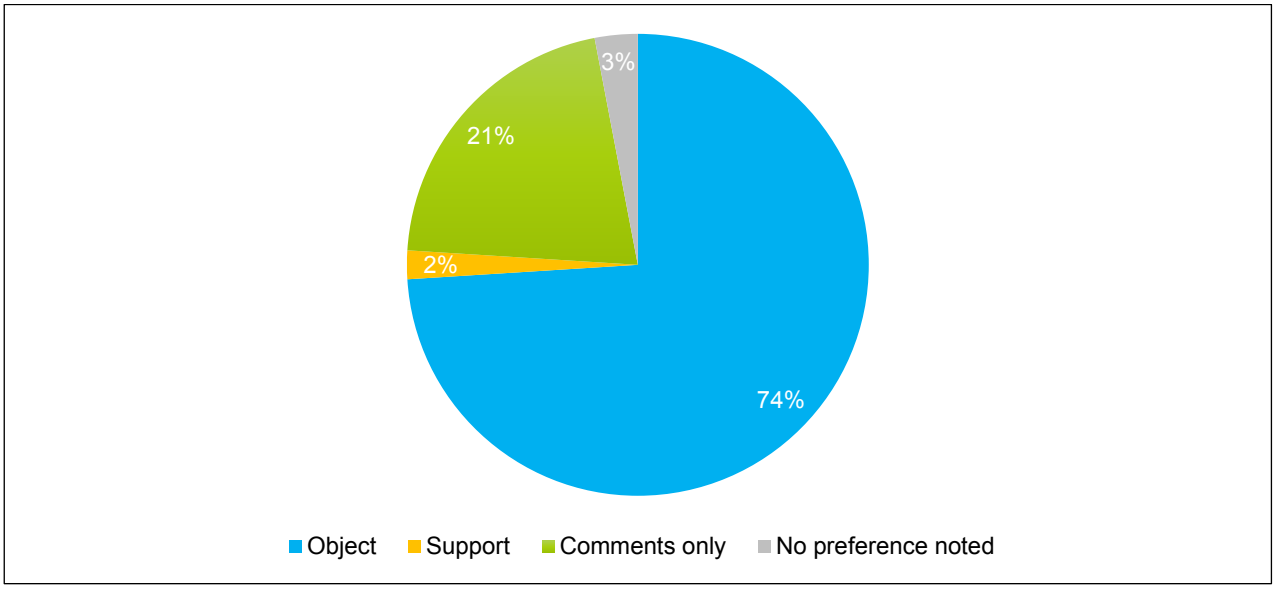


Figure 2-2 Summary of submission preferences

3 Response to agency submissions

3.1 Respondents

A total of eight government agencies made a submission. Table 3-1 provides a list of these government agencies, submission number, issues raised and where the Roads and Maritime response is provided in this report.

Table 3-1 List of respondents – government agencies

Respondent	Submission No.	Issue	Section number where issues are addressed
Sonia Hornery MP	122	Noise and vibration	3.9.2
		Pedestrian/cyclist access	3.8.2
		Project development and alternatives	3.4.1, 3.4.2 and 3.4.3
Department of Industry - Resources & Energy	174	Hazards and risk	3.15.1
		Land use and property	3.10.1
NSW Health Infrastructure	175	Project development and alternatives	3.4.1
Hunter New England Local Health District	176	Consultation	3.5
		Hazards and risk	3.15.2
		Project development and alternatives	3.4.1
Office of Environment & Heritage	177	Aboriginal heritage	3.14
		Biodiversity	3.6.1 and 3.6.3
		Flooding and drainage	3.11.1
Environment Protection Authority	178	Assessment process	3.2
		Groundwater	3.13
		Noise and vibration	3.9.1
		Water quality	3.12
The City of Newcastle (Newcastle City Council)	179	Biodiversity	3.6.1, 3.6.2 and 3.6.3
		Consultation	3.5

Respondent	Submission No.	Issue	Section number where issues are addressed
		Flooding and drainage	3.11.1 and 3.11.2
		Land use and property	3.10.1 and 3.10.2
		Pedestrian/cyclist access	3.8.1, 3.8.2, 3.8.3 and 3.8.4
		Project development and alternatives	3.4.1 and 3.4.2
		Project need	3.3
		Traffic and transport	3.7.1, 3.7.2 and 3.7.3
		Out of scope	3.16
		Water quality	3.12
Department of Primary Industries	180	Assessment process	3.2
		Biodiversity	3.6.1 and 3.6.3
		Water quality	3.12

3.2 Assessment process

Submission numbers

178, 180

Issue description

In summary, the respondents raised the following issues:

- Should DP&E grant approval for the project, the Environment Protection Authority (EPA) recommends including the Recommended Conditions of Consent provided at Attachment 2 (of the submission)
- Should DP&E grant approval for the project, Roads and Maritime will need an environment protection licence under the *Protection of the Environment Operations Act 1997* (POEO Act) from the EPA for the project before starting any construction activities
- The EPA notes the EIS contains a groundwater monitoring program. The EPA may consider adding groundwater monitoring conditions to the environment protection licence
- The EPA notes the EIS proposes water quality monitoring will be carried out at key discharge points during construction. The EPA may add monitoring conditions to the environment protection licence
- Any approval of the project should include conditions requiring the preparation of the following plans in consultation with Department of Primary Industries – Water:
  - Construction Groundwater and Dewatering Management
  - Operational Groundwater Management
  - Soil and Water Management
  - Mine Remediation Management (if required).

Response

Roads and Maritime is seeking project approval from DP&E under the EP&A Act. The draft conditions of consent proposed by the EPA are conditions which would be associated with an environment protection licence issued under the POEO Act.

As stated in Section 2.2.1 of the EIS, the project is a scheduled activity under the POEO Act. This means an environmental protection licence for 'road construction' will be required under chapter 3 (clause 35, schedule 1) of that Act.

Should DP&E grant project approval, Roads and Maritime will apply for an environment protection licence from EPA at the appropriate time. As part of this process, the applicable project specific licence conditions (including monitoring requirements) would be negotiated between Roads and Maritime and EPA.

As stated in Chapter 22 of the EIS, Roads and Maritime will prepare a number of management plans for the project and these will be developed in consultation with relevant government agencies.

3.3 Project need

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- The project budget being fixed before the full project scope being determined is a matter of concern as it suggests opportunities for further amendments to the design of the proposal are limited.

Response

Roads and Maritime has carried out an extensive assessment and review process to identify options and select the preferred option to ensure it best meets the project objectives and provides value for money (refer to Chapter 4 of the EIS).

Following exhibition of the EIS, receipt of submissions and further consultation with stakeholders a number of design refinements have been made to the project as detailed in Chapter 5. The inclusion of these design refinements, in particular the refined hospital interchange layout (Section 5.4.1), which requires additional funding, shows the project can be refined. Further, the project will continue to be refined during detailed design to ensure it best meets the project objectives and provides value for money.

3.4 Project development and alternatives

3.4.1 Hospital interchange

Submission numbers

122, 175, 176, 179

Issue description

In summary, the respondents raised the following issues:

- The interchange at the John Hunter Hospital needs to have both northbound and southbound access ramps to cater for future traffic
- NSW Health Infrastructure commented provision of a full interchange would have benefits for the hospital precinct in terms of access and internal traffic flow

- Hunter New England Local Health District - Hunter New England Population Health commented for emergency management considerations a full interchange should be provided for the John Hunter Hospital precinct
- Newcastle City Council commented construction of a full interchange was preferred to address existing traffic congestion issues and to provide additional access for emergency vehicles
- Newcastle City Council considers the EIS should assess a full interchange so when future traffic growth requires its construction further project approvals are not required.

Response

Following exhibition of the EIS, receipt of submissions and further consultation with NSW Health Infrastructure and Hunter New England Local Health District, Roads and Maritime has refined the design for the hospital interchange adding south-facing ramps, resulting in a full interchange. NSW Health has committed to providing $13 million to cover the additional costs associated with the design, environmental assessment and construction of the south-facing ramps. The full interchange would provide access to/from the north and south for use by all hospital users including public, staff and emergency services (Section 5.4.1). Additional assessments have been carried out for the full interchange (Chapter 6). Full access to the hospital would still be available to/from Lookout Road at the main entrance (Kookaburra Circuit).

The hospital interchange would enable the John Hunter Hospital precinct to expand its facilities and/or change its internal configuration (eg relocation of facilities and/or parking) to alleviate existing congestion issues within the precinct.

3.4.2 McCaffrey Drive ramps

Submission numbers

122, 179

Issue description

In summary, the respondents raised the following issues:

- Lack of ramps provided at McCaffrey Drive and belief substantially more people would use the ramps than predicted in the EIS. By not providing the ramps there will be increased traffic on local roads such as Elbrook Drive, Grandview Road and Marshall Street. These roads are local roads and not designed to take this increase in traffic
- Newcastle City Council is aware of heavy use of Douglas Street to access Newcastle Road due to existing congestion of Lookout Road and Croudace Street and considers these movements would be substantially reduced if ramps were provided at McCaffrey Drive
- Newcastle City Council supports local resident's calls for the provision of ramps at McCaffrey Drive.

Response

An integral element of the traffic assessment relates to the development of a microsimulation base model representing existing traffic conditions in the two hour morning (7am to 9am) and two hour evening (4pm to 6pm) peak periods. The model was calibrated and validated using 2014/15 traffic survey data with reference to the criteria as outlined in the Roads and Maritime document Traffic Modelling Guidelines, Version 1.0, February 2013 (Section 4.4.1 of the EIS).

Comparison results illustrate the model provides good replication of existing traffic conditions against network calibration criteria and observed journey times. Accordingly the microsimulation base model was assessed as fit for purpose and provided a robust model for:

- Undertaking traffic analysis of design options
- Assessing the construction and operational impacts of the project within the study area.

Assessment of the need for provision of ramps connecting the bypass with McCaffrey Drive is provided in Sections 4.4.6, 4.5.1 and 4.5.3 of the EIS. This assessment determined ramps were not required for the following key reasons:

- Origin-destination surveys in 2014 and 2015 indicate less than one per cent of McCaffrey Drive traffic would use the bypass if the ramps were provided (Section 4.4.6 of the EIS)
- The combination of steep grade of the bypass (8.5 per cent) and undulating topography would make the design and construction of the ramps difficult and costly (Section 4.4.6 of the EIS)
- While the design and construction of the ramps is technically possible, the low forecast usage of the ramps and their high cost to build meant the ramps were not economically viable (Section 4.4.6 of the EIS)
- Additional sensitivity analysis was carried out to assess the need for the McCaffrey Drive ramps if more traffic used the ramps than was predicted, representing the maximum possible use of the ramps. Based on these traffic volumes, economic analysis concluded the provision of the ramps does not offer value for money (Section 4.5.3 of the EIS).

Traffic modelling was carried out (Section 4.5.3 of the EIS) to assess traffic impacts as a result of the project on the surrounding road network. Key findings included:

- A reduction in traffic is predicted on McCaffrey Drive by 15 per cent from about 20,000 to 17,000 vehicles per day in 2030. This is primarily due to traffic from the north-west portion of the study area (suburbs such as Wallsend, Maryland and Fletcher) being predicted to switch routes to use the new bypass for trips to and from south of McCaffrey Drive
- The bypass is predicted to have a minor increase in traffic on Grandview Road by about seven per cent from 3000 to 3200 vehicles each day in 2030
- Given the predicted low volumes of traffic forecast to use north-facing ramps at McCaffrey Drive, the modelling indicates the omission of north-facing ramps at McCaffrey Drive from the southern interchange would have very small impact to traffic volumes on surrounding local roads including Grandview Road, Elbrook Drive and Marshall Street, compared to the bypass with no north-facing ramps.

The traffic analysis and road safety assessment (Section 4.5.3 of the EIS) carried out to investigate the potential impacts on Grandview Road with the project indicated:

- Predicted traffic volumes on Grandview Road with the project (3200 vehicles per day in 2030) are well within the traffic carrying capacity of Grandview Road
- Predicted level of service of the Lookout Road and Grandview Road intersection with the project is level of service A in both the morning and afternoon peaks (2030), which is the highest performance measure for an intersection
- Additional traffic volumes on Grandview Road with the project, predicted at 200 vehicles per day (or 20 vehicles in the peak hour) would not result in any inherent safety risk on Grandview Road or roads which connect with Grandview Road.

Updated traffic modelling has been carried out (Section 6.3 and Appendix C) for the project (including the design refinements (Chapter 5)), which shows the project will carry up to 34,500 vehicles per day in 2030 and result in a corresponding reduction in traffic volumes on the existing route of Lookout Road (up to 38 per cent), Croudace Street (up to 43 per cent) and Newcastle Road (up to 24 per cent). As a result, the project would ease traffic congestion on the existing route and reduce the likelihood of roads such as Douglas Street being used as alternative routes.

3.4.3 Northern interchange

Submission numbers

122

Issue description

In summary, the respondent raised the following issues:

- The replacement of the existing Jesmond roundabout with traffic lights will increase congestion for east-west traffic
- A grade separated flyover should also be provided for east-west traffic.

Response

Updated traffic modelling has been carried out (Section 6.3 and Appendix C) for the project (including the design refinements (Chapter 5)), which shows the project will carry up to 34,500 vehicles per day in 2030 and result in a corresponding reduction in traffic volumes on the existing route of Lookout Road (up to 38 per cent), Croudace Street (up to 43 per cent) and Newcastle Road (up to 24 per cent). As a result, the project would ease traffic congestion on these key roads.

An assessment of options for the northern interchange (including options which retained the roundabout) is provided in Chapter 4 of the EIS. Section 4.5.2 of the EIS identifies northern option 6 was the preferred option as it maximises the future functionality of the interchange and provided the best value for money with substantial benefits for traffic flow both on the bypass and Newcastle Road. The preferred option, as detailed in Section 5.3.5 of the EIS includes a traffic light controlled intersection to provide for all traffic movements at the interchange and would widen Newcastle Road to three lanes in each direction near the interchange.

An assessment of the level of service (Section 6.3 and Appendix C) indicates the northern interchange would have an improved level of service of C (with the project) compared to D (without the project) in 2030 during both peak periods. This indicates that with the project, the intersection of the bypass and Newcastle Road would have less congestion than if the Jesmond roundabout was left in place.

The provision of an additional grade separation for east-west traffic on Newcastle Road is beyond the scope of the project and would result in significant additional environmental, property and community impacts and costs. Options for the bypass to pass beneath Newcastle Road are not feasible due to flooding and drainage issues (Chapter 12 of the EIS) and geotechnical conditions which would substantially increase the cost of the project and would not represent value for money.

3.5 Consultation

Submission numbers

176, 179

Issue description

In summary, the respondents raised the following issues:

- Hunter New England Local Health District - Hunter New England Population Health emphasised the importance of community consultation and the need for it to continue
- Newcastle City Council invited a representative from Roads and Maritime, a McCaffrey Drive resident and a representative from Newcastle Cycleways to present at a Public Voice session in February 2017 on the project.

Response

Community and stakeholder engagement carried out for the project is detailed in Chapter 6 of the EIS. This consultation has been guided by a *Stakeholder and Community Engagement Plan* (Roads and Maritime 2014c) which establishes the objectives and strategies for stakeholder engagement during the life of the project. In 2015, a *Community and Stakeholder Engagement Plan* (Roads and Maritime 2015b) was prepared, to support the 2014 plan by identifying specific communication and consultation activities for the concept design and environmental assessment phases of the project. The objectives of the community and consultation activities were to:

- Inform the community and stakeholders of the project and relevant stages for consultation
- Work with the community and stakeholders during the planning process to identify issues and minimise potential impacts
- Expand the database of stakeholders who would like to be kept informed and engaged about the project
- Provide a general level of awareness about the project in the wider community.

To guide future ongoing communication and consultation during construction of the project a *draft Community Consultation Framework* (Roads and Maritime 2016a) has been prepared and is provided in Appendix D of the EIS. The strategy will enable appropriate consideration and balancing of community and stakeholders' issues to achieve best project outcomes.

As stated in Chapter 6 of the EIS, ongoing two-way communication will be carried out during detailed design and construction. This will effectively address and manage issues as they emerge and support the delivery of best outcomes for the project, stakeholders and the broader community.

In accordance with these plans Roads and Maritime has carried out extensive consultation with NSW Health Infrastructure and Hunter New England Local Health District during all stages of the project to date. Roads and Maritime will carry out further consultation with these parties during future stages of the project.

Roads and Maritime noted the invitation from Newcastle City Council to attend a public voice session. However, as the project is being assessed by DP&E under Part 5.1 of the EP&A Act attendance was not appropriate. During exhibition of the EIS, Roads and Maritime held community drop-in sessions at Silver Ridge Community Cottage, Wallsend on Saturday 26 November 2016 (9am-2pm) and Thursday 1 December (3pm-6pm). Roads and Maritime will continue to keep all stakeholders informed as the project progresses as detailed in Chapter 6 of the EIS and is willing to provide future briefings to Newcastle City Council on the status of the project.

3.6 Biodiversity

3.6.1 Assessment

Submission numbers

177, 179, 180

Issue description

Office of Environment and Heritage (OEH)

OEH identified a number of issues where the project does not comply with the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (Framework for Biodiversity Assessment) (Office of Environment and Heritage 2014a) guidelines and/or requires additional justification to meet these guidelines.

OEH confirmed the biodiversity assessment complied with the Framework for Biodiversity Assessment as follows:

- It included a biodiversity assessment report and biodiversity offset strategy
- The biodiversity assessment report adequately assessed the project specific matters (*Corybas dowlingii* and Lower Hunter Spotted Gum - Ironbark Forest)
- The assessment was carried out by an accredited person
- The BioBanking credit calculator files were submitted via OEH's portal.

Specific issues raised by OEH are discussed in the following sections.

Identified plant community types

- Noted only six of the 30 BioBanking floristic sampling plots are located in the construction footprint and requested justification as to why these are representative of the plant community types within the construction footprint.
- OEH confirmed the identified plant community types in the biodiversity assessment report are correct.
- OEH noted a number of the quadrats presented in the biodiversity assessment report (Figure 3.1 of the biodiversity assessment report) are not within the correct plant community type and requested the information to be updated
- OEH requested further assessment of the southern part of the vegetation zone mapped as 'exotic vegetation' based on the observed presence of native grasses and regrowth shrubs
- OEH requested further assessment of the vegetation zone identified as 'planted and parkland vegetation' within Jesmond Park based on the observed presence of native tree species which due to their size are likely to be remnant trees and not planted

Green and Golden Bell Frog

- OEH considered the waterbody located in the north-western part of the study area would potentially offer habitat to the Green and Golden Bell Frog and additional targeted surveys for Green and Golden Bell Frog be carried out or appropriate justification as to why surveys are not required.

Typographical errors

- Quadrats 4 and 11 (Q4 and Q11) are not shown in Figure 3.1 of the biodiversity assessment report
- OEH noted in Section 3.2.10 of the biodiversity assessment report, there are some minor typographical errors. Under the 'description' tab the dam is said to be identified in Figure 3.2, this should be corrected to Figure 3.1b; and the second photo reference 'Photo 3.12' should be corrected to 3.13.

BioBanking credit calculations

- OEH identified the 'area to perimeter ratio' calculations in the biodiversity assessment report were incorrect
- Within the credit calculator, the wrong 'IBRA Subregion' has been used. Wyong IBRA subregion, instead of the Hunter IBRA subregion should be used. As such the credit calculator will need to be rerun with the corrected IBRA Subregion.

Project specific matters for further consideration

- OEH considers appropriate surveys were carried out for *Corybas dowlingii* and it is unlikely to be present within the construction footprint
- OEH concurs with the identification and mapping of Lower Hunter Spotted Gum - Ironbark Forest provided in the biodiversity assessment report. OEH notes the project alignment minimises impacts to this community. As such OEH is of the opinion, coupled with the proposed offset matches to this community within the BOS, the biodiversity assessment report has adequately dealt with long-term conservation/management of this community.

Newcastle City Council

Newcastle City Council provided data on vegetation, watercourse floristics and expected fauna presence which has not been incorporated in the document. For instance there is a lack of acknowledgement in the EIS of threatened species such as the Masked Owl and Squirrel Gliders.

Riparian, habitat tree and vegetation 'ground-truthed' datasets and lists of other local studies were provided for inclusion in the development of the EIS. Many of these datasets have not been cited or appear to have been utilised within the EIS. For example, nest boxes containing Squirrel Gliders east of the road corridor appear not to have been included in the EIS survey effort, whereas nest boxes to the west which did not contain Squirrel Gliders were surveyed.

Department of Primary Industries

It is noted impacts to downstream groundwater dependent ecosystems would be mitigated by discharging groundwater inflow back into local watercourses which support these groundwater dependent ecosystems. Implementation and monitoring of this activity should be addressed in development of the relevant management plan.

Response

Office of Environment and Heritage (OEH)

Identified plant community types

Additional biodiversity investigations to address all issues identified by OEH have been carried out for the project and are reported in Section 6.2 and Appendix B. This assessment has resulted in a refinement to the vegetation mapping presented in the EIS and the findings were discussed at a meeting with OEH on 13 November 2017.

Green and Golden Bell Frog

Additional biodiversity investigations have been carried out for the project and are reported in Section 6.2 and Appendix B. This assessment included targeted surveys of the Birchgrove Drive Reserve dam for Green and Golden Bell Frog in February and March 2017. No Green and Golden Bell Frogs were detected and the findings were discussed at a meeting with OEH on 13 November 2017.

Typographical errors

The identified errors are noted and have been addressed in the updated biodiversity assessment report (GHD 2018a) provided in Appendix B.

BioBanking credit calculations

As a result of the additional biodiversity investigations (Section 6.2 and Appendix B) and refinements to the construction footprint due to project design refinements (Chapter 5), updated BioBanking credit calculations have been carried out which address the issues raised by OEH. These are reported in Section 6.2 and were discussed at a meeting with OEH on 13 November 2017.

Project specific matters for further consideration

Noted.

Newcastle City Council

The project has been subject to a number of biodiversity assessments during its history of development including Umwelt Environmental Consultants (2006), Parsons Brinckerhoff (2014), Parsons Brinckerhoff (2015a), Parsons Brinckerhoff (2015b), Parsons Brinckerhoff (2015c) and Parsons Brinckerhoff (2016). These assessments included, as relevant, a review of publicly available existing studies, database searches for registered records of threatened flora and fauna, review of biodiversity information provided by Newcastle City Council and field surveys.

The database searches included those held by government agencies such as OEH and Department of Environment and Energy, which contain registered and verified records. The searches, in conjunction with the review of previous studies, are used to inform the scope for field surveys in conjunction with a review of potential habitat values.

Newcastle City Council provided a range of information for consideration in preparation of the EIS. While providing useful information on the biodiversity values of the bushland area, some of this data relating to riparian and terrestrial vegetation species and communities was identified to not be of direct or current relevance for the biodiversity assessment as it did not meet the current methodology and requirements of the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (Framework for Biodiversity Assessment) (Office of Environment and Heritage 2014a).

Information provided by Newcastle City Council included comprehensive habitat tree mapping for the Jesmond bushland area. Parsons Brinckerhoff (2015b) reviewed this data set and in conjunction with comprehensive hollow bearing tree survey of the project area carried out by Parsons Brinckerhoff (2014) developed a consolidated map of habitat trees which was subsequently used in the biodiversity assessment report (GHD 2016f, Appendix E of the EIS).

Data provided by Newcastle City Council included information on potential and recorded locations of habitat for certain threatened species and this was included in the biodiversity assessments for the EIS. Parsons Brinckerhoff (2015a and 2015b) confirmed the presence of Powerful Owl and while targeted searches did not record the presence of Masked Owl, it was identified as having a moderate likelihood of occurrence due to suitable habitat being present. As a result these species have been appropriately considered in the biodiversity assessment report.

The biodiversity assessment states Squirrel Gliders have been recorded in the bushland area and these were considered as required by the Framework for Biodiversity Assessment. Squirrel Glider nest box information was used in the biodiversity assessment report (GHD 2016f, Appendix E of the EIS, Figure 4.1) and Chapter 7 (Figure 7-6) of the EIS. An inspection of the nest boxes to the west of the John Hunter Hospital precinct was carried out by Parsons Brinckerhoff (2015c) as these nest boxes are located inside the construction footprint for the project. The assessment was carried out to identify the current level of usage and to assist in the development of management options for possible replacement of these nest boxes. Nest boxes to the east of the John Hunter Hospital precinct were not inspected as these would not be directly or indirectly impacted by the project.

Parsons Brinckerhoff (2015a) carried out comprehensive biodiversity surveys of the project area in accordance with the relevant guidelines and provides detailed information on the biodiversity values of the bushland area used to inform the biodiversity assessment report for the EIS.

The biodiversity assessment report (GHD 2016f, Appendix E of the EIS and summarised in Chapter 7 of the EIS) was prepared based on the findings of the previous assessments and, as required by the project SEARs, in accordance with the Framework for Biodiversity Assessment (Office of Environment and Heritage 2014a) and relevant survey guidelines. Under the Framework for Biodiversity Assessment all relevant threatened species and vegetation communities are included in the assessment and calculation of offset credits. Specifically the Framework for Biodiversity Assessment identifies species credits, being threatened species for which specific offsets are required such as Black-eyed Susan (*Tetratheca juncea*), and ecosystem credits, which account for threatened and other species (including Squirrel Glider (*Petaurus norfolcensis*) and Masked Owl (*Tyto novaehollandiae*)) which are not species credits and the habitat values provided by the identified plant community types. Through this process all species, threatened or otherwise, are accounted for in the assessment of potential impacts and provision of offset credits.

Department of Primary Industries

Potential impacts to groundwater dependent ecosystems were assessed in Sections 7.3.6 and 14.4.3 of the EIS. Three vegetation types in the study area were identified to be groundwater dependent ecosystems. Two of the communities (Sydney Blue Gum – White Mahogany shrubby tall open forest) were found to be intermittently dependent on groundwater, while one community (Smooth-barked Apple Red Bloodwood open forest - *Gahnia clarkei* variant) was found to be dependent on groundwater. Of these only the intermittently groundwater dependent ecosystems would be directly or indirectly impacted by the project.

The concept design for the project has been developed to minimise the inflow of groundwater into cuttings and to maximise the return of any captured groundwater to the ephemeral watercourses which support the identified groundwater dependent ecosystems.

As stated in Section 14.5 of the EIS:

- During detailed design the cuttings will be designed to minimise the volume of groundwater inflow as far as is practicable
- A construction groundwater and dewatering management plan will be prepared to manage groundwater inflows during construction
- An operational groundwater management plan will be prepared if groundwater monitoring results indicate there are likely to be post-construction groundwater quality discharge exceedances of the project specific water quality objectives or a reduction in flows which support downstream intermittent groundwater dependent ecosystems.

The management plans would be developed in consultation with relevant government agencies including the Department of Primary Industries.

3.6.2 Fauna connectivity

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- The EIS does not satisfactorily address fauna movement east-west across the bypass. In previous project documentation provided to Newcastle City Council there has been at least two fauna underpasses proposed. It is now proposed to provide a northern underpass and a dedicated fauna culvert south of the John Hunter Hospital precinct. There is no explanation in the EIS for the southern underpass being removed
- The northern underpass at Bridge 4 only provides about 30 metres beneath the bridge, with pylons and creek redirection occupying most of the transit space. This does not appear adequate for the connectivity of habitat and the sustainability of fauna populations
- The EIS does not provide sufficient details of what species the faunal passage ways are intended to cater for and comment on their likelihood of success
- The EIS does not provide adequate details of other measures to be implemented to address fauna connectivity across the project footprint. Specifically, any proposed measures to support the long term viability of species which may not use the underpass such as Squirrel Gliders
- It is considered the dimensions of the dedicated fauna culvert (about three by three metres) are inadequate to accommodate its use by macropods
- Concerns are raised about the effectiveness of the proposed fencing to guide fauna to crossing infrastructure and the potential increased risk from predators
- The EIS does not include adequate measures to minimise potential conflict between vehicles travelling on the bypass and threatened owl species flying low over the roadway while hunting at night.

Response

Chapter 4 of the EIS describes the various alternatives to the project which were considered as part of the project development process and explains how and why the project was selected as the preferred option. As part of the options process, alignment option 2 was selected as the preferred option. This option replaced the second bridge to the south of the John Hunter Hospital precinct (which was provided with alignment option 1) with a dedicated fauna culvert and relocated the other bridge (Bridge 4) to the north which would provide for fauna passage beneath the bridge. As described in Sections 4.4.5 and 7.3.1 of the EIS, the preferred option minimises fragmentation of the bushland area and impacts on endangered ecological communities and threatened species.

The realignment of the project allowed for a wider vegetated corridor on the western side of alignment than the 2007 strategic design, which improves north-south connectivity between vegetation and associated habitat, increasing the potential for large and small fauna species to use habitats surrounding the project. It also improves connectivity to the west to Dangerfield Drive Reserve.

Details of the avoidance measures incorporated into the project are shown in Figure 4-10 of the EIS and detailed in Section 7 of the biodiversity assessment report (GHD 2016f, Appendix E of the EIS and updated biodiversity assessment report (GHD 2018a, Appendix B of this report)) and is further discussed in Section 4.6.3.

Section 7.3.2 of the EIS outlines the proposed fauna connectivity strategy for the project. Section 7.3 of the biodiversity assessment report (GHD 2016f, Appendix E of the EIS) and updated biodiversity assessment report (GHD 2018a, Appendix B of this report) also provides a detailed discussion of the proposed fauna connectivity strategy, including target species and key design considerations for their successful utilisation. The strategy, which will be further refined during detailed design provides:

- One dedicated fauna culvert of appropriate size and dimension (about three by three metres) for terrestrial fauna, including macropods, with fauna fencing and fauna 'furniture'
- A bridge (Bridge 4) which would provide for fauna passage beneath the bridge span
- Rope bridges for arboreal fauna established at two separate locations along the alignment
- Fencing to guide fauna to the crossing infrastructure. The fencing would be established as close as possible to the final road formation, which maximises available habitat for fauna, and includes fauna escape points.

The underpasses are suitable for use by ground based species including Swamp Wallaby (*Wallabia bicolor*) while the rope bridges are suitable for arboreal mammal species including Squirrel Glider (*Petaurus norfolcensis*), Sugar Glider (*Petaurus breviceps*) and Brushtail Possum (*Trichosurus vulpecula*).

As such, the project would still provide two fauna underpasses, with the dedicated fauna culvert replacing the bridge identified in the 2007 strategic design.

During detailed design the fauna connectivity strategy would be finalised in consultation with OEH. At Bridge 4, key considerations will be provision of dry passage for fauna and possible need for fauna furniture. Based on the concept design the span between abutments is currently about 40 metres, leaving sufficient space for provision of suitable fauna passage in addition to the bridge piers and indicative creek realignment treatment shown in the EIS.

The proposed dedicated fauna culvert has been sized based on other projects including Pacific Highway upgrades for use by larger terrestrial fauna such as macropods including Swamp Wallaby. The culvert would be three by three metres, a maximum grade of eight per cent and about 50-60 metres long which is considered suitable for fauna usage.

The proposed fauna fencing is considered adequate to guide fauna towards the crossing infrastructure and would be effective in minimising animal mortality by road strike and the potential for associated injury to motorists. This would outweigh any potential for increased risk of predation.

There are no specific measures which could be incorporated to manage the risk of collision between low flying birds or owls with vehicles on the bypass. It is considered unlikely owls would fly low over the bypass due to a lack of prey in the roadway.

3.6.3 Offsets

Submission numbers

177, 179, 180

Issue description

In summary, the respondents raised the following issues:

- OEH notes the EIS includes a biodiversity offset strategy (Appendix B of the biodiversity assessment report (GHD 2016f)) as required under the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (Framework for Biodiversity Assessment) (Office of Environment and Heritage 2014a). OEH concurs with the intended approach to address the offset credit requirements of the project. However, OEH requires the credit requirements to be updated to address issues identified with the assessment and notes this could occur during detailed design when the final construction footprint is determined
- Local offsets are preferred and Newcastle City Council may have suitable land available
- Where riparian land/vegetation is permanently removed by the project the riparian area should be offset either at the project site or elsewhere along the relevant watercourse.

Response

Roads and Maritime notes OEH's endorsement of the proposed approach to securing the biodiversity offset credits for the project.

As a result of the additional biodiversity investigations (Section 6.2 and Appendix B) and refinements to the construction footprint due to project design refinements (Chapter 5), updated BioBanking credit calculations have been carried out which address the issues raised by OEH. These are reported in Section 6.2 and were discussed at a meeting with OEH on 13 November 2017. An updated biodiversity offset strategy is provided in Appendix B.

The updated biodiversity offset strategy identifies potential sites which could meet the offset requirements for the project and this will be further refined during detailed design in consultation with OEH. If Newcastle City Council has a site which would meet the offset requirements of the project then Roads and Maritime will consider its future inclusion in the offsets strategy.

As stated in Section 7.5 of the EIS, as part of a flora and fauna management plan for the project, native vegetation will be re-established in accordance with a re-vegetation management plan prepared in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 3: Re-establishment of native vegetation)* (RTA 2011a). The revegetation management plan will use suitable species from the indigenous vegetation communities present at the site to replace habitat for threatened species including Grey-headed Flying-fox.

3.7 Traffic and transport

3.7.1 Existing road network

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- Following construction of the project it is considered likely there will be increased numbers of vehicles turning right from McCaffrey Drive into Elbrook Drive. The intersection does not have an overtaking lane for through traffic. A preschool is also located at the intersection. Greater turn movements will result in an increase of existing safety issues.

Response

As discussed in Section 4.5.3 of the EIS the potential for additional traffic to use Elbrook Drive was assessed. The assessment noted drivers would be unlikely to use the longer, slower and indirect route of Elbrook Drive and Grandview Road to access the bypass rather than using McCaffrey Drive and the existing route of Lookout Road, Croudace Street and Newcastle Road.

Further, the updated traffic modelling carried out for the project (Section 6.3 and Appendix C), shows the project would reduce traffic on McCaffrey Drive by 15 per cent from about 20,000 to 17,000 vehicles per day in 2030. As a result, there would be less vehicles on McCaffrey Drive which may turn right into Elbrook Drive.

3.7.2 Parking

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- It is requested measures be incorporated to discourage parking on the shoulders of the bypass ramp and the bypass near the hospital interchange
- The EIS indicates removal of 16 parking spaces (including three disabled spaces) is required on Newcastle Road next to Jesmond Park. These parking spaces are highly used on weekends and parking spaces for persons with a disability are located in this area due to the suitability of grades. Further consultation with Newcastle City Council will be required to address the loss of these spaces.

Response

As stated in Section 8.3.2 of the EIS, on-street parking would not be permitted on the new bypass including the on-ramps and off-ramps at the northern interchange, hospital interchange and southern interchange. Appropriate signage would be installed to clearly indicate parking is not permitted.

About eight car park spaces eastbound and about 16 car park spaces (including three disabled) westbound in the existing road shoulder of Newcastle Road (to the east of the northern interchange) would be permanently removed by the project. This area is generally used by visitors to Jesmond Park. Given the off-street parking available in Jesmond Park (off Robinson Avenue) and on surrounding streets, the loss of these spaces is not expected to result in any noticeable impacts in the study area. However, the removal of the disabled car parking spaces may cause impacts for disabled users of the park. Roads and Maritime will consult with Newcastle City Council during detailed design to determine if replacement spaces are required in the dedicated car park in Jesmond Park.

3.7.3 Public transport

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- The EIS indicates the existing westbound bus lane and bus traffic light at the Newcastle Road and Blue Gum Road intersection would be removed to allow for three lanes of through traffic. This measure is counter-productive to making public transport a more convenient option than private vehicle use.

Response

As stated in Section 8.3.2 of the EIS, the provision of three through lanes and one turning lane in the westbound direction at the intersection of Newcastle Road and Blue Gum Road, would require removal of the existing westbound bus only lane, which is about 40 metres long. Bus services would use the main traffic lanes at the upgraded intersection. This is unlikely to result in any noticeable impacts to bus services in the area, in particular as the Newcastle Road and Blue Gum Road intersection would operate at a higher level of service with the project.

Bus services and potential increase in patronage in the area would benefit from the improved traffic conditions due to the project, including reduced congestion on the existing route of Newcastle Road, Croudace Street and Lookout Road.

3.8 Pedestrian/cyclist access

3.8.1 Interchanges

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- The proposed shared path crossing of the southbound off-ramp at the hospital interchange requires further consideration to improve safety
- At the southern interchange, provision for safe passage of southbound on-road cyclists is required at the intersection of the bypass with Lookout Road
- At the southern interchange, provision for safe passage of northbound on-road cyclists across the Lookout Road flyover is required. Newcastle City Council understands Roads and Maritime is considering provision of a separated facility for northbound on-road cyclists and supports adoption of the refined design.
- The footpath on the northern side of McCaffrey Drive should be widened and upgraded to a shared path standard
- The northern interchange should include additional facilities for on-road cyclists such as provision for hook turns, bike storage and bike lanes across turning lanes.

Response

Following exhibition of the EIS, receipt of submissions and further consultation with stakeholders, Roads and Maritime has made a number of design refinements associated with pedestrian and cyclist facilities as detailed in Section 5.4.2. The design refinements include:

- At the hospital interchange the project would now provide traffic lights on the southbound off-ramp at the shared path crossing point so pedestrians and cyclists do not need to give way to vehicles

- At the southern interchange where the bypass connects with Lookout Road a traffic light controlled (one way only from west to east) cyclist crossing would now be provided across Lookout Road to enable southbound on-road cyclists on the bypass to access the road shoulder of Lookout Road to remain on-road or access the proposed shared path on the eastern side of Lookout Road
- At the southern interchange the project would now provide a new northbound cycleway connection (one way only). This design refinement eliminates potential conflict between northbound cyclists and traffic exiting the bypass on the Lookout Road flyover
- On the northern side of McCaffrey Drive the proposed footpath would now be replaced with a three metre wide shared path for use by both pedestrians and cyclists.

Arrangements for on-road cyclists at the northern interchange would be finalised during detailed design in accordance with *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005) and in consultation with Newcastle City Council.

3.8.2 Jesmond Park shared path

Submission numbers

122, 179

Issue description

In summary, the respondents raised the following issues:

- A better solution for the Jesmond Park shared path is required so pedestrians and cyclists don't need to cross the northern interchange via traffic lights
- The need for pedestrians and cyclists to cross the northern interchange via traffic lights will result in delays for motorists, pedestrians and cyclists and encourage risk-taking behaviour. Investigation of an alternative option is required
- Requested clarification regarding what provisions will be made for users of the Jesmond Park shared path during construction.

Response

During and following exhibition of the EIS, receipt of submissions and further consultation with Hunter Cycling Forum, Roads and Maritime has refined the design for the Jesmond Park shared path to provide a grade separated crossing for both pedestrians and cyclists as discussed in Section 5.4.2. The project would now provide an overpass bridge (Bridge 8) and underpass arrangement so pedestrians and cyclists do not need to cross the project via traffic lights. Crossing points would still be provided at the traffic lights as described in the EIS.

During construction, the existing Jesmond Park shared path would be closed within the construction footprint. Access for pedestrians and cyclists would be available via the new shared path bridge (Bridge 7) over Newcastle Road near Steel Street (which would be constructed as early work), Coles Street and the existing shared path bridge over the Jesmond to Shortland section of the Newcastle Inner City Bypass. Access for on-road cyclists would also be available through the northern interchange during construction.

It is also proposed to provide pedestrian and cyclist access across the construction footprint on the southern side of Newcastle Road for limited periods of time where safe and practical to do so. However, for safety reasons this access would not be available for extended periods as it would be located beneath bridge construction activities and would conflict with proposed construction traffic access to the site.

The proposed new overpass bridge (Bridge 8) and underpass arrangement for the Jesmond Park shared path (Section 5.4.2) would be constructed and open for use as soon as practicable. However, for safety reasons this can't occur until major construction activities, including compound operations, in the immediate area are completed.

3.8.3 Parallel cycleway

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- Newcastle City Council requested provision of physically separated bike lanes along the length of the bypass to encourage access to both the John Hunter Hospital precinct and University of Newcastle via active transport. The proposed use of road shoulders is not consistent with the key objective of the *Newcastle Cycling Strategy and Action Plan* (The City of Newcastle 2012) to make cycling a safe and attractive option.

Response

The project includes provision for pedestrians and cyclists as discussed in Section 5.3.14 of the EIS and Chapter 5.4.2 of this report. This includes new and upgraded facilities which would link with existing facilities and provide for north-south movements between Lookout Road and the existing Jesmond to Shortland section of the Newcastle Inner City Bypass as follows:

- Lookout Road (eastern side) – new shared path from the Blackbutt Reserve car park opposite Grandview Road to Ridgeway Road, linking via traffic light controlled crossings to the main entrance of the John Hunter Hospital precinct (Kookaburra Circuit)
- John Hunter Hospital precinct (Kookaburra Circuit) – existing on-road cyclist provisions connect to the existing shared path that links the John Hunter Hospital precinct to the existing east-west Jesmond Park shared path
- Jesmond Park (eastern end) – a new section of shared path between the existing east-west Jesmond Park shared path and the new shared path bridge over Newcastle Road (Bridge 7)
- Newcastle Road (east of the northern interchange) – new shared path bridge (Bridge 7) over Newcastle Road to the west of Steel Street replacing the existing mid-block traffic controlled pedestrian crossing on Newcastle Road, near Hill Street. The shared path bridge would be linked to the existing off-road facilities on either side of Newcastle Road
- Coles Street – a new section of on-road cycleway and a new pedestrian footpath would be constructed along Coles Street (northern side). This would connect the new shared path bridge over Newcastle Road (Bridge 7) with the existing shared path on the eastern side of the Jesmond to Shortland section of the Newcastle Inner City Bypass which runs to The University of Newcastle. It also connect with the existing east-west shared path bridge over the Jesmond to Shortland section of the Newcastle Inner City Bypass, linking to Stockland Jesmond Shopping Centre.

In addition the project provides:

- Northern interchange – the existing east-west Jesmond Park shared path would now be grade separated via an overpass bridge (Bridge 8) and underpass arrangement (Section 5.4.2) linking with the existing shared path near the northern end of Victory Parade. This will provide access to the Newcastle Road and Blue Gum Road intersection via Illoura Street. Crossing points would still be provided at the traffic lights as described in the EIS.

Cyclists would also be able to use the road shoulder of the bypass for north-south movements. At the southern interchange a new northbound cycleway connection (one way only) would be provided for northbound on-road cyclists between Lookout Road and the bypass (Section 5.4.2). For southbound cyclists, a traffic light controlled (one way only from west to east) cyclist crossing would now be provided across Lookout Road to enable on-road cyclists to access the road shoulder of Lookout Road to remain on-road or access the proposed shared path on the eastern side of Lookout Road.

A separated shared path, similar to the one provided along the M7 Motorway in Sydney, is beyond the scope of the project and was not considered necessary:

- Due to the combination of new and existing facilities which provide for north-south movements as described above
- It would require additional clearing of native vegetation in the bushland area, including if it were located immediately adjacent to the bypass.

3.8.4 Shared path bridge (Newcastle Road)

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- Newcastle City Council supports the provision of a new shared path bridge over Newcastle Road. However, council would prefer it be located further west to avoid conflicts with high activity areas of the park and to facilitate more direct connections. It is requested consultation occurs regarding coordination of this part of the project with council's work program as soon as practicable.

Response

Roads and Maritime has continued consultation with Newcastle City Council following exhibition of the EIS which has included discussions on the location of the shared path bridge (Bridge 7) over Newcastle Road. This included an alternative bridge location proposed by council immediately east of the proposed traffic light controlled intersection on Newcastle Road at the northern interchange. Issues with locating the shared path bridge at the alternative location include:

- It would require an increased bridge span over Newcastle Road
- There is limited available space on the northern side of Newcastle Road between the edge of road and property boundary to accommodate the shared path bridge and associated connections
- It would require increased span over areas subject to flooding within Jesmond Park
- Due to the level differences between Newcastle Road and the shared path it would require a substantially longer connection ramp from the shared path bridge to shared path at ground level
- A shared path bridge at this location would not service bus patrons crossing Newcastle Road. The existing uncontrolled pedestrian refuge crossing of Newcastle Road at Steel Street would need to remain for pedestrians and cyclists seeking to cross at this location.

It was also noted the proposed traffic light controlled intersection on the eastern side of the northern interchange would provide a controlled crossing of Newcastle Road for pedestrians and cyclists. This would provide connectivity to shared path facilities north and south of Newcastle Road.

It was subsequently agreed with council the location of the shared path bridge (Bridge 7) over Newcastle Road would remain at Steel Street as proposed in the EIS. The location best accommodates the shared path bridge and connecting ramps to nearby shared path networks. The bridge would also provide a grade separated crossing of Newcastle Road for bus patrons using the existing bus stops on Newcastle Road at this location.

Discussion with council also included the connections either side of the shared path bridge over Newcastle Road. As a result design refinements have been made improve connectivity with existing shared paths and reduce impact on Jesmond Park as discussed in Section 5.4.2.

Roads and Maritime will continue to consult with council including during the detailed design of the shared path bridge.

3.9 Noise and vibration

3.9.1 Assessment

Submission numbers

178

Issue description

In summary, the respondent raised the following issues:

- The EPA is satisfied the noise assessment satisfied the SEARs for the project.

Response

Noted.

Potential noise and vibration impacts were assessed in Chapter 9 of the EIS and the noise and vibration assessment (GHD 2016b, Appendix G of the EIS). Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

3.9.2 Operational noise and vibration

Submission numbers

122

Issue description

In summary, the respondent raised the following issues:

- Residents immediately to the south-west and north-east of the northern interchange will be impacted by road traffic noise and appropriate noise mitigation is required.

Response

Potential noise and vibration impacts were assessed in Chapter 9 of the EIS and the noise and vibration assessment (GHD 2016b, Appendix G of the EIS). Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment are provided in Section 6.4 and Appendix D.

Consistent with the EIS, the updated assessment has identified sensitive receivers near the northern interchange would experience operational noise levels above the relevant criteria. As such, these receivers qualify for consideration for mitigation. The preliminary mitigation scenario, which will be re-evaluated during detailed design, includes noise barriers for receivers to the west/south-west of the interchange and at-property treatments for receivers located to the north-east of the interchange to mitigate road traffic noise.

3.10 Land use and property

3.10.1 Land use

Submission numbers

174, 179

Issue description

In summary, the respondents raised the following issues:

- NSW Department of Industry – Geological Survey of NSW noted the EIS correctly identified there are no current coal, petroleum or mineral titles over the project site
- NSW Department of Industry – Geological Survey of NSW identified no concerns with the project
- Newcastle City Council requested environmental studies, particularly biodiversity, should be extended to encompass all surrounding lands up to existing urban areas to assist with possible land rezoning
- Newcastle City Council requested Roads and Maritime advise when the proposed road corridor is finalised to enable the *Newcastle Local Environmental Plan 2012* to be updated and noted this process can take up to 12 months to complete.

Response

The comments from NSW Department of Industry - Geological Survey of NSW are noted.

The EIS has been prepared to assess the project as described in Chapter 5 of the EIS. Specialist studies carried out to inform the EIS were prepared to address the requirements identified in the SEARs and the EP&A Act. The methods used for the specialist studies were developed in consultation with relevant government agencies.

Where relevant, the specialist studies prepared for the EIS included consideration of the existing conditions surrounding the project in order to properly assess potential impacts associated with the project. The biodiversity assessment assessed areas beyond the construction footprint of the project. Roads and Maritime is willing to share all relevant information gathered during preparation of the EIS or earlier stages of the project with Newcastle City Council to assist with possible land rezoning.

Due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road (Section 5.4.2), there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road. The project will be further refined during detailed design, and this could result in additional refinement of the proposed road corridor. Roads and Maritime will continue to liaise with Newcastle City Council so any amendments to the *Newcastle Local Environmental Plan 2012* can start when the road corridor is finalised.

3.10.2 Property

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- The proposed use of Jesmond Park for the purposes detailed in the EIS is not supported for the following reasons and the works proposed in Jesmond Park are to be contained within the road corridor footprint:
  - Unnecessary disturbance to park access and amenity
  - Creation of significant disturbance within/too close to council's recreational facilities
  - Reduces the community's access to recreational facilities
  - Reduces the vegetation cover present, which includes habitat trees council has invested significant money in maintaining over recent years.

Response

Due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road (Section 5.4.2), there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road. Updated property impact information is provided in Section 5.5.5.

This would involve property acquisition and transfer of ownership. Most of the land which would be impacted by the project is designated as a road corridor for the project and is either already owned by Roads and Maritime, or by other government agencies. A number of other properties have also been acquired by Roads and Maritime during planning for the project. Most of the land required for the northern interchange is already owned by Roads and Maritime and forms part of an existing designated road corridor, either for the project or for Newcastle Road. This includes the open space areas with scattered mature trees generally to the south of the existing Jesmond roundabout which currently provides a continuation of the open space contained in Jesmond Park (owned by Newcastle City Council). The project would require acquisition of about 0.3 hectares (3.6 per cent of the affected lot) of Jesmond Park. This impacted area is partially zoned as SP2 Infrastructure (Classified Road) for the project, with the balance zoned RE1 Public Recreation.

While most of the open space area near Jesmond Park impacted by the project is part of the proposed road corridor, the project would result in loss of about 1.5 hectares of open space resulting in a change in land use. Subject to detailed design, the land not directly impacted by the new road infrastructure, could potentially remain as open space following construction of the project.

The extent of property acquisition would be confirmed during detailed design. Land acquisition will be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime 2014b) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

The area required to construct the project is discussed in Section 5.4.5 of the EIS. Due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road and grade separation of the Jesmond Park shared path (Section 5.4.2), there has been some slight adjustments to the construction footprint (Section 5.5.8). Updated construction lease area information is provided in Section 5.5.9.

Due to substantial constraints such as access from major roads, surrounding residential areas and extensive vegetated areas, a construction compound (construction compound B) is required to be located in the western end of Jesmond Park. In the EIS, two other compound areas (construction compounds A and C) have been identified and are located in areas which have been previously disturbed. Following exhibition of the EIS and further review of constructability issues for the project, three additional construction compounds are now proposed. Of the additional compounds, construction compound D would also be partially located in Jesmond Park. Refer to Section 5.4.4 for further information. Without construction compounds B and D there would be insufficient space to construct the project and either off-site areas would be required resulting in increased construction traffic movements or additional native vegetation in the bushland area surrounding the project would need to be cleared.

Construction compounds B and D would require leasing of about 1.2 hectares (about 15 per cent of the affected lot) of Jesmond Park from Newcastle City Council (Section 5.5.8). Construction compound B would be required for the duration of construction. Construction compound D is only required for the early work phase associated with construction of the shared path bridge (Bridge 7) over Newcastle Road and associated shared path connections. These areas would be reinstated for recreational use following the completion of construction activities at each location.

As stated in Section 7.5 of the EIS, clearing of native vegetation and mature trees, particularly hollow-bearing trees, will be avoided and minimised where possible in Jesmond Park. It is not proposed to clear any mature native vegetation (including habitat trees) within the lease area for construction compound D. Roads and Maritime would continue to consult with Newcastle City Council to consider management measures required to minimise potential impacts to the area.

3.11 Flooding and drainage

3.11.1 Flooding

Submission numbers

177, 179

Issue description

In summary, the respondents raised the following issues:

- OEH has reviewed the flooding component of the EIS and is satisfied the project will have no significant impact on flooding near the project
- Newcastle City Council noted there are flood impacts to private properties on Robert Street. It is recommended mitigation of these impacts is required during the detailed design phase
- Newcastle City Council commented the construction of a 0.8 metre bund to alleviate flooding at the northern interchange is a feasible approach to improve the flood immunity of Newcastle Road. Council is interested in working with Roads and Maritime to identify what additional benefit could be achieved by increasing the volume of detention in Jesmond Park to reduce existing flood risks immediately downstream of the northern interchange.

Response

The comment from OEH is noted.

Potential flooding impacts are assessed in Chapter 12 of the EIS and the flooding and drainage assessment (Aurecon 2016b, Appendix J of the EIS). Following exhibition of the EIS and receipt of submissions, additional flood modelling has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the supplementary flooding and drainage assessment are provided in Section 6.7 and Appendix F.

As discussed in Section 5.5.2 the design includes flood mitigation works at the northern interchange, including specific works to the north-east of the northern interchange.

Consistent with the EIS, the updated assessment identified there would be a minor increase (up to 0.02 metres in the 5 year ARI event (decreased from 0.04 metres in the EIS)) in existing flooding of the garden area of a block of residential units to the north-east of the northern interchange. For all other modelled events there would be a decrease in flood levels to the north-east of the northern interchange. The flood model would be further refined during detailed design.

Roads and Maritime is willing to consult with Newcastle City Council during detailed design to determine if the project can provide further improvements to flood conditions immediately downstream of the northern interchange, provided the changes do not result in significant impacts to the environment, assets or property and any additional costs are borne by Newcastle City Council.

3.11.2 Drainage

Submission numbers

179

Issue description

In summary, the respondents raised the following issues:

- Department of Primary Industries noted Roads and Maritime should provide further detail regarding the reshaping of watercourse 2 and the cross-drainage culverts proposed for watercourses 3 and 4 during detailed design.

Response

As stated in Section 12.4 of the EIS, further refinement of the design for the realignment of watercourse 2 will be investigated during detailed design to ensure it is designed to behave in a similar hydrologic and geomorphic manner as existing conditions as far as is practicable.

As stated in Section 13.6 of the EIS, for watercourses 3 and 4, stabilised flow paths, including scour protection measures, to convey the cross drainage outlet flows to existing drainage lines on the western side of the project will be provided during detailed design.

3.12 Water quality

Submission numbers

178, 179, 180

Issue description

In summary, the respondents raised the following issues:

- EPA recommended the construction sediment basins should be designed to capture the 85th percentile five-day storm event, consistent with the practices and principles in *Managing Urban Stormwater, Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008) for sites with sensitive receiving environments
- Roads and Maritime should carry out all relevant work in accordance with DPI Water's *Guidelines for Controlled Activities on Waterfront Land*
- The EPA noted the project would result in increased stormwater discharges and considered the EIS did not adequately consider the potential impacts with reference to NSW Government policy
- Newcastle City Council raised concerns that changes to instream flows would accelerate existing erosional processes within the surrounding ephemeral watercourses. This would result in increased downstream sedimentation and increased risks to the environment and property
- Department of Primary Industries noted the EIS indicated the potential for upstream migration of an existing gully head located downstream of Bridge 4 over watercourse 2. Roads and Maritime should give further consideration of the need to stabilise this site to mitigate future risk to road infrastructure and ongoing sedimentation in the watercourse
- Newcastle City Council notes no water quality and quantity targets are identified in the EIS. It is recommended the requirements of Section 7.06 – Stormwater of the *Newcastle Development Control Plan 2012* be observed to manage stormwater
- Newcastle City Council notes there are some locations where no operational water quality controls are proposed and considers the EIS does not demonstrate there will be no adverse impact to watercourses in accordance with the stream erosion index of the *Newcastle Development Control Plan 2012*.

Response

During construction, erosion and sediment controls would include sedimentation basins and associated dirty water catch drains and management of off-site stormwater through and/or around the site via clean water diversion drains. These would be planned, designed and constructed in accordance with the *Managing Urban Stormwater, Soils and Construction, Volume 1 4th Edition, March 2004* (Landcom 2004) and *Managing Urban Stormwater, Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008).

In the EIS design, during construction, about 16 sedimentation basins would be installed to capture sediment laden runoff from construction areas (Section 13.5.1 and Figure 5-18 of the EIS). Due to design refinements described in Chapter 5, during construction there will be still be about 16 sedimentation basins but some would be in new locations (Section 5.5.11 and Figure 5-8) to capture sediment laden runoff from construction areas.

The project is located in a sensitive urban bushland area, including an endangered ecological community and habitat for threatened species, and as such is a constrained site. The sedimentation basins have been designed to capture the 80th percentile five-day storm event in order to minimise further clearing of the surrounding native vegetation. This is consistent with the requirements of the *Managing Urban Stormwater, Soils and Construction, Volume 1 4th Edition, March 2004* (Landcom 2004) and *Managing Urban Stormwater, Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008) which recognise constrained sites. The location and size of sedimentation basins would be further refined during detailed design in consultation with EPA as part of the environment protection licence application process.

As stated in Section 7.5 of the EIS, work near to natural watercourses will be carried out in accordance with Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 10: Aquatic habitats and riparian zones)* (RTA 2011a), standard precautions and mitigation measures of the *Policy and guidelines for fish habitat conservation and management Update 2013* (Department of Primary Industries 2013) and with reference to DPI Water *Guidelines for Controlled Activities on Waterfront Land*.

An assessment of potential changes to watercourse hydraulics is provided in Section 12.3.2 of the EIS and the flooding and drainage assessment (Aurecon 2016b, Appendix J of the EIS). Following exhibition of the EIS and receipt of submissions, additional flooding and drainage assessment (Section 6.7 and Appendix F) has been carried out to address the design refinements (Chapter 5) and to respond to submissions.

The updated results indicate there would be minor increases in peak flows (typically up to 1.2 cubic metres per second), flow velocities (up to 0.09 metres per second) and water levels (up to six centimetres). Conversely, there would be minor decreases in some sub-catchments.

These results are consistent with the EIS and as such, no additional impacts are expected. As discussed in the EIS and updated in this report, the project includes a range of measures to manage stormwater including the roadside drainage system, vegetated swales and operational water quality treatment structures. Scour protection and energy dissipators will be provided where the drainage system discharges to the surrounding ephemeral watercourses. These measures have been developed in accordance with relevant guidelines and are typical treatments commonly applied to ephemeral watercourses.

Consistent with the EIS, all increases (in peak flows, velocities and levels) are relatively minor and are not expected to result in any significant impacts to the downstream ephemeral watercourses in relation to long term bed and bank stability or occurrence of overtopping flows which could result in property or environmental damage. As identified by Roads and Maritime in the EIS, there are existing erosional processes occurring in some of the ephemeral watercourses located in the bushland area. While minor, the predicted increases would likely increase the rate of these existing processes however the geomorphological assessment carried out as part of the EIS identified this would only continue short term until either bedrock is reached or the gully heads reach the project drainage outlets. It is important to note these processes would continue even if the project wasn't constructed.

The proposed control measures are therefore considered to be reasonable and feasible to address the minor impacts as a result of the project.

An assessment of potential operational water quality impacts was provided in Section 13.4.3 of the EIS and the water quality and watercourse assessment (GHD 2016d, Appendix K of the EIS). Following exhibition of the EIS and receipt of submissions, additional water quality and watercourse assessment (Section 6.8 and Appendix G) has been carried out to address the design refinements (Chapter 5) and to respond to submissions.

The EIS assessment was carried out with reference to key guidelines, in particular the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000) and *Significant impacts guidelines 1.1: Matters of National Environmental Significance* (Department of the Environment 2013). The updated assessment has also been carried out in accordance with or in consideration of these guidelines, in addition to the following:

- *NSW Water Quality and River Flow Objectives* (OEH 2006), which define agreed environmental values and long-term goals for NSW's surface waters. The values defined for the Hunter River for protection of aquatic ecosystems have been adopted for the assessment and are consistent with the framework for assessing water quality provided by *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000)
- Newcastle City Council *Development Control Plan 2012* (Newcastle City Council 2012) supplements the *Newcastle Local Environmental Plan 2012* and provides additional information which should be taken into account when preparing a development application. It should be noted the project does not require a development application to be submitted and therefore the requirements of the *Development Control Plan 2012* do not apply. However, the relevant water treatment targets requirements have been considered in the assessment. The stream erosion index has not been considered in the assessment due to the scale of the project and detailed watercourse hydraulic and water quality modelling has been carried out (Sections 6.7 and 6.8).

As discussed in the EIS and updated in this report, the project includes a range of measures to manage stormwater including the roadside drainage system, vegetated swales and operational water quality treatment structures. Scour protection and energy dissipators will be provided where the drainage system discharges to the surrounding ephemeral watercourses. These measures have been developed in accordance with relevant guidelines and are typical treatments commonly applied to ephemeral watercourses.

Consistent with the EIS, with implementation of these controls, there would be a substantial reduction in the pollutants reporting to the surrounding environment. The updated assessment indicates that the project results in water quality reporting to the SEPP 14 and Ramsar wetlands located downstream that is no worse than the existing situation. The proposed control measures are consistent with the surrounding road network and balanced with reducing the scale of the project in the urban bushland setting. Substantial hard engineering structures within the ephemeral watercourses downstream of the project would be required to implement any potential additional controls to achieve higher compliance with guideline values/targets which are typically not met under existing conditions. Additional environmental impacts (eg vegetation clearing and in-stream construction work) are considered to be disproportionate and unnecessary.

3.13 Groundwater

Submission numbers

178

Issue description

In summary, the respondent raised the following issues:

- The EPA considers the EIS adequately assesses groundwater issues.

Response

Noted.

3.14 Aboriginal heritage

Submission numbers

177

Issue description

In summary, the respondent raised the following issues:

- OEH considers the Aboriginal heritage assessment contained within the EIS does not meet the requirements of the SEARs. The assessment concludes the cultural and archaeological significance of the study area is low, however, it does not provide adequate justification for these conclusions either by way of archaeological investigation or Aboriginal community consultation.

Response

Potential impacts to Aboriginal heritage were assessed in Chapter 15 of the EIS. The assessment was based on previous investigations carried out for the project which included a site inspection with Awabakal Local Aboriginal Land Council (LALC), consultation with Awabakal LALC carried out during the EIS and an assessment and site inspection conducted in accordance with the Roads and Maritime *Procedure for Aboriginal cultural heritage consultation and investigation* (Roads and Maritime 2011a).

To address the concerns raised by OEH, Roads and Maritime has carried out additional consultation and investigations as detailed in Section 6.10 and Appendix H. The additional investigations identified two artefact scatters and two isolated artefacts within the construction footprint. In consultation with the Aboriginal community these will be subject to archaeological collection and/or salvage before the start of construction in the affected area.

3.15 Hazards and risk

3.15.1 Mine subsidence

Submission numbers

174

Issue description

In summary, the respondent raised the following issues:

- NSW Department of Industry - Geological Survey of NSW noted the EIS correctly identified a portion of the project is located within the Newcastle Mine Subsidence District and appropriate consultation was being carried out.

Response

Noted.

Following exhibition of the EIS, the NSW Government has made changes to the management arrangements for the legislation governing mine subsidence in NSW. Mine subsidence is now legislated under the *Coal Mine Subsidence Compensation Act 2017* (formerly the *Mine Subsidence Compensation Act 1961*) and is administered by Subsidence Advisory NSW (formerly the Mine Subsidence Board).

As discussed in Chapter 19 of the EIS, Roads and Maritime has considered the risk of mine subsidence in the design of the project and has consulted with the Mine Subsidence Board. During detailed design, further consultation will be carried out with Subsidence Advisory NSW in order to obtain the required approvals under the *Coal Mine Subsidence Compensation Act 2017*.

3.15.2 Public health

Submission numbers

176

Issue description

In summary, the respondent raised the following issues:

- Hunter New England Population Health noted the assessment and commitments contained in the EIS in relation to the management of air quality, noise, soil, and water issues which may have an impact on human health appeared to be consistent with existing requirements to mitigate the impacts which may arise from these public health issues.

Response

Noted.

3.16 Out of scope

Submission numbers

179

Issue description

In summary, the respondent raised the following issues:

- Appropriate investigations should be carried out to alleviate congestion within the John Hunter Hospital precinct and provide traffic and shared path connection to the hospital interchange
- The EIS does not indicate a connection from the existing Jesmond Park shared path to the proposed shared path on Lookout Road, or the proposed shared path at the hospital interchange. It recommended shared path connections are addressed in master planning of the John Hunter Hospital precinct.

Response

As stated in Section 5.3.5 of the EIS, Roads and Maritime are providing an interchange and connection road to the west of the John Hunter Hospital precinct. NSW Health Infrastructure would carry out any required road work in the hospital's internal road system to accommodate traffic movements to and from the interchange.

The provision of pedestrian and cyclist connections between Lookout Road and Jesmond Park, including those within the John Hunter Hospital precinct are the responsibility of NSW Health Infrastructure and Newcastle City Council. These works are beyond the scope of the project.

4 Response to community submissions

4.1 Respondents

A total of 172 community members including individuals, interest groups/organisations and businesses made a submission. Table 4-1 provides a list of these submissions, submission number and where the Roads and Maritime Services response is provided in this report.

Table 4-1 List of respondents – community

Respondent	Submission No.	Section number where issues are addressed
Individual	1	4.3.3
Individual	2	4.3.2
Individual	3	4.8.2
Individual	4	4.8.5
Individual	5	4.3.3, 4.8.2
Individual	6	4.7.4, 4.9.3, 4.10.2
Individual	7	4.8.4
Individual	8	4.8.4
Individual	9	4.3.3, 4.7.1, 4.17
Individual	10	4.3.2, 4.3.3, 4.4.3
Individual	11	4.8.4
Individual	12	4.8.4, 4.8.6
Individual	13	4.8.4
Individual	14	4.3.1, 4.3.4, 4.4.3, 4.5, 4.6.3, 4.7.1, 4.8.4, 4.9.2, 4.9.3, 4.10.2, 4.11.1, 4.11.2, 4.15.1
Individual	15	4.3.3, 4.8.2
Individual	16	4.3.2, 4.7.3
Individual	17	4.5
Individual	18	4.8.4
Individual	19	4.3.2, 4.3.3, 4.3.4, 4.3.5, 4.8.6, 4.17
Individual	20	4.8.4
Individual	21	4.8.4
Individual	22	4.3.2, 4.8.5

Respondent	Submission No.	Section number where issues are addressed
Interest group/organisation: Brandy Hill & Seaham Action (Committee)	23	4.4.6
Individual	24	4.8.4
Individual	25	4.8.4
Individual	26	4.8.4
Individual	27	4.8.4
Individual	28	4.8.4
Individual	29	4.8.4
Individual	30	4.8.1, 4.8.4, 4.8.6
Individual	31	4.8.4, 4.8.6
Individual	32	4.3.4, 4.6.3, 4.9.3, 4.10.2, 4.11.2
Individual	33	4.8.4
Individual	34	4.8.4
Individual	35	4.8.4
Individual	36	4.8.4
Individual	37	4.8.4
Individual	38	4.8.4
Individual	39	4.8.4
Individual	40	4.3.3, 4.9.3
Individual	41	4.8.4
Individual	42	4.3.3, 4.7.1
Individual	43	4.8.4
Individual	44	4.3.4, 4.4.3, 4.5, 4.6.3, 4.7.6, 4.8.1, 4.9.2, 4.9.3, 4.11.2, 4.17
Individual	45	4.8.4
Individual	46	4.5, 4.7.2, 4.8.4, 4.8.5
Individual	47	4.8.4
Individual	48	4.8.4

Respondent	Submission No.	Section number where issues are addressed
Individual	49	4.8.4
Individual	50	4.8.4
Individual	51	4.8.4
Individual	52	4.8.4
Individual	53	4.4.7, 4.5, 4.8.4, 4.9.3, 4.10.2
Individual	54	4.8.4
Individual	55	4.8.4
Individual	56	4.8.4
Individual	57	4.8.4
Individual	58	4.8.4
Individual	59	4.3.1, 4.8.4
Individual	60	4.8.4, 4.8.6
Individual	61	4.8.4
Individual	62	4.3.2, 4.7.7
Individual	63	4.8.4
Individual	64	4.3.2, 4.3.3, 4.7.3
Individual	65	4.8.4, 4.9.3, 4.15.2
Individual	66	4.9.3
Individual	67	4.8.3, 4.8.4, 4.8.6
Individual	68	4.3.2
Individual	69	4.8.4
Individual	70	4.8.1, 4.8.4
Individual	71	4.8.4
Individual	72	4.8.4
Individual	73	4.8.4
Individual	74	4.8.4
Individual	75	4.3.4, 4.5, 4.8.4, 4.9.2, 4.9.3, 4.11.2
Individual	76	4.8.4
Individual	77	4.8.4

Respondent	Submission No.	Section number where issues are addressed
Individual	78	4.7.2, 4.8.4, 4.8.5
Interest group/organisation: Newcastle University Bike User Group	79	4.8.1, 4.8.4, 4.8.5, 4.8.6
Individual	80	4.8.1, 4.8.4
Interest group/organisation: Forest Fauna Surveys Pty Ltd	81	4.5, 4.6.1
Individual	82	4.2, 4.3.2, 4.7.1, 4.7.2, 4.7.3, 4.13
Individual	83	4.8.4
Individual	84	4.8.4, 4.8.5
Individual	85	4.4.3, 4.7.2, 4.8.4
Individual	86	4.8.4
Individual	87	4.4.6
Individual	88	4.4.6
Interest group/organisation: Paterson Progress Association Company	89	4.4.6
Individual	90	4.4.6
Individual	91	4.4.6
Individual	92	4.4.6
Individual	93	4.4.6
Individual	94	4.4.6
Individual	95	4.8.4
Individual	96	4.8.4
Individual	97	4.8.4, 4.8.5
Individual	98	4.8.4
Individual	99	4.3.1, 4.3.3, 4.8.4
Individual	100	4.8.4
Individual	101	4.8.4

Respondent	Submission No.	Section number where issues are addressed
Individual	102	4.8.4
Individual	103	4.4.6
Individual	104	4.4.6
Individual	105	4.8.4
Individual	106	4.3.2, 4.3.3, 4.5, 4.7.3
Individual	107	4.8.4, 4.8.6
Individual	108	4.8.4
Individual	109	4.3.3, 4.9.3
Individual	110	4.8.1, 4.8.4, 4.8.6
Individual	111	4.8.4
Individual	112	4.8.4
Individual	113	4.4.6
Individual	114	4.8.4, 4.8.5
Individual	115	4.8.4
Individual	116	4.8.4
Individual	117	4.8.4
Individual	118	4.8.4
Individual	119	4.8.4
Individual	120	4.7.2
Individual	121	4.4.6
Individual	123	4.4.6
Individual	124	4.8.4
Individual	125	4.4.6
Individual	126	4.4.6
Individual	127	4.3.5, 4.4.2, 4.5, 4.11.2
Individual	128	4.3.5, 4.4.2, 4.7.5, 4.9.3, 4.10.2
Individual	129	4.3.1, 4.6.2, 4.8.2, 4.8.4
Interest group/organisation: Bicycle NSW	130	4.8.1, 4.8.3, 4.8.4, 4.8.5

Respondent	Submission No.	Section number where issues are addressed
Individual	131	4.8.4
Individual	132	4.8.4
Individual	133	4.8.4
Individual	134	4.4.6
Interest group/organisation: Newcastle Cycleways Movement Inc.	135	4.8.1, 4.8.3, 4.8.4, 4.8.5, 4.8.6
Business: Paterson Service Station	136	4.4.6
Individual	137	4.8.1, 4.8.4, 4.8.5
Individual	138	4.3.2, 4.4.1, 4.7.1, 4.7.6, 4.17
Individual	139	4.4.2, 4.4.4, 4.7.4, 4.7.5, 4.7.7, 4.9.1, 4.9.2, 4.9.3, 4.10.1, 4.10.2, 4.11.1, 4.11.2, 4.12, 4.15.1
Individual	140	4.8.4
Individual	141	4.8.4
Individual	142	4.4.6
Interest group/organisation: Transition Newcastle	143	4.8.4, 4.8.6
Individual	144	4.8.4
Individual	145	4.4.6
Individual	146	4.4.6
Individual	147	4.8.4, 4.8.6
Interest group/organisation: Hunter CycleSafe Network Inc.	148	4.8.1, 4.8.4
Individual	149	4.3.1, 4.3.2, 4.4.5, 4.5, 4.6.3, 4.8.1, 4.8.2, 4.8.4, 4.9.2, 4.9.3, 4.10.1, 4.10.2, 4.14, 4.15.1, 4.15.2, 4.16
Individual	150	4.8.1, 4.8.4, 4.8.5
Individual	151	4.3.2, 4.3.3
Individual	152	4.8.4

Respondent	Submission No.	Section number where issues are addressed
Individual	153	4.3.3
Individual	154	4.8.2, 4.8.4
Individual	155	4.3.3
Individual	156	4.8.2, 4.8.4
Individual	157	4.3.3, 4.5
Individual	158	4.2, 4.3.4, 4.5, 4.6.3, 4.8.4, 4.9.2, 4.9.3, 4.10.2, 4.15.2
Individual	159	4.3.3, 4.3.4, 4.3.5
Individual	160	4.6.3, 4.8.4, 4.8.6
Individual	161	4.8.4, 4.8.6
Individual	162	4.8.4, 4.8.6
Individual	163	4.8.4, 4.8.6
Individual	164	4.8.4, 4.8.6
Individual	165	4.8.4, 4.8.6
Individual	166	4.8.4, 4.8.6
Individual	167	4.8.4, 4.8.6
Individual	168	4.8.4, 4.8.6
Individual	169	4.8.4, 4.8.6
Individual	170	4.8.4, 4.8.6
Individual	171	4.8.4, 4.8.6
Individual	172	4.8.4, 4.8.6
Individual	173	4.10.2

4.2 Project need

Submission numbers

82, 158

Issue description

In summary, the respondents raised the following issues:

- Economic analysis of the project is based on comparison with Sydney projects
- The proposed northbound off-ramp at the northern interchange will not be cost effective.

Response

Section 3.3 of the EIS presents an economic appraisal of the project. The economic appraisal was prepared in accordance with the Transport for NSW *Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives* (Transport for NSW 2013). The appraisal was prepared to determine the benefits which would occur for the project relative to the do minimum (without project) scenario to ensure the project provides value for money for the NSW Government.

The economic appraisal is based on the specific costs and benefits of the project and does not include comparison with other projects.

An assessment of options for the northern interchange is provided in Chapter 4 of the EIS. Section 4.5.2 of the EIS identifies northern option 6 was the preferred option as it maximises the future functionality of the interchange and provided the best value for money with substantial benefits for traffic flow on both the bypass and Newcastle Road. The preferred option, as detailed in Section 5.3.5 of the EIS, includes a traffic light controlled intersection to provide for all traffic movements at the interchange. Further discussion regarding the arrangement of the northbound off-ramp at the northern interchange is provided in Section 4.3.1.

4.3 Project development and alternatives

4.3.1 Alignment

Submission numbers

14, 59, 99, 129, 149

Issue description

In summary, the respondents raised the following issues:

- The project should include greater use of bridges to minimise environmental impacts
- Commented the revised alignment provides a larger buffer to residential areas to the west
- The project is both more environmentally destructive and expensive than the 2007 design
- Commented the project alignment does not reduce potential noise and visual impacts to residential areas due to the closeness of the northbound off-ramp at the northern interchange to residences in Birchgrove Drive.

Response

Chapter 4 of the EIS describes the various alternatives to the project considered as part of the project development process and explains how and why the project was selected as the preferred option. Further information on the benefits of the preferred alignment option is provided below.

As part of the development of alignment options for consideration in the selection process greater provision of bridges was considered. However, due to constructability issues associated with the steep topography and historical mine workings, even with the provision of more bridges the existing vegetation below the bridges would still need to be cleared to permit construction activities. Following construction, while landscaping would be carried out no large trees could be included to ensure they did not impact the bridge structure. This combined with the substantial increase in costs with greater provision of bridges, meant it was determined that it did not represent value for money.

As described in Section 4.4.5 of the EIS, Roads and Maritime held a value management workshop on 1 April 2015 to assess the alignment options. Attendees included representatives from Newcastle City Council, Lake Macquarie City Council, NSW Health Infrastructure and Hunter New England Local Health District.

The purpose of the workshop was to review the two alignment options based on which best met the project objectives and provided an overall balance across social, environmental, economic and engineering issues. The outcome of the workshop was to recommend a preferred alignment option to progress for further design and refinement.

The alignment workshop used a multi criteria analysis process to identify key issues and assessment criteria to be used to assess each alignment option (alignment option 1 (2007 design) and alignment option 2). Issues which did not help to differentiate between alignment options were not included. As the cost of the two alignment options were considered to be of the same magnitude, cost was not considered in the assessment criteria.

The alignment selection process (Section 4.4.5 of the EIS) included consideration of potential impacts to biodiversity, community and landscape/visual.

Alignment option 2 was selected as the preferred option for the following key reasons:

- Would result in fewer impacts to threatened flora and fauna species and less fragmentation of bushland areas
- Is 200 metres shorter than alignment option 1
- Is further away from a large number of sensitive receivers located to the west of the project
- Has a higher design speed of 100 kilometres per hour (compared to 90 kilometres per hour) which provides a higher standard road environment
- Less potential visual impacts on surrounding receivers with a larger bushland buffer maintained between the main project alignment and the residential areas to the west of the project
- Has a lower maximum grade of 8.5 per cent (compared to 10 per cent)
- Is considered to be a better fit with the existing landform
- Comprises easier terrain for construction.

Alignment option 2 was therefore recommended as the preferred alignment option to progress forward due its strong environmental, community and technical advantages. Roads and Maritime acknowledges while the overall project alignment is further away from many sensitive receivers, the northbound off-ramp at the northern interchange is located near sensitive receivers in Birchgrove Drive.

The northbound off-ramp has been designed in accordance with the design criteria and standards detailed in Section 5.2 of the EIS. The northbound off-ramp needs to have a curved alignment in order to meet road design criteria for vehicle speeds, minimum stopping sight distances for drivers and curve radius size. Due to these design constraints there is limited scope for moving the northbound off-ramp further away from Birchgrove Drive. During detailed design the northern interchange layout will be reviewed including opportunities to refine the layout of the northbound off-ramp further away from residential properties.

Potential operational noise impacts were assessed in Section 9.4.2 of the EIS and are further discussed in Section 4.9. Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment are provided in Section 6.4 and Appendix D. As part of the preliminary operational noise mitigation scenario, noise barriers are proposed on the northbound off-ramp and main bypass at the northern interchange to manage operational noise impacts on nearby residential areas including sensitive receivers in Birchgrove Drive.

Potential visual impacts for residents near to the northbound off-ramp were assessed in Chapter 10 of the EIS and further discussion in response to submissions is provided in Section 4.10 of this report.

4.3.2 Hospital interchange

Submission numbers

2, 10, 16, 19, 22, 62, 64, 68, 82, 106, 138, 149, 151

Issue description

In summary, the respondents raised the following issues:

- A full interchange should be provided at the John Hunter Hospital due to traffic congestion on Lookout Road and Croudace Street and to improve access for emergency vehicles
- Not providing a full interchange will increase congestion on Lookout Road at the main John Hunter Hospital precinct access (Kookaburra Circuit)
- Support the half interchange at the hospital.

Response

Following exhibition of the EIS, receipt of submissions and further consultation with NSW Health Infrastructure and Hunter New England Local Health District, Roads and Maritime has refined the design for the hospital interchange adding south-facing ramps resulting in a full interchange. NSW Health has committed to providing $13 million to cover the additional costs associated with the design, environmental assessment and construction of the south-facing ramps. The full interchange would provide access to/from the north and south for use by all hospital users including public, staff and emergency services (Section 5.4.1). Additional assessments have been carried out for the full interchange (Chapter 6). Full access to the hospital would still be available to/from Lookout Road at the main entrance (Kookaburra Circuit).

The hospital interchange would enable the John Hunter Hospital precinct to expand its facilities and/or change its internal configuration (eg relocation of facilities and/or parking) to alleviate existing congestion issues within the precinct.

4.3.3 McCaffrey Drive ramps

Submission numbers

1, 5, 9, 10, 15, 19, 40, 42, 64, 99, 106, 109, 151, 153, 155, 157, 159

Issue description

In summary, the respondents raised the following issues:

- The lack of ramps at McCaffrey Drive will not ease traffic congestion on Lookout Road, Croudace Street, McCaffrey Drive and other local roads
- Traffic modelling used to justify not providing ramps at McCaffrey Drive hasn't considered the total traffic which uses other local roads to head northbound
- The lack of ramps at McCaffrey Drive will result in traffic using Kookaburra Circuit (through the John Hunter Hospital precinct) to access the bypass to travel north
- Support the exclusion of McCaffrey Drive ramps
- The lack of ramps at McCaffrey Drive will result in motorists using Grandview Road, which is a residential road and not suitable for dealing with additional traffic
- The addition of ramps at McCaffrey Drive would ease congestion on McCaffrey Drive
- Questioned why traffic counts were not carried out on Douglas Street
- Questioned why Dent Street was not included in the origin-destination surveys
- The traffic models state there would be the same volumes of traffic travelling to/from McCaffrey Drive, which the respondent believed was inaccurate and called into question all traffic modelling for the project
- The predicted increase in use of Grandview Road would result in additional maintenance costs for Lake Macquarie City Council
- The traffic modelling has not considered northbound motorists from McCaffrey Drive would use alternative routes to access the bypass and avoid existing traffic congestion issues
- Roads and Maritime should build only a northbound on-ramp to meet traffic needs which would be cheaper than building both an on-ramp and off-ramp at McCaffrey Drive.

Response

An integral element of the traffic assessment relates to the development of a microsimulation base model representing existing traffic conditions in the two hour morning (7am to 9am) and two hour evening (4pm to 6pm) peak periods. The model was calibrated and validated using 2014/15 traffic survey data with reference to the criteria as outlined in the Roads and Maritime *Traffic Modelling Guidelines, Version 1.0, February 2013* (Section 4.4.1 of the EIS).

Comparison results illustrate the model provides good replication of existing traffic conditions against network calibration criteria and observed journey times. Accordingly the microsimulation base model was assessed as fit for purpose and provided a robust model for:

- Undertaking traffic analysis of design options
- Assessing the construction and operational impacts of the project within the study area.

Assessment of the need for provision of ramps connecting the bypass with McCaffrey Drive is provided in Sections 4.4.6, 4.5.1 and 4.5.3 of the EIS. This assessment determined ramps were not required for the following key reasons:

- Origin-destination surveys in 2014 and 2015 indicate less than one per cent of McCaffrey Drive traffic would use the bypass if the ramps were provided (Section 4.4.6 of the EIS)
- The combination of steep grade of the bypass (8.5 per cent) and undulating topography would make the design and construction of the ramps difficult and costly (Section 4.4.6 of the EIS)
- While the design and construction of the ramps is technically possible, the low forecast usage of the ramps and their high cost to build meant the ramps were not economically viable (Section 4.4.6 of the EIS)
- Additional sensitivity analysis was carried out to assess the need for the McCaffrey Drive ramps if additional traffic used the ramps than was predicted, representing the maximum possible use of the ramps. Based on these traffic volumes, economic analysis concluded the provision of the ramps does not offer value for money (Section 4.5.3 of the EIS).

Traffic modelling was carried out (Section 4.5.3 of the EIS) to assess traffic impacts of the surrounding road network. Key findings included:

- A reduction in traffic is predicted on McCaffrey Drive by 15 per cent from about 20,000 to 17,000 vehicles per day in 2030. This is primarily due to traffic from the north-west portion of the study area (suburbs such as Wallsend, Maryland and Fletcher) being predicted to switch routes to use the new bypass for trips to and from south of McCaffrey Drive
- The bypass is predicted to have a minor increase in traffic on Grandview Road by about seven per cent from 3000 to 3200 vehicles each day in 2030
- Given the predicted low volumes of traffic forecast to use north-facing ramps at McCaffrey Drive, the modelling indicates the omission of north-facing ramps at McCaffrey Drive from the southern interchange would have very small impact to traffic volumes on surrounding local roads including Grandview Road, Elbrook Road and Marshall Street, compared to the bypass with no north-facing ramps.

Traffic analysis and road safety assessment (Section 4.5.3 of the EIS) carried out to investigate the potential impacts on Grandview Road with the project indicated:

- Predicted traffic volumes on Grandview Road with the project (3200 vehicles per day in 2030) are well within the traffic carrying capacity of Grandview Road
- Predicted level of service of the Lookout Road and Grandview Road intersection is level of service A in both the morning and afternoon peaks (2030), which is the highest performance measure for an intersection
- Additional traffic volumes on Grandview Road with the project, predicted at 200 vehicles per day (or 20 vehicles in the peak hour) would not result in any inherent safety risk on Grandview Road or roads which connect with Grandview Road.

Updated traffic modelling has been carried out (Section 6.3 and Appendix C) for the project (including the design refinements (Chapter 5)), which shows the project will carry up to 34,500 vehicles per day in 2030 and result in a corresponding reduction in traffic volumes on the existing route of Lookout Road (up to 38 per cent), Croudace Street (up to 43 per cent) and Newcastle Road (up to 24 per cent). As a result, the project would ease traffic congestion on the existing route and reduce the likelihood of roads such as Douglas Street being used as alternative routes.

With the project, the likelihood for the road network within the John Hunter Hospital precinct being used to provide a route between the bypass and Lookout Road (and in turn McCaffrey Drive) was assessed. The assessment concluded the use of the route would be undesirable due to a number of factors including extra travel distance, existing congestion and a highly constrained road environment within the hospital precinct. Therefore there would be negligible impact on the road network in the John Hunter Hospital precinct, if the McCaffrey Drive ramps were not included in the project (Section 4.5.3 of the EIS).

Traffic survey inputs for the project's traffic assessment including origin-destination survey locations are discussed in Section 8.1 of the EIS. As shown in Figure 8-1 of the EIS, an origin-destination station was based in Dent Street. Section 8.2.2 of the EIS summaries findings from the origin-destination surveys including existing distribution of traffic to/from McCaffrey Drive.

4.3.4 Northern interchange

Submission numbers

14, 19, 32, 44, 75, 158, 159

Issue description

In summary, the respondents raised the following issues:

- Commented the design of the northbound off-ramp at the northern interchange will unnecessarily disrupt traffic flow on Newcastle Road and the design should be modified to exclude the off-ramp and use the University Drive interchange
- Questioned if it would it be possible to move the traffic lights at the northern interchange further to the west so the off-ramp has a straight alignment rather than curving towards residences
- Commented the northbound off-ramp at the northern interchange will impact residences in Birchgrove Drive more than the 2007 strategic design and it should revert to the strategic design
- Commented the proposed northbound off-ramp at the northern interchange would result in impacts to residences in Birchgrove Drive and it should be realigned similar to the consideration provided to residences further to the south
- Commented the northern interchange, including traffic lights, will not assist traffic flow on Newcastle Road
- Objected to the arrangement of the northern interchange due to the closeness of the southbound off-ramp to residences and suggested an alternative arrangement including moving the interchange further to the south-west, relocation of the traffic lights and changed lane arrangements
- Suggested at the northern interchange the bypass should pass beneath Newcastle Road to minimise potential impacts
- Suggested the northern interchange should be modified to include a roundabout beneath the bypass, eliminating the need for traffic lights, making better use of available land, permit drivers to change directions of travel and to improve traffic flow.

Response

An assessment of options for the northern interchange is provided in Chapter 4 of the EIS. Section 4.5.2 of the EIS identifies northern option 6 was the preferred option as it maximises the future functionality of the interchange and provided the best value for money with substantial benefits for traffic flow both on the bypass and Newcastle Road. Options for the northern interchange, reasons for selection of the preferred option and post selection design refinements are discussed in Sections 4.4.4, 4.4.6, 4.4.7 and 4.5 of the EIS.

The preferred option, as detailed in Section 5.3.5 of the EIS includes a traffic light controlled intersection to provide for all traffic movements at the interchange. An assessment of the level of service (Section 6.3 and Appendix C) indicates the northern interchange would have an improved level of service of C (with the project) compared to D (without the project) in 2030 during both peak periods, and therefore, would have improved efficiency of traffic movements.

Updated traffic modelling has been carried out (Section 6.3 and Appendix C) for the project (including the design refinements (Chapter 5)), which shows the project will carry up to 34,500 vehicles per day in 2030 and result in a corresponding reduction in traffic volumes on the existing route of Lookout Road (up to 38 per cent), Croudace Street (up to 43 per cent) and Newcastle Road (up to 24 per cent). As a result, the project would ease traffic congestion on these key roads.

The project needs to provide full connectivity at the northern interchange between the Newcastle Inner City Bypass and Newcastle Road to provide for all traffic movements in the north-south and east-west directions. To provide full connectivity, the project needs to cross over Newcastle Road. The provision of an additional grade separation for east-west traffic on Newcastle Road is beyond the scope of the project and would result in significant additional environmental, property and community impacts and costs. Options for the bypass to pass beneath Newcastle Road are not feasible due to flooding and drainage issues (Chapter 12 of the EIS) and geotechnical conditions which would substantially increase the cost of the project and would not represent value for money.

The existing interchange at University Drive is already subject to high traffic volumes during peak periods and the surrounding roads are not suitable for the numbers of vehicles expected to use the northern interchange.

As discussed in Sections 4.4.4 and 4.4.6 of the EIS, northern option 1, which was the strategic design displayed in 2007 was considered in the options selection process. This option uses the existing four lanes on Newcastle Road and the two lane roundabout, with the addition of on and off-ramps to the south of Newcastle Road. A new four lane bridge is provided over Newcastle Road connecting the new bypass with the existing Newcastle Inner City Bypass. This option was not selected as the preferred option as it did not meet the key functional objectives of the project and had a very poor traffic performance.

Roads and Maritime acknowledges while the overall project alignment is further away from many sensitive receivers, the northbound off-ramp at the northern interchange is located near sensitive receivers in Birchgrove Drive. The northbound off-ramp has been designed in accordance with the design criteria and standards detailed in Section 5.2 of the EIS. The northbound off-ramp needs to have a curved alignment in order to pass under the main project alignment while meeting road design criteria for vehicle speeds, minimum stopping sight distances for drivers and curve radius size. Due to these design constraints there is limited scope for moving the northbound off-ramp further away from Birchgrove Drive. During detailed design the northern interchange layout will be reviewed including opportunities to refine the layout of the northbound off-ramp further away from residential properties.

The southbound off-ramp has been designed in accordance with the design criteria and standards detailed in Section 5.2 of the EIS. The southbound off-ramp needs to have a curved alignment in order to connect with Newcastle Road on the eastern side of the new intersection at the northern interchange. During detailed design, the northern interchange layout will be reviewed to investigate opportunities to move the intersection (including the southbound off-ramp) to the south-west further away from residential properties.

Potential operational noise impacts for residents near to the northbound off-ramp and southbound off-ramp were assessed in Section 9.4.2 of the EIS and are further discussed in Section 4.9. Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment are provided in Section 6.4 and Appendix D.

Consistent with the EIS, the updated assessment has identified sensitive receivers near the northern interchange would experience operational noise levels above the relevant criteria. As such, these receivers qualify for consideration for mitigation. The preliminary mitigation scenario, which will be re-evaluated during detailed design, includes noise barriers for receivers to the west/south-west of the interchange and at-property treatments for receivers located to the north-east of the interchange to mitigate road traffic noise.

Potential visual impacts for residents near to the northern interchange were assessed in Chapter 10 of the EIS and are further discussed in Section 4.10 of this report. Due to the addition of the grade separation of the Jesmond Park shared path (Section 5.4.2), the visual impact assessment for key viewpoints near the northern interchange has been updated (Section 6.5).

4.3.5 Southern interchange

Submission numbers

19, 127, 128, 159

Issue description

In summary, the respondents raised the following issues:

- Commented existing congestion issues on Lookout Road near the southern interchange are due to a combination of traffic volumes, traffic lights and school zone. Suggested the project did not address these issues and should have considered a tunnel
- Suggested the proposed batter to be constructed on private property to the west of Lookout Road is not required and the northbound flyover should be extended
- Stated the project has not considered feasible alternatives to the construction of the batter
- Suggested an alternative option where full access to and from the bypass could be provided at McCaffrey Drive by building a roundabout beneath the bypass and another roundabout at Lookout Road.

Response

As discussed in Section 8.3.2 of the EIS, as part of the Roads and Maritime Inner Newcastle Traffic Study, preliminary investigations were carried out to the south of the Rankin Park to Jesmond connection with Lookout Road (including looking at existing traffic lights and school zones). The primary focus of the study was to inform future road network planning in inner Newcastle. The community was invited to comment on the Inner Newcastle Traffic Study in July and August 2014. The feedback and suggestions received have been considered to prioritise future projects and seek funding. Addressing existing congestion issues to the south of the project is beyond the scope of the project.

A fill embankment batter (Fill 1 in Figure 5-1 of the EIS) is shown on the western side of Lookout Road associated with the southern interchange. Various options where considered at this location including retaining walls and bridge structures, with a fill embankment adopted based on consideration of engineering risk, constructability and cost. Final configuration of the batter is subject to further geotechnical investigations and detailed design. Roads and Maritime will continue to consult with the property owner impacted by the fill batter.

The alternative option with the bypass raised above two roundabouts has been reviewed and assessed as not feasible due to reduced traffic performance, increased cost and road safety concerns. Key issues include:

- As a result of constructing the bypass over McCaffrey Drive substantially more bridge structures would be required (particularly in the bushland valley north of McCaffrey Drive)
- Requires major reconstruction of McCaffrey Drive in order to accommodate a large roundabout resulting in significant additional earthworks and clearing area (due to the sites topography)
- Reduced traffic performance as a result of traffic on Lookout Road and McCaffrey Drive required to pass through uncontrolled intersections in the form of roundabouts

- Road safety issues associated with uncontrolled traffic from Lookout Road southbound on-ramp needing to cross multiple lanes within a short distance to access right turn lanes at Grandview Road or Cardiff Road.

4.4 Project description

4.4.1 Design criteria and standards

Submission numbers

138

Issue description

In summary, the respondent raised the following issues:

- The project does not take into account broader development patterns in the Lower Hunter. The new roadway should be built to a higher standard, meet B Triple Standards, have a design speed of 110 kilometres per hour and match the needs of driverless vehicles. It should also allow the safe and easy route for over dimension vehicles.

Response

The design criteria and standards which apply to the project are detailed in Section 5.2 of the EIS. The project has been designed to be consistent with other free flowing sections of the Newcastle Inner City Bypass with a posted speed limit of 90 kilometres per hour which is appropriate to the road network which the project connects with.

It is not current NSW Government policy to design roads for driverless vehicles.

As stated in Section 8.3.2 of the EIS, the project has been designed to accommodate restricted access vehicles, 19 metre B- doubles, 23 metre B-doubles and 25/26 metre B-doubles. The project would give potential for this section of the Newcastle Inner City Bypass to be approved for use by restricted access vehicles, providing efficiency and safety improvements for freight on the road network. Other heavy vehicles would also be able to continue to use the existing route along Croudace Street and Lookout Road.

4.4.2 Lookout Road fill batter 1

Submission numbers

127, 128, 139

Issue description

In summary, the respondents raised the following issues:

- The proposed batter will be prone to erosion and will increase erosion in Blue Wren Creek
- The proposed batter has steep slopes requiring mechanical stabilisation and will be difficult to construct. The cross section provided in the EIS does not show the full extent of the batter slope so the full extent of the impact is not shown
- Suggested DP&E should not approve the project until Roads and Maritime provide further details of the batter design, including:
  - How stormwater would be handled
  - How the Blue Wren Creek tributary will be restored and further erosion prevented
  - How the vertical faces of the batter will be stabilised (ie what is the construction material)
  - The level of replacement vegetation (eg pot sizes and quantity of planting) to be provided to ensure the batter achieves the desired bushland regeneration as quickly as possible
- The clearing of vegetation to construct the fill batter will destabilise an existing fill batter on the northern boundary of private property. Requested the existing fill batter be stabilised and re-constructed with a more stable slope.

Response

The design criteria and standards which apply to the project are detailed in Section 5.2 of the EIS. This includes design criteria for batter slopes and heights. As stated in Section 13.4.1 of the EIS, the slopes of the proposed cuts and fills have been designed to address the existing site conditions. Generally, there is maximum (steep) batter slope of 2H:1V (two metres wide and one metre high) and a preferred slope of up to 4H:1V where there are no surrounding constraints. In rock cuts the batter slope may be further steepened and would be confirmed during detailed design. The maximum batter height between benches is 10 metres (vertical). Benches of 4.5 metres and four metres wide are also provided on all large cuts and fills respectively. The design of all cuts and fills would be further refined during detailed design.

The design of the cut and fill batter slopes has been informed by geotechnical investigations which have been carried out for the project. These investigations have identified the physical characteristics of the material to be excavated in cuts and placed on fills and provided recommendations about stability to inform maximum slopes, benching requirements and need for additional mechanical stabilisation. These will be further refined during detailed design following completion of further geotechnical investigations. The same design criteria and standard would also apply to stabilisation of any existing fill batters affected by the project.

The fill batter is in the upper reaches of the Blue Wren Creek catchment. During construction all disturbed areas would be managed in accordance with an erosion and sediment control plan. During operation, surface runoff from the batter would be managed in accordance with the project drainage system.

As such, during construction and operation, with the implementation of management measures detailed in Sections 13.5 and 13.6 of the EIS, including diversion of clean water runoff, longitudinal catch drains on benches, drainage system outlet controls including energy dissipators and scour protection and operational water quality treatment structures, the risk of slope instability is considered to be low.

The cross sections shown in Figure 5-2 of the EIS are representative only for that specific location and don't necessarily show the full extent of any cut or fill. The full extent of cuts and fills can be seen in Figure 5-1 of the EIS. As a result of the project design refinements, the extent of fill batter 1 has increased slightly and is shown in Figure 5-1 of this report.

To assist with mitigating the potential erosion and visual impacts, landscaping of the project is proposed as detailed in the Urban Design, Landscape Character and Visual Impact Assessment (Ki Studio 2016, Appendix H of the EIS). As a result of the project design refinements (Chapter 5), the Urban Design, Landscape Character and Visual Impact Assessment has been updated and is summarised in Section 6.5 and provided in Appendix E. The concept landscaping plan would be further refined during detailed design.

4.4.3 Northern interchange

Submission numbers

10, 14, 44, 85

Issue description

In summary, the respondents raised the following issues:

- The northbound off-ramp at the northern interchange needs to be increased in length to prevent traffic from queuing onto the bypass during peak hours
- The northbound off-ramp at the northern interchange is too close to residences in Birchgrove Drive and it should be moved to reduce impacts
- A visual barrier is required between the eastbound Newcastle Road lanes and northbound on-ramp at the northern interchange to screen headlights
- Noted there is no option to re-enter the bypass if a motorist realises they made a wrong turn.

Response

The design of the northern interchange, including the northbound off-ramp, has taken into consideration predicted traffic volumes during peak periods. Section 6.3 of this report and Section 8.3.2 of the EIS presents information on the predicted traffic volumes on key sections of road and level of service for key intersections, with and without the project. The analysis indicates the northern interchange would have an improved level of service of C (with the project) compared to D (without the project) in 2030 during both peak periods.

Further discussion regarding the selection of the preferred option for the project alignment and northern interchange (including the northbound off-ramp) is provided in Sections 4.3.1 and 4.3.4.

The concept design for the project includes a screen between the northbound on-ramp and eastbound Newcastle Road lanes at the northern interchange to eliminate headlight glare. The final form and type of the screen will be determined during detailed design.

The northern interchange does not allow for a vehicle which has exited the bypass in error, to re-enter the bypass at the traffic light controlled intersection. Any vehicle seeking to re-enter the bypass would be required to travel to the next available intersection in order to turn around or find an alternative route to the bypass.

4.4.4 Public utilities

Submission numbers

139

Issue description

In summary, the respondent raised the following issues:

- Concerned about the impacts of temporary disruptions to public utilities.

Response

As stated in Section 5.3.22 of the EIS, a number of utilities are located near to the project including electricity, sewer, water, gas and telecommunications. A number of these would require relocation to allow for construction of the project. Existing utility services and requirements for their potential relocation would be further refined during detailed design in consultation with the asset owners.

As stated in Section 11.3.1 of the EIS, this work may result in temporary disruptions for nearby properties. However, careful planning and consultation with impacted owners would minimise these disruptions as far as possible. As stated in Section 11.4 of the EIS, Roads and Maritime will co-ordinate work with respective utility providers before any changes to the infrastructure. Affected residents will be consulted before work is carried out which may disrupt services.

4.4.5 Construction – hours of operation

Submission numbers

149

Issue description

In summary, the respondent raised the following issues:

- Construction hours should be limited to normal working hours during weekdays to minimise impacts to surrounding residents.

Response

As stated in Section 5.4.4 of the EIS, Roads and Maritime is seeking approval for proposed extended construction hours. The proposed extended construction hours would apply across the full length of the project for all construction activities, but would not apply to blasting (if it is required).

Following exhibition of the EIS, receipt of submissions, further review of constructability issues for the project and consultation with DP&E, Roads and Maritime has refined the approach to the proposed extended construction hours as detailed in Section 5.4.5. The refined approach would limit construction activities carried out in the weekday extended morning hours to those which do not result in noise levels above the relevant construction noise management level at the nearest affected sensitive residential receiver.

Roads and Maritime acknowledges there would be impacts to neighbouring sensitive receivers associated with the proposed extended construction hours (as discussed in Section 9.4.1 of the EIS and the updated noise and vibration assessment (Section 6.4 and Appendix D)), however it is considered they would result in significant benefits to the greater community. These benefits would include:

- An overall construction period reduction by three to four months
- Reduced duration of disruptions to road users, particularly on McCaffrey Drive, Lookout Road, Croudace Street and Newcastle Road
- Reduced duration of public's exposure to changed traffic conditions and interaction with construction traffic
- Reduced timeframe of exposure of surrounding sensitive receivers, including neighbouring residents and the John Hunter Hospital precinct, to construction noise, vibration and dust
- Earlier completion of the project and improved traffic and safety performance.

All work carried out during the proposed extended construction hours would be managed through implementation of a construction noise and vibration management plan, which would include feasible and reasonable mitigation measures to minimise the potential for adverse impact on the local community. The plan would be implemented in conjunction with an environment protection licence for the project issued by the NSW Environment Protection Authority (EPA) under the POEO Act. Roads and Maritime will carry out further consultation with DP&E, EPA and the community to minimise potential construction noise impacts.

4.4.6 Construction – quarries

Submission numbers

23, 87, 88, 89, 90, 91, 92, 93, 94, 103, 104, 113, 121, 123, 125, 126, 134, 136, 142, 145, 146

Issue description

In summary, the respondents raised the following issues:

- Objected to the inclusion of Martins Creek Quarry in the EIS as a possible source of construction materials
- Requested clarification regarding the start of delivery times from quarries which may supply materials for construction of the project
- Questioned why the EIS did not contain a detailed discussion of quarry sources or assess the impacts of quarry operations and haulage
- Objected to the proposed extended construction hours on the basis it would result in truck movements at quarries potentially supplying materials for construction of the project before 6am
- Objected to the proposed extended construction hours on the basis it would result in noise impacts associated with truck movements for both local residents and those located near quarries supplying materials to the project.

Response

The potential sources of construction materials identified in Section 5.4.14 of the EIS are indicative only and intended to demonstrate there is sufficient material available to construct the project and that the project would not exhaust any limited supplies of construction materials. Roads and Maritime has not made any commitment to use the identified suppliers. The need, source and final amount of materials for the project would be determined by the construction contractor.

The construction contractor will be responsible for ensuring only legally operating suppliers are used. Standard Roads and Maritime construction contracts include provisions for monitoring of sub-contract arrangements. Individual suppliers, such as quarries, are responsible for ensuring they operate within their consent conditions and for the environmental assessment of impacts associated with their operations, including haulage and hours of operation. Due to the uncertainty of potential supplier locations, the EIS assesses potential impacts of construction traffic volumes on key roads near to the project (Section 8.3.1 of the EIS) and construction traffic noise (Section 9.4.1 of the EIS).

4.4.7 Construction compounds

Submission numbers

53

Issue description

In summary, the respondent raised the following issues:

- Requested more information regarding the operation of construction compounds B and C
- Objected to a crushing plant/batching plant being located close to residential properties.

Response

Section 5.4.5 and Figure 5-18 of the EIS provides details of the location, size and activities at each of the proposed three main construction compounds. Following exhibition of the EIS and further review of constructability issues for the project, three additional construction compounds are now proposed. There has also been slight boundary and activity adjustments to construction compounds B and C to match the minor adjustments to the construction footprint at these locations. Refer to Section 5.4.4 for further information. These construction compounds have been located based on:

- Topography and accessibility to construction areas
- Minimising impacts on native vegetation and residential areas where possible
- Clearance above the 20-year ARI event flood level where possible or a contingency plan to manage flooding would be prepared and implemented.

The proposed uses are indicative only and would require further refinement based on the needs of the construction contractor. Construction staging would influence the staging and use of construction compounds. The proposed use for construction compounds B and C include, but are not limited to, the following:

- Site offices
- Small plant delivery
- Material deliveries and stockpiling operations
- Construction personnel parking.

Due to the proximity of construction compounds B and C to residential areas, it is not proposed to locate a crushing plant or batching plant at these locations.

4.5 Consultation

Submission numbers

14, 17, 44, 46, 53, 75, 81, 106, 127, 149, 157, 158

Issue description

In summary, the respondents raised the following issues:

- Residents in Birchgrove Drive near the northern interchange did not receive a letterbox drop in May/June 2016 and should have received a direct letter to advise of the EIS and potential impacts

- Residents in Birchgrove Drive near the northern interchange have not been consulted regarding the impacts of the northbound off-ramp
- Requested ongoing consultation with Roads and Maritime to address concerns with the design of the northern interchange
- Resident was not consulted about the proposed batter to be constructed on private property
- Feedback from the community has not been considered in the EIS
- Roads and Maritime does not listen to community submissions
- Roads and Maritime has ignored all previous community feedback
- Commented issues raised in submissions provided in response to the refined strategic design display had not been addressed and Roads and Maritime had not provided a reply
- The exhibition period was too short to review the EIS
- The project should schedule a completion date and keep affected residents appraised of progress and in the event of over run of the project projected completion residents should be informed
- If the project is delayed during construction, contingency should be made to restore access to the bushland.

Response

Community and stakeholder engagement carried out for the project is detailed in Chapter 6 of the EIS. This consultation has been guided by a *Stakeholder and Community Engagement Plan* (Roads and Maritime 2014c) which establishes the objectives and strategies for stakeholder engagement during the life of the project. In 2015, a *Community and Stakeholder Engagement Plan* (Roads and Maritime 2015b) was prepared, to support the 2014 plan by identifying specific communication and consultation activities for the concept design and environmental assessment phases of the project. The objectives of the community and consultation activities were to:

- Inform the community and stakeholders of the project and relevant stages for consultation
- Work with the community and stakeholders during the planning process to identify issues and minimise potential impacts
- Expand the database of stakeholders who would like to be kept informed and engaged about the project
- Provide a general level of awareness about the project in the wider community.

To guide future ongoing communication and consultation during construction of the project a *draft Community Consultation Framework* (Roads and Maritime 2016a) has been prepared and is provided in Appendix D of the EIS. The strategy will enable appropriate consideration and balancing of community and stakeholders' issues to achieve best project outcomes.

As stated in Chapter 6 of the EIS, ongoing two-way communication will be carried out during detailed design and construction. This will effectively address and manage issues as they emerge and support the delivery of best outcomes for the project, stakeholders and the broader community.

In accordance with these plans Roads and Maritime has carried out extensive consultation with the community during all stages of the project to date. Roads and Maritime will carry out further consultation with all stakeholders during future stages of the project.

Consultation carried out during preparation of the EIS is detailed in Section 6.2.4 of the EIS. Since project planning re-started in June 2014, Roads and Maritime has carried out ongoing community engagement in the development of the refined strategic design, concept design and EIS. The consultation built on earlier consultation processes for the project, ensuring stakeholders and the community were informed and able to provide input to the EIS. Engagement activities during preparation of the EIS included:

- Community update (letterbox drop, email to registered stakeholders and Roads and Maritime website updates) announcing project funding (June 2014)
- Project update (letterbox drop, email to registered stakeholders and Roads and Maritime website updates) inviting early feedback to the 2007 design

- Community information drop-in sessions at Jesmond (March 2015)
- Project update (letterbox drop, email to registered stakeholders and Roads and Maritime website updates) summarising early feedback including questions and answers document responding to early feedback (May 2015)
- Meetings with individual stakeholders (2014 to 2016)
- Community information line and email address established for inquiries (2014 to date)
- Display of the refined strategic design (May/June 2016) including media releases, Newcastle Herald advertisements, community update and postcard (letterbox drop and email to registered stakeholders), stakeholder briefings and Roads and Maritime website updates
- Community drop-in sessions (May/June 2016)
- Written correspondence with key government agencies, community, stakeholders and interest groups (May 2016).

The EIS was exhibited by DP&E for 30 days from 16 November 2016 to 16 December 2016. The exhibition was advertised in the Newcastle Herald in November 2016 (a copy of the advertisement is provided in Appendix A).

As part of the exhibition a number of activities were carried out by Roads and Maritime to engage with the community. A postcard was distributed to around 20,000 households in Rankin Park, New Lambton Heights, New Lambton, Lambton, Jesmond, North Lambton, Garden Suburb, Cardiff Heights, Elermore Vale, Birmingham Gardens, Waratah West and Kotara. Postcards were also available at Service NSW Centres at Newcastle, Wallsend and Warners Bay, the Roads and Maritime regional office in Newcastle, John Hunter Hospital, Newcastle City Council and Lake Macquarie City Council. The postcards included information on how to make a submission, details on community drop-in sessions and where to go for further information.

All registered stakeholders were notified of the public exhibition of the EIS by email on 16 November 2016.

All directly affected property owners likely to be affected by property acquisition were notified by mail on 22 November 2016.

A free call project information line (1800 818 433) and project email address (rp2j.community@aurecongroup.com) were available during the exhibition.

A 3D visualisation showing the key features and benefits of the project was made available to view on the Roads and Maritime project webpage (www.rms.nsw.gov.au/rp2j).

Community drop-in sessions, were held during the exhibition period to allow community members to ask the project team questions and get further information. The sessions were advertised in the Newcastle Herald, on the postcard, the EIS overview document and the project webpage. The community drop-in sessions were held at Silver Ridge Community Cottage, Wallsend on Saturday 26 November 2016 (9am-2pm) and Thursday 1 December (3pm-6pm). More than 125 interested community members attended these sessions.

The following materials were made available during the community drop-in sessions:
- The EIS and technical papers
- The EIS overview document
- The postcard with information on how to make a submission
- Information posters displaying the concept design, interchanges, artist's impressions of the interchanges and how to make a submission
- A 3D visualisation shown on several screens and used to engage during one-on-one discussions with community members to get a better idea of visual impacts and the look and feel of the proposed bypass.

A meeting was held with the Roads and Maritime Hunter Cycling Forum on 7 December 2016 at the RMS Hunter Region Office, with representatives from Newcastle City Council, Newcastle Cycleways Movement, Bicycle NSW and Kooragang Open Cycle Club.

Further responses to issues raised in the submissions are provided in the following sections.

Residences in Birchgrove Drive have been included in the distribution area for all letterbox drops carried out for the project, including in May/June 2016. As these residences are not directly impacted by the project, specific letters were not issued.

Roads and Maritime has consulted with the property owners impacted by the fill batter including a discussion at the drop-in session conducted during the refined strategic design display in May 2016 and a meeting in September 2016. A letter was also issued to the property owners in November 2016 to advise of the EIS exhibition and noting the proposed impact to the property.

Section 6.2.4 of the EIS details consultation carried out during preparation of the EIS, including consultation for the refined strategic design. Section 6.3 of the EIS identifies where issues raised in submissions during the display period of the refined strategic design and consultation carried out for the EIS are addressed.

It is important to note Roads and Maritime follows issue based decision making. This means although preferences and frequency of a comment or issue are noted, Roads and Maritime examines the issues raised throughout the consultation period using the fact based assessment process.

Roads and Maritime does not directly respond to individual submissions received with responses to issues raised provided in the relevant report, such as the EIS. When this report is made publicly available, Roads and Maritime will notify all registered stakeholders.

Exhibition of the EIS was managed by DP&E and was carried out in accordance with the requirements of the EP&A Act.

Roads and Maritime will carry out further consultation with all stakeholders during future stages of the project, if approved. This will include engagement activities such as community updates at key stages of the project. In the unlikely event of construction being delayed for an extended period, Roads and Maritime would arrange for public access where safe to do so.

4.6 Biodiversity

4.6.1 Assessment

Submission numbers

81

Issue description

In summary, the respondent raised the following issues:

- The EIS biodiversity assessment contains omissions and has not considered all previous biodiversity surveys conducted in the bushland area including habitat tree mapping carried out for Newcastle City Council and records of Masked Owls
- The report should include records from interest groups such as Hunter Bird Observers Club.

Response

The project has been subject to a number of biodiversity assessments during its history of development including Umwelt Environmental Consultants (2006), Parsons Brinckerhoff (2014), Parsons Brinckerhoff (2015a), Parsons Brinckerhoff (2015b), Parsons Brinckerhoff (2015c) and Parsons Brinckerhoff (2016). These assessments included, as relevant, a review of publicly available existing studies, database searches for registered records of threatened flora and fauna, review of biodiversity information provided by Newcastle City Council and field surveys.

Following exhibition of the EIS and receipt of submissions, additional biodiversity investigations have been carried out for the project and are reported in Section 6.2 and Appendix B. This assessment has resulted in a refinement to the vegetation mapping presented in the EIS.

The database searches included those held by government agencies such as OEH and Department of Environment and Energy, which contain registered and verified records. The searches, in conjunction with the review of previous studies, are used to inform the scope for field surveys in conjunction with a review of potential habitat values.

Information provided by Newcastle City Council included comprehensive habitat tree mapping for the Jesmond bushland area. Parsons Brinckerhoff (2015b) reviewed this data set and in conjunction with comprehensive hollow bearing tree survey of the project area carried out by Parsons Brinckerhoff (2014), developed a consolidated map of habitat trees which was subsequently used in the biodiversity assessment report (GHD 2016f, Appendix E of the EIS) and updated biodiversity assessment report (GHD 2018a, Appendix B of this report).

Data provided by Newcastle City Council did include information on potential and recorded locations of habitat for certain threatened species and this was included in the biodiversity assessments for the EIS. Parsons Brinckerhoff (2015a and 2015b) confirmed the presence of Powerful Owl and while targeted searches did not record the presence of Masked Owl, it was identified as having a moderate likelihood of occurrence due to suitable habitat being present. As a result these species have been appropriately considered in the biodiversity assessment report.

The biodiversity assessment report (GHD 2016f, Appendix E of the EIS and summarised in Chapter 7 of the EIS) and updated biodiversity assessment report (GHD 2018a, Appendix B of this report) was prepared based on the findings of the previous assessments and, as required by the project SEARs, in accordance with the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (Framework for Biodiversity Assessment) (Office of Environment and Heritage 2014a) and relevant survey guidelines. Under the Framework for Biodiversity Assessment, all relevant threatened species and vegetation communities are included in the assessment and calculation of offset credits. Specifically the Framework for Biodiversity Assessment identifies species credits, being threatened species for which specific offsets are required such as Black-eyed Susan (*Tetratheca juncea*), and ecosystem credits, which account for threatened and other species (including Squirrel Glider (*Petaurus norfolcensis*) and Masked Owl (*Tyto novaehollandiae*)) which are not species credits and the habitat values provided by the identified plant community types. Through this process all species, threatened or otherwise, are accounted for in the assessment of potential impacts and provision of offset credits.

As a result of the additional biodiversity investigations (Section 6.2 and Appendix B) and refinements to the construction footprint due to project design refinements (Chapter 5), updated BioBanking credit calculations have been carried out. These are reported in Section 6.2.

4.6.2 Fauna connectivity

Submission numbers

129

Issue description

In summary, the respondents raised the following issues:

- The project will result in severance of the bushland and there is insufficient connectivity for fauna.

Response

Chapter 4 of the EIS describes the various alternatives to the project considered as part of the project development process and explains how and why the project was selected as the preferred option. As described in Sections 4.4.5 and 7.3.1 of the EIS, the preferred option, minimises fragmentation of the bushland area and impacts on endangered ecological communities and threatened species.

The realignment of the project allowed for a wider vegetated corridor on the western side of the alignment than the 2007 strategic design, which improves north-south connectivity between vegetation and associated habitat, increasing the potential for large and small fauna species to use habitats surrounding the project. It also improves connectivity to the west to Dangerfield Drive Reserve.

Details of the avoidance measures incorporated into the project are shown in Figure 4-10 of the EIS and detailed in Section 7 of the biodiversity assessment report (GHD 2016f, Appendix E of the EIS) and updated biodiversity assessment report (GHD 2018a, Appendix B of this report) and is further discussed in Section 4.6.3.

Section 7.3.2 of the EIS outlines the proposed fauna connectivity strategy for the project. Section 7.3 of the biodiversity assessment report (GHD 2016f, Appendix E of the EIS) and updated biodiversity assessment report (GHD 2018a, Appendix B of this report) also provides a detailed discussion of the proposed fauna connectivity strategy. The strategy, which will be further refined during detailed design provides:

- One dedicated fauna culvert of appropriate size and dimension (about three by three metres) for terrestrial fauna, including macropods, with fauna fencing and fauna 'furniture'
- A bridge (Bridge 4) which would provide for fauna passage beneath the bridge span
- Rope bridges for arboreal fauna established at two separate locations along the alignment
- Fencing to guide fauna to the crossing infrastructure. The fencing would be established as close as possible to the final road formation, which maximises available habitat for fauna, and includes fauna escape points.

The underpasses are suitable for use by ground based species including Swamp Wallaby (*Wallabia bicolor*) while the rope bridges are suitable for arboreal mammal species including Squirrel Glider (*Petaurus norfolcensis*), Sugar Glider (*Petaurus breviceps*) and Brushtail Possum (*Trichosurus vulpecula*).

4.6.3 Flora and fauna impacts

Submission numbers

14, 32, 44, 149, 158, 160

Issue description

In summary, the respondents raised the following issues:

- Concerned about the potential impacts of the northbound off-ramp at the northern interchange on native flora and fauna
- Suggested the areas to the north-east and south-west of the northern interchange could be established as community native gardens to provide habitat for native birds
- Commented the project provides for minimisation of impacts to the biodiversity and landscape features in the bushland areas

- Commented flora and fauna destroyed or displaced in the construction phase may not recover or return. Provision should be made to retain the flora and fauna of the area during the construction phase
- Stated following construction the disturbed area should be revegetated using indigenous species
- Stated an ongoing program to manage weeds and bushfire hazard reduction is required between the bypass and residential properties.

Response

Potential impacts to biodiversity were assessed in Chapter 7 of the EIS and the biodiversity assessment report (GHD 2016f, Appendix E of the EIS). The assessment included comprehensive surveys of the bushland area to identify biodiversity values, minimise impacts and identify management measures.

Following exhibition of the EIS and receipt of submissions, additional biodiversity investigations have been carried out for the project and are reported in Section 6.2 and Appendix B. This assessment has resulted in a refinement to the vegetation mapping presented in the EIS.

As discussed in Section 7.3.1 of the EIS, the project is a regionally significant road infrastructure project which has a long history of design planning and refinement (Chapter 4 of the EIS). The preferred corridor for the project was originally identified in 1957 and the alignment has been refined over many years, specifically in 1985, 2006 and 2016. During each design refinement, environmental and ecological impacts were specifically considered when carrying out the options evaluation. Several alignment options (including interchange arrangements) were discounted over the years due to the adverse ecological and environmental impacts.

The final preferred project alignment (including interchange arrangements) was selected based on this process. Further adjustments were then made to the project to further minimise direct impacts on identified endangered ecological communities and threatened species. These avoidance measures are shown in Figure 4-10 of the EIS and detailed in Section 7 of the biodiversity assessment report (GHD 2016f, Appendix E of the EIS) and updated biodiversity assessment report (GHD 2018a, Appendix B of this report).

The residual impacts are considered unavoidable given the array of additional constraints the project was required to consider, such as mine subsidence, road safety, flooding and traffic. The clearing footprint for the project has been minimised as far as practicable to enable safe construction of the project and to retain existing native vegetation.

During construction there would be direct and indirect impacts to flora and fauna in the bushland area. Section 7.5 of the EIS details environmental management measures which would be implemented during construction to minimise impacts as part of a flora and fauna management plan.

Following completion of construction, native vegetation will be re-established in accordance with a re-vegetation management plan prepared in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 3: Re-establishment of native vegetation)* (RTA 2011a). The revegetation management plan will use suitable species from the indigenous vegetation communities present at the site to replace habitat for native birds and threatened species including Grey-headed Flying-fox.

A biodiversity offsets strategy will also be implemented in accordance with the *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects* (Framework for Biodiversity Assessment) (Office of Environment and Heritage 2014a).

As a result of the additional biodiversity investigations (Section 6.2 and Appendix B) and refinements to the construction footprint due to project design refinements (Chapter 5), updated BioBanking credit calculations have been carried out. These are reported in Section 6.2.

As detailed in Section 7.5 of the EIS, protocols for preventing or minimising the spread of noxious and environmental weeds will be developed and implemented in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 6: Weed Management)* (RTA 2011a). During operation, weed management would be carried out in accordance with standard Roads and Maritime maintenance procedures.

The project is not expected to be a significant bushfire hazard during operation as ongoing vegetation management activities by Roads and Maritime would limit vegetation encroachment in the proposed road corridor and ensure adequate separation from adjacent bushland. Bushfire hazard reduction and management responsibilities would continue to be carried out by Rural Fire Service and Fire and Rescue NSW. Roads and Maritime would continue to liaise with these agencies during operation of the project.

4.7 Traffic and transport

4.7.1 General

Submission numbers

9, 14, 42, 82, 138

Issue description

In summary, the respondents raised the following issues:

- Commented the proposed southbound traffic lights at the southern interchange would delay traffic and does not provide for free flowing traffic
- Concerned about the potential impacts of the northbound off-ramp at the northern interchange on residences in Birchgrove Drive and requested further information on what is the predicted traffic volume using the off-ramp
- Requested clarification if the existing southbound school zone on Lookout Road will remain following construction of the project. Suggested this zone should be removed to help with easing traffic congestion
- Commented there is substantial new development proposed in the western suburbs of Newcastle and the traffic modelling for the project does not take these into consideration
- Noted information on projected traffic volumes provided in Section 3.2.3 of the EIS did not indicate the origin, destination or travel route of the vehicles and this is required to ensure the project meets current and future traffic needs.

Response

As described in Section 5.3.5 of the EIS, traffic lights to manage the connection between southbound traffic on the bypass and southbound traffic on Lookout Road are required. The traffic lights would be located about 320 metres north of Grandview Road where the main project alignment joins Lookout Road southbound. This would eliminate conflict between these two traffic streams and allow for motorists from Lookout Road southbound to safely access the right turn lanes at the Grandview Road and Cardiff Road intersections.

Traffic modelling carried out for the project predicts traffic volumes on the northbound off-ramp at the northern interchange would be about 4300 vehicles per day in 2030. Further discussion regarding potential impacts to residences near the northbound off-ramp at the northern interchange is provided in Section 4.3.4.

The project would not remove the existing school zone on Lookout Road to the south of the project. The provision of school zones are an essential safety requirement in accordance with NSW Government policy.

Traffic modelling for the project is detailed in the traffic and transport assessment (Aurecon 2016a, Appendix F of the EIS). The model is based on a combination of historical traffic growth (based on traffic counts) and future traffic growth numbers derived from the *Lower Hunter Traffic Model* (Arcadis 2016). The *Lower Hunter Traffic Model* uses traffic volume forecasts based on land use assumptions and forecast population and employment growth as predicted in the *Lower Hunter Regional Strategy 2006-31* (Department of Planning 2006). As such, the traffic modelling has included consideration of future population growth.

The traffic information provided in Section 3.2.3 of the EIS is an overview of the projected future traffic growth to demonstrate the project is required. Detailed information on current and future traffic volumes, origin-destination surveys and travel routes/times is provided in Chapter 8 of the EIS.

As a result of the refined hospital interchange design (Section 5.4.1), there have been minor refinements to the projected traffic volumes on roads in the study area as discussed in Section 6.3 and Appendix C.

4.7.2 Existing road network

Submission numbers

46, 78, 82, 85, 120

Issue description

In summary, the respondents raised the following issues:

- The project is required to address traffic congestion on Croudace Street
- The project will not ease traffic congestion on surrounding roads including Newcastle Road
- The project does not include any measures to improve access for residents during peak periods in the area bounded by Newcastle Road and Croudace Street
- The removal of the Jesmond roundabout will remove the ability to change travel direction
- Consider the project would assist with access out of Steel Street onto Newcastle Road during peak periods
- The removal of the existing Jesmond roundabout will result in increased traffic congestion
- McCaffrey Drive should be upgraded to take more traffic from Newcastle Road to assist with improved travel times for access to/from the western suburbs of Newcastle.

Response

Updated traffic modelling has been carried out (Section 6.3 and Appendix C) for the project (including the design refinements (Chapter 5)), which shows the project will carry up to 34,500 vehicles per day in 2030 and result in a corresponding reduction in traffic volumes on the existing route of Lookout Road (up to 38 per cent), Croudace Street (up to 43 per cent) and Newcastle Road (up to 24 per cent). As a result, the project would ease traffic congestion on these key roads. This would substantially improve traffic flow and reduce travel times along the existing route and potentially provide improved access out of side streets.

As stated in Section 8.3.2 of the EIS, the project would include a number of changes to the existing road network as described in Sections 5.3.5 and 5.3.6 of the EIS. These changes would retain most of the existing traffic movements on the affected road network. However, to the east of the northern interchange, at Robinson Avenue, while there is existing provision for right turn movements, during congested periods some traffic may turn left and use the existing roundabout to head back east. This movement would no longer be available, however traffic can use other local streets to access Croudace Street in order to then travel east on Newcastle Road. Alternatively, vehicles seeking to change direction could use other locations such as Blue Gum Road or the University interchange.

An assessment of options for the northern interchange is provided in Chapter 4 of the EIS. Section 4.5.2 of the EIS identified northern option 6 was the preferred option as it maximises the future functionality of the interchange and provided the best value for money with substantial benefits for traffic flow both on the bypass and Newcastle Road. The preferred option, as detailed in Section 5.3.5 of the EIS includes a traffic light controlled intersection to provide for all traffic movements at the interchange and would widen Newcastle Road to be three lanes in each direction near the interchange.

An assessment of the level of service (Section 6.3 and Appendix C) indicates the northern interchange would have an improved level of service of C (with the project) compared to D (without the project) in 2030 during both peak periods. This indicates that with the project, the intersection of the bypass and Newcastle Road would have less congestion than if the Jesmond roundabout was left in place.

McCaffrey Drive is a Regional Road managed by Newcastle City Council. Council has the responsibility to determine the need for upgrade works to McCaffrey Drive or any other road under their control. Further discussion regarding upgrade work for McCaffrey Drive as part of the project is provided in Section 4.7.3.

4.7.3 McCaffrey Drive upgrade

Submission numbers

16, 64, 82, 106

Issue description

In summary, the respondents raised the following issues:

- The project will increase traffic congestion at the McCaffrey Drive intersection and further improvements are required
- Consider the project will improve traffic flow in McCaffrey Drive
- Requested further information regarding how the proposed improvements to McCaffrey Drive would assist traffic flows and take into account future population growth
- The proposed improvements to McCaffrey Drive will not result in improved traffic flow as motorists currently use the road shoulder.

Response

As discussed in Section 8.2.2 of the EIS the road network surrounding the project, including McCaffrey Drive and the existing route of Lookout Road, Croudace Street and Newcastle Road are subject to existing high levels of traffic congestion, particularly during peak periods. In 2014, the Lookout Road and McCaffrey Drive intersection was operating at a level of service of D in the morning peak and B in the afternoon peak.

Updated traffic modelling has been carried out (Section 6.3 and Appendix C) for the project (including the design refinements (Chapter 5)), which shows the project is predicted to carry up to 31,300 vehicles per day in 2020 and up to 34,500 in 2030. As a result, there would be a corresponding reduction in traffic on the existing route of Lookout Road (by up to 38 per cent), Croudace Street (43 per cent) and Newcastle Road (24 per cent). This would substantially improve traffic flow and reduce travel times along the existing route. It is predicted that McCaffrey Drive would carry about 3000 less vehicles per day in 2030.

With the project all existing traffic movements would be retained at the Lookout Road and McCaffrey Drive intersection (Section 5.3.6 of the EIS). The project would include upgrades for the existing intersection to improve traffic flow. Key features of the intersection upgrade include:

- Provision of a second right turn lane out of McCaffrey Drive
- Extension of the right and left turn lanes on McCaffrey Drive to Lookout Road
- Extension of the left turn merge lane out of McCaffrey Drive onto Lookout Road.

Traffic volumes on all roads in the study area will increase even if the project is not constructed. As a result of the upgrades to the intersection and reduced traffic on Lookout Road and McCaffrey Drive the level of service of the intersection would improve from F (without the project) to B (with the project) in the morning peak) and C (without the project) to B (with the project) in the afternoon peak in 2030.

Further discussion regarding how the traffic modelling for the project has considered future population growth is provided in Section 4.7.1.

4.7.4 Parking

Submission numbers

6, 139

Issue description

In summary, the respondents raised the following issues:

- Concerned about the loss of public parking along Lookout Road and suggested the project should provide replacement parking
- Suggested there would be sufficient room for continuation of parking in the road shoulders of Lookout Road
- Noted it is not possible to park in Grandview Road and access properties in Lookout Road due to the lack of a footpath
- Stated the removal of on-street parking will impact access to properties on the western side of Lookout Road
- Requested compensation for impacts to existing driveway and for provision of additional parking within the property.

Response

As discussed in Section 8.3.2 of the EIS, no on-street parking would be available between McCaffrey Drive and Grandview Road on both sides of Lookout Road, with the exception of a 90 metre section next to Lookout Road southbound between the Blackbutt Reserve access road and Grandview Road, which provides about 13 on-street car parking spaces. The project would remove about 43 on-street car parking spaces southbound and about 60 northbound.

The parking spaces to be removed on Lookout Road are informal spaces in the shoulder of a State road. These spaces will not be replaced by the project and parking will be prohibited due to various road safety reasons as follows:

- Eliminating on-street car parking in the shoulder will remove obstructions to visibility created by parked vehicles when entering or exiting a property access. In addition it also allows the shoulder to be used when entering or exiting a property, reducing conflict with traffic in the through lane
- Eliminating on-street parking would improve on-road provision for cyclists who use the shoulder reducing conflict points with parked vehicles.

It is noted that the primary functions of the road shoulder on a State road are to enhance safety by providing an emergency stopping/breakdown lane and a clear zone for an errant vehicle to recover. The provision of on-street parking in the shoulder impacts these functions. Lookout Road at this location is subject to high traffic volumes, so the provision of on-street parking is undesirable.

Local residents, and staff and visitors to the John Hunter Hospital precinct generally use this area for parking. Given the available parking in the hospital (over 3400 car parking spaces) and on surrounding streets, the loss of these spaces is not expected to result in any significant impacts in the study area.

During operation, access to all properties will be reinstated with any adjustments required to suit the new road infrastructure. Roads and Maritime does not provide direct compensation for indirect impacts. Residents and visitors will be required to park within the boundaries of their property or find alternative parking on nearby roads such as Grandview Road. The project would reinstate the existing unsealed road verge (about two metres wide) between Grandview Road and the remaining two properties on the western side of Lookout Road. A new footpath will not be constructed as part of the project from Grandview Road as it would only service two properties. In addition, for pedestrians heading northbound along Lookout Road the intent is to encourage use of the existing underpass immediately south of Grandview Road to access the proposed new shared path on the eastern side of Lookout Road. Property owners are responsible for the provision of adequate parking to suit their individual requirements within the boundaries of their property.

4.7.5 Property access

Submission numbers

128, 139

Issue description

In summary, the respondents raised the following issues:

- The construction of the batter across the adjoining property will prevent the resident constructing a second access road to their property. Requested the batter design is amended to widen the lowest bench to continue the access track to allow access from the north-east corner of the property
- Vehicular and pedestrian access is required to the respondent's property at all times. Due to various infrastructure located in Grandview Road and along the western side of Lookout Road it is difficult for visitors to park in Grandview Road and walk to this property.

Response

The subject property impacted by the fill batter does not front McCaffrey Drive and as such does not have access to this road. This arrangement would not change with the project. The property fronts Marshall Street, with access available from this road, which would not change with the project. Roads and Maritime has and will continue to consult with the property owners.

The arrangements for temporary traffic management and access to all affected properties will be finalised in consultation with residents and owners during development of a construction traffic management plan once the construction staging and methodology is confirmed.

A footpath along the western side of Lookout Road from Grandview Road to the two residential properties will not be provided as part of the project. The project would reinstate the existing unsealed road verge (about two metres wide) between Grandview Road and the remaining two properties located on the western side of Lookout Road. During operation access to all properties will be reinstated with any adjustments required to suit the new road infrastructure. Residents and visitors that do not park in nearby streets and walk to the properties will be required to park within the boundaries of the properties.

4.7.6 Public transport

Submission numbers

44, 138

Issue description

In summary, the respondents raised the following issues:

- The northern interchange should include bus lanes and bus stops located within the interchange
- The project should include greater provision for bus services.

Response

As stated in Section 5.3.6 of the EIS, Newcastle Road would be widened to provide three lanes in each direction to cater for projected traffic growth and alleviate congestion. A dedicated bus lane in each direction would therefore not be provided as part of the project. The project is not expected to require the alteration of any existing public bus routes however, it would provide an opportunity for bus routes to be reconfigured to take advantage of the hospital interchange, with existing bus access to the hospital precinct continuing to be available from Lookout Road. The design and construction of the main project alignment would not prevent the potential of bus services being provided via the hospital interchange.

As stated in Section 5.3.15 of the EIS bus stops are already provided near the northern interchange and the project is not expected to generate the need for any additional bus stops.

Bus services and potential increase in patronage in the area would benefit from the improved traffic conditions due to the project, including reduced congestion on the existing route of Newcastle Road, Croudace Street and Lookout Road.

4.7.7 Construction impacts

Submission numbers

62, 139

Issue description

In summary, the respondents raised the following issues:

- The EIS does not provide any information about traffic impacts during construction for access to Rankin Park via McCaffrey Drive
- Commented traffic disruptions during construction could delay students attending lessons at the property in Lookout Road.

Response

Potential impacts to traffic during construction are discussed in Section 8.3.1 of the EIS and in the traffic and transport assessment (Aurecon 2016a, Appendix F of the EIS). The assessment identifies potential traffic and transport impacts during construction include:

- Construction access to the site from public roads
- Transport of materials to the site
- Increased traffic on the surrounding road network
- Temporary traffic arrangements such as speed limit restrictions, traffic diversions and traffic lane or road closures
- Temporary changes to property access and parking
- Increased travel times on the surrounding road network
- Temporary changes for pedestrian and cyclist movements
- Temporary removal of bus stops.

Construction of the project would impact roads in and immediately next to the construction footprint. In particular, sections of Lookout Road, McCaffrey Drive and Newcastle Road. Construction activities are expected to be completed while maintaining through traffic on existing roads. Access to/from McCaffrey Drive is expected to be available throughout construction. Closure of roads are not expected to be required, however temporary short-term diversions may be required. Temporary traffic arrangements would be implemented to provide for the safety of road users and construction staff. These could include modification to lane widths or road shoulders, use of separation barriers, detours and temporary signage. Construction speed limits (typically 40 kilometres per hour) may apply to road segments in and directly next to the construction site. These could lead to short-term travel delays for motorists.

Main works construction is expected to take about 30 months and impacts would be variable during this period depending on the construction stage. Construction staging would be developed to minimise impacts on the road network. Where possible, construction activities which could substantially affect traffic congestion would be carried out outside peak periods, as far as is practicable.

Roads and Maritime acknowledges there would be impacts to normal traffic conditions during construction of the project. This would include access to a number of properties including residences on Lookout Road. These changes are required to enable construction activities to occur and to protect the safety of workers and the public. As stated in Section 11.4 of the EIS, Roads and Maritime will consult with local residents who could be affected by the project during detailed design to manage the identified potential impacts.

For access to any property affected by construction activities, including the subject property on Lookout Road, in consultation with the residents/owners, Roads and Maritime would:

- Provide vehicle access as far as practical/safe to enable residents, visitors and patrons to park inside the affected property
- Where vehicle access is not available, pedestrian access would be provided where practical/safe
- Where pedestrian access is unavailable for safety reasons, pedestrians can be escorted through the construction site by pre-arrangement with the construction contractor.

The arrangements for temporary traffic management and access to all affected properties will be finalised in consultation with residents and owners during development of a construction traffic management plan when the construction staging and methodology is confirmed.

4.8 Pedestrian/cyclist access

4.8.1 General

Submission numbers

30, 44, 70, 79, 80, 110, 130, 135, 137, 148, 149, 150

Issue description

In summary, the respondents raised the following issues:

- The project does not comply with NSW Government or Roads and Maritime policy because provision for pedestrians and cyclists has not been maintained or improved due to the severance of the shared path in Jesmond Park
- Roads and Maritime should be providing better infrastructure for pedestrians and cyclists to improve community health
- Roads and Maritime should provide more off-road cycleways
- The project would result in an overall net loss of connectivity for pedestrians and cyclists
- The project is inconsistent with commitments in the *Hunter Regional Plan 2036* (Department of Planning and Environment 2016) to improve the active transport network
- Suggested alternative arrangements at the northern interchange to provide for pedestrians and cyclists on both the northern and southern sides of a revised interchange layout
- Suggested the proposed new overbridge over Newcastle Road near Steel Street should be connected to the existing Jesmond Park shared path and to the existing shared path on the eastern side of the existing Jesmond to Shortland section of the Newcastle Inner City Bypass via new shared path facilities
- The project should include removal of the need for cyclists to cross Newcastle Road via traffic lights at Blue Gum Road and to the east of the existing Jesmond roundabout at the mid-block pedestrian crossing

- The project only has one traffic light free crossing point for pedestrians only and not for cyclists across the bypass. This is not consistent with adjacent sections of the Newcastle Inner City Bypass which have multiple crossing points for pedestrians and cyclists
- Newcastle Cycleways Movement is concerned about the existing shared path from Jesmond Park to the John Hunter Hospital precinct due to grades and lack of lighting which may discourage cyclists.

Response

The project has been developed and designed in accordance with the:

- Strategic planning and policy framework (Section 3.2 of the EIS)
- Economic benefits of the project (Section 3.3 of the EIS)
- Preferred route selection process taking into account engineering, environmental, community and cost considerations (Chapter 4 of the EIS)
- Design criteria and standards (Section 5.2 of the EIS)
- Feedback from community consultation (Chapter 6 of the EIS)
- Environmental and social constraints and opportunities (Chapters 7 to 21 of the EIS).

In selecting the preferred route and completing the concept design for the project, an overall balance across social, environmental, economic and engineering issues has been required. As a result, no single issue necessarily prevails.

The project would provide new and upgraded facilities for pedestrians and cyclists as detailed in Section 5.3.14 of the EIS. These would connect with existing facilities surrounding the project. The proposed pedestrian and cyclist network has been developed with consideration to:

- *NSW Bike Plan 2010* (Transport for NSW 2010)
- *Newcastle Cycling Strategy and Action Plan* (The City of Newcastle 2012)
- *Newcastle Transport Strategy* (Newcastle City Council 2014)
- *Local Planning Strategy* (Newcastle City Council 2015).

During and following exhibition of the EIS, receipt of submissions and further consultation with Hunter Cycling Forum, Roads and Maritime has refined the design (Section 5.4.2) to make further improvements for pedestrians and cyclists as follows:

- Jesmond Park shared path – an overpass bridge (Bridge 8) and underpass arrangement would now be provided and would provide grade separated crossing for both pedestrians and cyclists
- Hospital interchange – the shared path crossing of the southbound off-ramp would now be controlled by traffic lights
- McCaffrey Drive – the proposed pedestrian footpath on the northern side would now be replaced with a shared path for use by both pedestrians and cyclists
- Southern interchange – a new northbound cycleway connection from Lookout Road to the bypass would be provided for on-road cyclists
- Lookout Road and McCaffrey Drive intersection – the pedestrian crossings on the left turn lane from McCaffrey Drive onto Lookout Road, and across Lookout Road, would now be shared path crossings controlled by traffic lights for use by both pedestrians and cyclists
- Newcastle Road – the shared path connections to the shared path bridge (Bridge 7) over Newcastle Road have been refined to improve connectivity with existing shared paths.

The project, including the design refinements, would represent an overall improvement in connectivity surrounding the project and is consistent with NSW Government and Roads and Maritime policy. It would contribute to the *Newcastle Cycling Strategy and Action Plan* (The City of Newcastle 2012) “strategy direction” of providing “a safe, continuous and convenient bicycle network” by providing improved connectivity and safety for cyclists traveling through the study area.

The project and existing facilities provide for pedestrian and cyclist movements near the northern interchange as follows:

- North-south via the new shared path bridge (Bridge 7) over Newcastle Road near Steel Street, via the existing intersection of Newcastle Road and Blue Gum Road and via the eastern side of the new intersection at the northern interchange
- East-west via the existing overbridge on the existing Jesmond to Shortland section of the Newcastle Inner City Bypass, via the refined design for the Jesmond Park shared path (Section 5.4.2) and via the southern side of the new intersection at the northern interchange.

Pedestrian and cyclist access, including wheelchairs or mobility impaired persons, will still be available on the southern side of the northern interchange via traffic lights. Additional provisions for pedestrians and cyclists on the northern side of the northern interchange is not required as east-west access is provided at the existing overbridge on the Jesmond to Shortland section of the Newcastle Inner City Bypass.

The new shared path bridge (Bridge 7) over Newcastle Road would replace the existing mid-block pedestrian crossing of Newcastle Road near Hill Street and connect to the existing Jesmond Park shared path via an upgraded shared path. On the northern side of Newcastle Road it would connect to the existing shared path on the Jesmond to Shortland section of the Newcastle Inner City Bypass via a new pedestrian footpath on the northern side of Coles Street and a short on-road (Coles Street) section for cyclists.

The existing traffic light controlled crossing of Newcastle Road at Blue Gum Road for pedestrians and cyclists will remain. Grade separation of this crossing is beyond the scope of the project.

Due to the project being located mostly in a bushland area there is limited need for provision of formal crossing points. As described in Section 5.3.14 of the EIS and Section 5.4.2 of this report, the project provides crossing points for pedestrians and cyclists at the following locations:

- Proposed new shared path bridge (Bridge 7) over Newcastle Road near Steel Street
- Northern interchange (via the Jesmond Park grade separated shared path refined design and at-grade traffic light controlled crossings)
- Hospital interchange shared path overbridge
- Proposed McCaffrey Drive shared path
- Lookout Road and McCaffrey Drive intersection (via traffic light controlled crossings).

The project would also result in a number of the existing trails used for informal access between the John Hunter Hospital precinct and residential areas to the west being permanently severed. Formal access across the project would be provided via a shared path at the hospital interchange and informal access for bushwalkers would be available under Bridge 4. As stated in section 10.5 of the EIS, during detailed design, Roads and Maritime will investigate the feasibility of an additional pedestrian access point across the proposed road corridor in the bushland area in consultation with nearby landowners, in order to provide improved connectivity between the hospital precinct and residential areas to the west.

The provision of pedestrian/cyclist networks near to, but beyond the extent of the project which would join with the connections provided by the project, is the responsibility of Newcastle City Council and NSW Health Infrastructure (within the John Hunter Hospital precinct).

The existing path linking the Jesmond Park shared path to the John Hunter Hospital precinct is the responsibility of Newcastle City Council and any improvements are beyond the scope of the project.

4.8.2 Bushland access

Submission numbers

3, 5, 15, 129, 149, 154, 156

Issue description

In summary, the respondents raised the following issues:

- Commented construction will impact access to the bushland area and management measures are required to minimise the impact
- The existing tracks in the bushland area are not appropriate for pedestrians and cyclists and an additional shared path and bridge should be provided between the John Hunter Hospital precinct and residential areas to the west
- Noted the bushland area is highly utilised for recreational purposes. Suggested additional crossing points are required and requested information on how the project will reinstate connections between the tracks in the bushland area and provide connectivity for recreational activities
- The project will impact the Bicentennial walking trail in the bushland area which was constructed by Newcastle City Council. The EIS is incorrect in stating the trail partially uses informal tracks. The project should incorporate the preservation of the trail and its unique features and this has not been considered in the EIS.

Response

Potential impacts to fire trails and informal tracks throughout the bushland area are assessed in Chapters 8 and 11 of the EIS. As stated in the EIS, these are used for pedestrian access between the John Hunter Hospital precinct and the residential areas to the west and for recreational bushwalking and mountain bike riding.

In the limits of the construction footprint, all east–west access across the project in the bushland area would be closed for the duration of construction (around 30 months) for safety reasons. A fence would be erected to exclude people and animals.

Access for pedestrians and cyclists between the western and eastern sides of the project would be available via the new shared path bridge (Bridge 7) over Newcastle Road near Steel Street (which would be constructed as early work), Coles Street and the existing shared path bridge over the Jesmond to Shortland section of the Newcastle Inner City Bypass. Access for on-road cyclists would also be available through the northern interchange during construction. Access would also be available on the northern side of McCaffrey Drive. It is also proposed to provide pedestrian and cyclist access across the construction footprint on the southern side of Newcastle Road for limited periods of time where safe and practical to do so. However, for safety reasons this access would not be available for extended periods as it would be located beneath bridge construction activities and would conflict with proposed construction traffic access to the site.

Access to bushland areas outside the construction footprint would not be affected.

The project would provide connections to the fire trails for emergency access as discussed in Chapters 5 and 19 of the EIS. However, any further improvements to the existing trails or tracks for recreational or other purposes beyond the limits of the project would be the responsibility of the landowner such as Newcastle City Council.

The project would include permanent operational fencing to exclude people and animals from the road for safety reasons. The fencing would be located as close as possible to the new road infrastructure to minimise the need to clear additional vegetation outside the construction footprint. This may enable ongoing recreational use of the surrounding bushland, even though it may be located within the proposed road corridor for the project.

The project would also result in a number of the existing trails which are used for informal access between the John Hunter Hospital precinct and residential areas to the west being permanently severed. Formal access across the project would be provided via a shared path at the hospital interchange and informal access for bushwalkers would be available under Bridge 4. As stated in Section 10.5 of the EIS, during detailed design, Roads and Maritime will investigate the feasibility of an additional pedestrian access point across the proposed road corridor in the bushland area in consultation with nearby landowners, in order to provide improved connectivity between the hospital precinct and residential areas to the west.

Roads and Maritime acknowledges the description provided in Section 11.2.2 of the EIS was incorrect and the Bicentennial walking trail originally consisted of constructed tracks. As stated in Sections 11.3.2 and 11.4 of the EIS the project would partially impact the western extent of the Bicentennial walking trail and Roads and Maritime will carry out further consultation with Newcastle City Council during detailed design to identify if modification to the trail is required.

4.8.3 Interchanges

Submission numbers

67, 130, 135

Issue description

In summary, the respondents raised the following issues:

Hospital interchange

- In relation to the hospital interchange:
  - Expressed safety concerns with pedestrian and cyclists having to cross the southbound off-ramp and suggested the crossing needs to be controlled
  - Commented the shared path should be connected to additional facilities in the John Hunter Hospital precinct
  - Bicycle NSW is concerned about the safety of pedestrians and cyclists at the southbound off-ramp and consider the crossing should be controlled
  - Newcastle Cycleways Movement supports the provision of a shared path at the hospital interchange however:
    - The crossing of the southbound off-ramp needs to be controlled
    - The shared path width of 2.5 metres is not wide enough for fire trucks and a protective barrier should be provided

Southern interchange

- In relation to the southern interchange:
  - Expressed safety concerns for southbound and northbound on-road cyclists having to cross traffic lanes and suggested separated facilities should be provided
  - Bicycle NSW support the proposed amendments to the southern interchange outlined in the briefing by Roads and Maritime and consider these should be included in the detailed design
  - Newcastle Cycleways Movement noted northbound on-road cyclists using the bypass will need to cross two lanes of traffic to continue north. Suggested provision of a separated slip lane for cyclists to address this safety issue.
  - Newcastle Cycleways Movement also suggested provision of an off-road connection to the southern side of McCaffrey Drive
  - Newcastle Cycleways Movement noted southbound on-road cyclists using the bypass will need to cross two lanes of traffic to continue south. Suggested provision of a refuge in the tapering island and a ramp to ensure cyclists can get off Lookout Road, and onto the shared path

Lookout Road

- At Lookout Road:
  - Newcastle Cycleways Movement supports the proposed shared path on the eastern side of Lookout Road however:
    - It should be extended to the north and address cyclist access issues at the intersection of Carrington Parade and Lookout Road
    - It should be extended to the south to connect with the existing Grinsell Street shared path
    - The gates at the Blackbutt Reserve carpark are locked at night and prevent free bicycle access to the north and this should be resolved

McCaffrey Drive

- At McCaffrey Drive:
  - Newcastle Cycleways Movement commented the proposed footpath over Bridge 2 should be a shared path to connect to the proposed Lookout Road shared path. It should also include a protection barrier between vehicle traffic and the shared path

Lookout Road and McCaffrey Drive intersection

- At the Lookout Road and McCaffrey Drive intersection:
  - Newcastle Cycleways Movement noted Figure 5-4 of the EIS did not show the traffic light controlled crossing points at the intersection of Lookout Road and McCaffrey Drive as being a shared path connection which is the case for the existing southern crossing.

Response

Hospital interchange

As discussed in Section 5.3.5 of the EIS the crossing of the southbound off-ramp at the hospital interchange was designed in accordance with *Guide to Road Design* (Austroads 2009) and *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005). These guidelines do not require the crossing point to be traffic light controlled taking into consideration factors such as the low speed environment (50 kilometre per hour) and sight distances for drivers and pedestrians/cyclists. However, in response to submissions, Roads and Maritime has refined the design as discussed in Section 5.4.2, and the crossing would now be controlled by traffic lights.

The shared path at the hospital interchange is proposed to be three metres wide, consistent with other shared paths provided by the project. Where the shared path crosses over the bypass on Bridge 3 a one metre wide shoulder and barrier kerb is provided to separate the eastbound travel lane and shared path in this low speed environment.

West of the hospital interchange, where the shared path forms part of the fire trail network the path width would be in accordance Fire and Rescue NSW requirements, with continued consultation to occur in detailed design.

Southern interchange

At the southern interchange, the movement of southbound cyclists on the bypass across Lookout Road was proposed to be provided informally via the new traffic lights whereby the traffic on Lookout Road would be at a stop when cyclists are crossing with the southbound bypass traffic. The design has now been refined and a formalised traffic light controlled cyclist crossing (one way only from west to east) would be provided across Lookout Road. This would enable on-road cyclists to access the road shoulder of Lookout Road to remain on-road, or access the proposed shared path on the eastern side of Lookout Road as discussed in Section 5.4.2. All on-road cyclists on the bypass would be required to cross at this location, avoiding potential for conflict with southbound traffic on Lookout Road.

For northbound cyclists it was proposed they would cross the traffic lanes entering the northbound flyover with suitable measures to be developed during detailed design in accordance with *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005). In response to submissions, the design has now been refined to provide a separated northbound cycleway connection (one way only) between Lookout Road and the bypass as discussed in Section 5.4.2.

In accordance with the *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005), appropriate facilities, such as ramps, would be provided for cyclists at road edges as required to enable access to existing and proposed shared paths.

The additional provision of an off-road connection to McCaffrey Drive is beyond the scope of the project. Cyclists can use the existing intersection with Lookout Road to access McCaffrey Drive.

As stated in Section 8.3.2 of the EIS, provision for cyclists to cross on-ramps and off-ramps at the interchanges would be provided in accordance with *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005).

Lookout Road

The proposed shared path on the eastern side of Lookout Road would end at the entry to Blackbutt Reserve carpark where it would connect with the existing footpath. There is also an existing off-road (unpaved) connection via the Blackbutt Reserve carpark to the existing underpass beneath Lookout Road. While it is noted the gates to the carpark are locked at night, Roads and Maritime understand Newcastle City Council is currently investigating options to provide a formal shared path connection in this area. As stated in Section 6.3.2 of the EIS, further extension of the shared path network is beyond the scope of the project.

McCaffrey Drive

The pedestrian footpath on the northern side of McCaffrey Drive would now be replaced with a shared path for use by both pedestrians and cyclists as discussed in Section 5.4.2. Where the shared path crosses over the bypass on Bridge 2 a barrier kerb is provided to separate the left turn lane and shared path in this low speed environment.

Lookout Road and McCaffrey Drive intersection

As stated in Section 8.3.2 of the EIS, the existing traffic light controlled pedestrian crossing on the southern and western sides of the Lookout Road and McCaffrey Drive intersection would be removed. These crossings are no longer required as they mainly service properties on the south-west side of the intersection, which would be removed by the project. The existing traffic light controlled pedestrian crossing on the northern side of the intersection would be retained.

Following exhibition of the EIS, receipt of submissions and further consultation with stakeholders, it was noted the existing southern crossing functions as a shared path crossing for pedestrians and cyclists. As a result, the design has been refined and the retained northern crossing of Lookout Road and the left turn lane out of McCaffrey Drive would be a shared path crossing controlled by traffic lights (Section 5.4.2).

4.8.4 Jesmond Park shared path

Submission numbers

7, 8, 11, 12, 13, 14, 18, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31, 33, 34, 35, 36, 37, 38, 39, 41, 43, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 63, 65, 67, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 83, 84, 85, 86, 95, 96, 97, 98, 99, 100, 101, 102, 105, 107, 108, 110, 111, 112, 114, 115, 116, 117, 118, 119, 124, 129, 130, 131, 132, 133, 135, 137, 140, 141, 143, 144, 147, 148, 149, 150, 152, 154, 156, 158, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172

Issue description

In summary, the respondents raised the following issues:

- A number raised concerns with the severance of the Jesmond Park shared path and the need for pedestrians and cyclists to use three sets of traffic lights to cross the project including:
  - Safety concerns with pedestrians and cyclists having to cross three sets of traffic lights
  - It will discourage people from cycling
  - It will sever the two city loop around Newcastle and Lake Macquarie and open space connections
  - It will increase the risk of crashes at the traffic lights
  - It will encourage risk taking behaviour by pedestrians, cyclists and motorists
  - It will lead to more cyclists remaining on Newcastle Road increasing the risk of an accident and increasing delays for motorists
  - It will result in unnecessary delays to motorists at the traffic lights
  - It will have a negative effect on community amenity and health
- A number of suggested alternatives to the proposed design including:
  - A bridge over the interchange ramps before either passing beneath the bridge over Newcastle Road or beneath the bypass via a tunnel
  - Modified designs for an overpass with reduced grades
  - A bridge over the bypass and/or ramps further to the south
- Commented that Roads and Maritime has not consulted with Newcastle City Council, Lake Macquarie City Council or other cycling groups regarding the importance of the shared path in Jesmond Park
- Considers it would be cheaper to construct a grade separated crossing now
- Bicycle NSW supports the proposed amendments to the Jesmond Park shared path outlined in the briefing by Roads and Maritime
- Newcastle Cycleways Movement supports the proposed amendments to the Jesmond Park shared path outlined in the briefing by Roads and Maritime but would prefer it connect with Illoura Street rather than Newcastle Road to provide for improved access for cyclists
- Requested clarification on how access to the shared path will be maintained during construction.

Response

During and following exhibition of the EIS, receipt of submissions and further consultation with Hunter Cycling Forum (which includes Newcastle City Council and other cycling groups), Roads and Maritime has refined the design for the Jesmond Park shared path to provide a grade separated crossing for both pedestrians and cyclists as discussed in Section 5.4.2. The project would now provide an overpass bridge (Bridge 8) and underpass arrangement so pedestrians and cyclists do not need to cross the project via traffic lights. This would provide access to the Newcastle Road and Blue Gum Road intersection via Illoura Street. Crossing points would still be provided at the traffic lights as described in the EIS.

During construction, the existing Jesmond Park shared path would be closed within the construction footprint. Access for pedestrians and cyclists between the western and eastern sides of the project would be available via the new shared path bridge (Bridge 7) over Newcastle Road near Steel Street (which would be constructed as early work), Coles Street and the existing shared path bridge over the Jesmond to Shortland section of the Newcastle Inner City Bypass. Access for on-road cyclists would also be available through the northern interchange during construction.

It is also proposed to provide pedestrian and cyclist access across the construction footprint on the southern side of Newcastle Road for limited periods of time where safe and practical to do so. However, for safety reasons this access would not be available for extended periods as it would be located beneath bridge construction activities and would conflict with proposed construction traffic access to the site.

The proposed new overpass bridge (Bridge 8) and underpass arrangement for the Jesmond Park shared path (Section 5.4.2) would be constructed and open for use as soon as practicable. However, for safety reasons this cannot occur until major construction activities, including compound operations, in the immediate area are completed.

4.8.5 Parallel cycleway

Submission numbers

4, 22, 46, 78, 79, 84, 97, 114, 130, 135, 137, 150

Issue description

In summary, the respondents raised the following issues:

- A dedicated off-road cycleway should be provided along the length of the bypass
- The project should include a parallel cycleway between the existing shared path on the eastern side of the existing Jesmond to Shortland section of the Newcastle Inner City Bypass through to McCaffrey Drive. In the bushland area the path should be located as far as possible from the bypass.

Response

The project includes provision for pedestrians and cyclists as discussed in Section 5.3.14 of the EIS and Section 5.4.2 of this report. This includes new and upgraded facilities which would link with existing facilities and provide for north-south movements between Lookout Road and the existing Jesmond to Shortland section of the Newcastle Inner City Bypass as follows:

- Lookout Road (eastern side) – new shared path from the Blackbutt Reserve car park opposite Grandview Road to Ridgeway Road, linking via traffic light controlled crossings to the main entrance of the John Hunter Hospital precinct (Kookaburra Circuit)
- John Hunter Hospital precinct (Kookaburra Circuit) – existing on-road cyclist provisions connect to the existing shared path that links the John Hunter Hospital precinct to the existing east-west Jesmond Park shared path
- Jesmond Park (eastern end) – a new section of shared path between the existing east-west Jesmond Park shared path and the new shared path bridge over Newcastle Road (Bridge 7)
- Newcastle Road (east of the northern interchange) – new shared path bridge (Bridge 7) over Newcastle Road to the west of Steel Street replacing the existing mid-block traffic controlled pedestrian crossing on Newcastle Road, near Hill Street. The shared path bridge would be linked to the existing off-road facilities on either side of Newcastle Road
- Coles Street – a new section of on-road cycleway and a new pedestrian footpath would be constructed along Coles Street (northern side). This would connect the new shared path bridge over Newcastle Road (Bridge 7) with the existing shared path on the eastern side of the Jesmond to Shortland section of the Newcastle Inner City Bypass which runs to The University of Newcastle. It also connect with the existing east-west shared path bridge over the Jesmond to Shortland section of the Newcastle Inner City Bypass, linking to Stockland Jesmond Shopping Centre.

In addition the project provides:

- Northern interchange – the existing east-west Jesmond Park shared path would now be grade separated via an overpass bridge (Bridge 8) and underpass arrangement (Section 5.4.2) linking with the existing shared path near the northern end of Victory Parade. This will provide access to the Newcastle Road and Blue Gum Road intersection via Illoura Street. Crossing points would still be provided at the traffic lights as described in the EIS.

Cyclists would also be able to use the road shoulder of the bypass for north-south movements. At the southern interchange a new northbound cycleway connection (one way only from west to east) would be provided for northbound on-road cyclists between Lookout Road and the bypass (Section 5.4.2). For southbound cyclists, a traffic light controlled (one way only, west to east) cyclist crossing would now be provided across Lookout Road to enable on-road cyclists to access the road shoulder of Lookout Road to remain on-road or access the proposed shared path on the eastern side of Lookout Road.

A separated shared path, similar to the one provided along the M7 Motorway in Sydney, is beyond the scope of the project and was not considered necessary:

- Due to the combination of new and existing facilities which provide for north-south movements as described above
- It would require additional clearing of native vegetation in the bushland area, including if it were located immediately next to the bypass.

4.8.6 Shared path bridge (Newcastle Road)

Submission numbers

12, 19, 30, 31, 60, 67, 79, 107, 110, 135, 143, 147, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172

Issue description

In summary, the respondents raised the following issues:

- Support the provision of a shared path bridge over Newcastle Road
- Requested clarification if the shared path bridge over Newcastle Road would be wheelchair friendly and available for use by cyclists
- Newcastle Cycleways Movement supports the shared path bridge over Newcastle Road near Steel Street. However, Newcastle Cycleways Movement is concerned about the proposed connection to the existing shared path in Jesmond Park as the existing paths do not meet Austroads standards.

Response

Section 5.3.7 of the EIS provides a description of the proposed shared path bridge over Newcastle Road near Steel Street. The bridge would be suitable for use by pedestrians, cyclists and the mobility impaired.

The project would include upgrades to the existing paths for the connection of the new shared path bridge to the Jesmond Park shared path, to ensure they comply with relevant standards as described in Section 5.4.2.

4.9 Noise and vibration

4.9.1 Assessment

Submission numbers

139

Issue description

In summary, the respondent raised the following issues:

Relevant guidelines/criteria

- The EIS does not adequately assess potential impacts to the music business which should be classified as a "music studio" in accordance with the NSW government *Construction Noise Strategy* (Transport for NSW 2012) and appropriate criteria applied in accordance with *AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors* (Standards Australia 2016)

- The EIS is inconsistent as it refers to the residence/business as both a residential and commercial receiver.

Noise monitoring

- The noise monitoring was not carried out in accordance with the *Noise Criteria Guideline* (Roads and Maritime 2015d) as seven of the loggers were only deployed for six days (not seven days in addition to deployment and retrieval days)
- There are issues with the noise logging charts:
  - For some serial numbers are not provided
  - Some have data after the supposed last day of monitoring (17 June 2015)
  - Some have more data removed for adverse weather conditions than others and given the expected similar meteorological conditions this is not explained
- The noise model validation is not in accordance with the Roads and Maritime *Model Validation Guideline*, which states the validation results should typically be within +/-1.5 dB of measured results when the receiver is less than 30 metres from the road. Loggers L17 and L20 were both within 30 metres of the road and both have level differences greater than 1.5 dB. This has not been accounted for in the modelling
- Photographs of noise monitoring locations are not provided as is typical for noise reports for large projects
- The noise monitoring should have included specific readings and subsequent modelling for the time period when the business operates (weekdays between 11am and 7pm) and for a long enough number of days to obtain a valid data set. Requested specific noise monitoring and valid modelling.

Noise assessment

- In addition to the business being adversely affected by average sound levels, it will be adversely affected by intermittent noise as well

Noise modelling/mitigation

- Due to these issues with the noise assessment the noise monitoring and modelling is not adequate and as such, the respondent requested:
  - Recalculation of the noise and vibration exceedances for the business for both construction and operation
  - Consultation to achieve a suitable solution for both Roads and Maritime and the business owners
  - Mitigation procedures, including erection of sound barriers and at-property adjustments to the building. These mitigation measures would have to be implemented before construction to reduce noise both during construction and during operation.

Response

Relevant guidelines/criteria

The noise and vibration assessment (GHD 2016b, Appendix G of the EIS) carried out a comprehensive assessment of potential noise and vibration impacts to surrounding receivers. The results of the assessment are summarised in Chapter 9 of the EIS.

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

The assessment was carried out in accordance with the SEARs and the following:

- *Road Noise Policy* (DECCW 2011)
- *Noise Criteria Guideline* (Roads and Maritime 2015d)
- *Noise Mitigation Guideline* (Roads and Maritime 2015a)
- *Industrial Noise Policy* (EPA 2000a)

- *Construction Noise and Vibration Guideline* (Roads and Maritime 2016d)
- *Interim Construction Noise Guideline* (DECC 2009)
- *Assessing Vibration: A Technical Guideline* (DEC 2006)
- *Environmental Noise Management Manual* (RTA 2001).

The *Construction Noise Strategy* (Transport for NSW 2012) only applies to the assessment and management of construction noise and vibration for projects carried out by or on behalf of Transport for NSW.

For Roads and Maritime projects, the assessment and management of noise and vibration during both construction and vibration is carried out in accordance with the *Construction Noise and Vibration Guideline* (Roads and Maritime 2016d) during construction and the *Noise Criteria Guideline* (Roads and Maritime 2015d) and *Noise Mitigation Guideline* (Roads and Maritime 2015a) during operation. These Roads and Maritime guidelines refer to other guidelines as relevant.

The Roads and Maritime guidelines do not rely upon *AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors* (Standards Australia 2016) for the establishment of project criteria. However, it is noted the *Road Noise Policy* (DECCW 2011) does, in the absence of any other guideline, use the recommended operational noise criteria from AS/NZS 2107 (year 2000 version) for hospitals and classrooms. It should also be noted the recent 2016 revision of AS/NZS 2107 now explicitly states it should not be used for construction noise such as jackhammers and pile-drivers or road traffic noise.

As stated in Section 9.2.2 of the EIS, in accordance with the *Noise Criteria Guideline* (Roads and Maritime 2015d) and *Road Noise Policy* (DECCW 2011), for Roads and Maritime projects receivers are categorised based on sensitivity to noise as follows:
- Sensitive receivers (residential)
- Sensitive receivers (non-residential) – includes recreation areas, educational facilities (eg schools), childcare facilities, places of worship (churches), health facilities (eg hospitals) and community facilities (eg community halls)
- Commercial/industrial receivers – places of business, motels and other accommodation facilities, shops and industrial facilities.

As the home music business is located within a residential premises, the EIS assessed it as both a residential and commercial receiver throughout all relevant sections of the EIS. However, following exhibition of the EIS, Roads and Maritime has carried out further investigations and identified the home music business cannot be classified as a commercial receiver as commercial businesses are prohibited in the land zoning under the Newcastle Local Environment Plan 2012 (Newcastle LEP). Under the Newcastle LEP definitions, the home music business may satisfy home occupation criteria provided it meets requirements including not interfering with the amenity of the neighborhood by reason of noise and/or traffic generation. As such, it is now classified as a home occupation and is not considered further as a commercial receiver. The building is still considered a residential receiver and has been assessed as such. Consistent with the EIS, specific measures that will be implemented for all sensitive receivers including the home occupation activity, will include:
- Further consultation during detailed design
- Further consultation during pre-construction including during development of the construction environmental management plan, construction noise and vibration management plan and construction traffic management plan
- Notifications and further consultation during construction
- Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario (to be confirmed during detailed design) before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

Noise monitoring

As discussed in Section 2.3 of the noise and vibration assessment (GHD 2016b, Appendix G of the EIS) noise monitoring was carried out at 24 locations in the study area to define the existing noise environment. The collection of seven days of logged data is a guideline for noise monitoring and is not a mandatory requirement. Monitoring for less than this period is considered acceptable if the noise can be shown to be representative of the environment, particularly for locations with regular daily patterns of noise sources, such as road traffic noise. The *Industrial Noise Policy* (EPA 2000), which is used as a guide for noise monitoring procedures, notes "*In areas where the background noise levels are affected significantly by nearby road traffic with regular daily pattern, three days' worth of valid data may be sufficient.*"

Loggers L14, L18, L20 and L21 were incorrectly labelled in Table 2-3 of the noise and vibration assessment (GHD 2016b, Appendix G of the EIS) as being retrieved on 17 June 2015. These loggers were retrieved on 25 June 2015, representing nine days of logging inclusive of both deployment and retrieval days and are therefore compliant with the *Noise Criteria Guideline* (Roads and Maritime 2015d) and *Industrial Noise Policy* (EPA 2000).

Logger L19 was deployed on the 12 June 2015 and retrieved on 17 June 2015, representing seven days of logging inclusive of both deployment and retrieval days and is therefore compliant with the *Noise Criteria Guideline* (Roads and Maritime 2015d) and *Industrial Noise Policy* (EPA 2000).

Logger L17 was initially deployed on 12 June 2015 but was relocated on 17 June 2016 for security reasons. This logger was re-deployed as L24 at a nearby location and was retrieved on 26 June 2015 providing for 10 days of logging at the new location inclusive of both deployment and retrieval days and is therefore compliant with the *Noise Criteria Guideline* (Roads and Maritime 2015d) and *Industrial Noise Policy* (EPA 2000). Table 3-6 of the noise and vibration assessment (GHD 2016b, Appendix G of the EIS) notes less than seven days of data was recorded at L17.

Correct dates for all loggers have now been included in the updated noise and vibration assessment (GHD 2018b) provided in Appendix D.

It is acknowledged some of the logging charts provided in the appendix to the noise and vibration assessment (GHD 2016b, Appendix G of the EIS) did not include serial numbers. This was a report production error. The logging charts have now been updated to include serial numbers in the updated noise and vibration assessment (GHD 2018b) provided in Appendix D.

In addition to data exclusions caused by adverse weather, a number of data samples caused by extraneous events which were not road traffic were identified and these results were excluded. This is the cause of the apparent discrepancies between the logger charts.

The Roads and Maritime *Model Validation Guideline* notes "*Random scatter within +/-2.0 dBA and values that are of similar magnitude but opposite sign. Any random discrepancies outside of +/-2.0 dBA should be accounted for. Free field loggers within 30 m of the road and with unobstructed view to the road/tyre interface with an angle of view of around 150 degrees are regularly within +-1.5 dBA.*"

The loggers were within 2 dB(A) of model predictions (as noted in Table 3-6 of the noise and vibration assessment (GHD 2016b, Appendix G of the EIS)) and therefore fall within the validation tolerances of the Roads and Maritime *Model Validation Guideline*.

Logger photos are not required in Roads and Maritime noise reports to improve readability.

As discussed in the preceding section, noise monitoring was carried out at 24 locations in the study area to define the existing noise environment. The monitoring was carried out in accordance with the *Noise Criteria Guideline* (Roads and Maritime 2015d) and *Industrial Noise Policy* (EPA 2000). The loggers collected data 24 hours a day. As such, the assessment has adequately addressed

the hours of operation of the home occupation activity within the residence on Lookout Road and no further specific monitoring or modelling is required.

Noise assessment

The construction noise assessment (Section 9.4.1 and Appendix G (GHD 2016b) of the EIS) has considered the potential impacts associated with a range of construction activities and typical construction equipment. Most construction activities would generate intermittent noise and this has been included in the modelling.

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

Construction equipment would likely move about the site altering noise impacts with respect to the identified receivers. During any given period, construction equipment would operate at maximum sound power levels for only brief stages. At other times, the machinery would produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely all construction equipment would be operating at their maximum sound power levels at any one time. Certain types of construction equipment would only be present in the construction footprint near receivers for brief periods during construction activities.

The construction noise is assessed assuming the two loudest pieces of construction equipment are operational concurrently for each construction phase scenario. This is considered a worst case scenario. The magnitude of the off-site noise impact associated with construction activities would be dependent upon a number of factors:

- The intensity and location of construction activities
- The type of equipment used
- Existing local noise sources
- Intervening terrain
- The prevailing weather conditions

Due to the existing and predicted high volumes of traffic on roads near to the project any consideration of intermittent road traffic noise is not relevant.

As a result, the assessment has adequately considered intermittent noise sources in accordance with the relevant guidelines.

Further discussion regarding construction noise impacts is provided in Section 4.9.2.

Noise modelling/mitigation

As discussed in the previous sections the assessment has been carried out in accordance with the relevant guidelines and additional assessment is not required for the residence or home occupation.

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

Consistent with the EIS, the updated noise and vibration assessment identifies a preliminary mitigation scenario. Selection of the noise mitigation option, or combination of options, is carried out where feasible and reasonable in accordance with the *Noise Mitigation Guideline* (Roads and Maritime 2015a).

The feasible and reasonable assessment identified noise barriers were not feasible or reasonable for this residence located on Lookout Road. As such, the building has been identified for at-property treatment.

As stated in Section 9.5 of the EIS, the noise assessment and preliminary mitigation scenario will be re-evaluated at the detailed design stage and is subject to change. This may result in more or less receivers qualifying for consideration of noise mitigation. This will take into account any further refinement of the design and where required, feedback from consultation with affected residents. Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

Section 9.5 of the EIS identifies a range of management measures which will be implemented during construction to address the potential impacts of construction noise and vibration. Further discussion regarding construction noise and vibration impacts is provided in Section 4.9.2.

4.9.2 Construction noise and vibration

Submission numbers

14, 44, 75, 139, 149, 158

Issue description

In summary, the respondents raised the following issues:

Construction noise

- Concerned about the potential impacts of the northbound off-ramp at the northern interchange on residences in Birchgrove Drive and requested further information on what measures will be implemented to address construction noise impacts
- Concerned about the impacts of construction noise at night time on residences close to the northern interchange and in the John Hunter Hospital precinct
- The EIS predicts exceedance of sleep disturbance criteria at the residence
- The EIS predicts construction noise levels will exceed the criteria for commercial receivers. As the business has been incorrectly classified as a commercial/industrial receiver, the construction noise levels proposed are far in excess of what the business can tolerate
- Commented the project incorporates features and management measures to minimise noise pollution and further consideration is required for noise monitoring and the use of non-tonal reversing alarms
- Commented construction activities would result in increased noise levels and the construction phase should use practices to minimise impacts to the environment such as:
  - Turning off machinery when not in use
  - Positioning stationary machinery away from residential areas
  - Lowering the sound of or removing reversing beepers of machinery, investigation of methods to keep a safe worksite without polluting the environment with constant loud beepers
  - Equipment should be stored in compounds away from residential areas
  - Regular noise monitoring during the construction phase and taking corrective action where it approaches unacceptable levels

Early work assessment

- The EIS did not include the removal of the rock shelf as early work so there will be more exceedances than predicted in the EIS. Requested noise attenuation such as window glazing and air conditioning for the residence and music studios

Construction hours

- Suggested all construction activities at the northern interchange could be conducted during the day time to avoid sleep disturbance

Construction vibration

- The proposed northbound off-ramp at the northern interchange will result in possible property damage
- The EIS Overview did not state who will be responsible for any damaged caused by construction vibration. The property is in a mine subsidence area and could be subjected to damage to homes, retaining walls, bridges and roads.
- The EIS did not identify musical equipment as sensitive equipment which may be impacted by construction vibration and should have identified appropriate buffer distances
- The EIS did not assess the potential construction vibration impacts associated with removal of the rock shelf near the residence which is proposed as part of early work. There is also no information as to what hours these works would be carried out
- The removal of the rock shelf will generate more than intermittent vibration and this has not been assessed
- The EIS has used incorrect guidelines for human comfort for construction vibration. The assessment used *BS 5228.2 Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration* (British Standards 2009). The current correct standard should be *AS 2670.1 – 2001 Evaluation of human exposure to whole-body vibration Part: General requirements* (incorporating Amendment No. 1, reconfirmed 2016) (Standards Australia 2013). The new standard identifies human discomfort reaction would occur at much lower levels than those identified in the EIS
- The respondent requested confirmation that the water main in Lookout Road would not be relocated within the easement in their property due to potential construction vibration impacts
- The respondent requested confirmation that there would be no blasting near Lookout Road
- The respondent noted the EIS identifies their residence as being located within a zone for potential building damage associated with construction vibration and due to existing insulation controls, any damage would need to be repaired to the same standard
- The respondent requested further consultation and confirmation the removal of the rock shelf would not adversely impact their home occupation activity, conduct of a property condition survey before construction and vibration monitoring during construction.

Construction noise mitigation

- Construction noise will severely impact the business and requested further consultation and treatment of the property to mitigate construction noise

Response

Construction noise

Potential construction noise impacts are assessed in Section 9.4.1 of the EIS and the noise and vibration assessment (GHD 2016b, Appendix G of the EIS).

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

The assessment identified during construction there will be exceedances of the construction noise management levels for a number of sensitive receivers in the study area. The assessment also identified a number of construction activities could exceed the *Road Noise Policy* sleep disturbance levels.

Refer to Section 4.9.1 for discussion regarding the classification of the home occupation activity within the residence on Lookout Road.

Section 9.5 of the EIS proposes a range of environmental management measures to address the identified potential construction noise impacts including preparation of a construction noise and vibration management plan as part of the construction environmental management plan.

Early work assessment

Section 9.4.1 of the EIS and Section 4 of the noise and vibration assessment (GHD 2016b, Appendix G of the EIS) provides an assessment of potential noise impacts during construction of the project. The assessment considered 22 typical construction activities as detailed in Table 9-15 of the EIS which are expected to be carried out during construction of the project.

The proposed early work activities identified in Section 5.5.2 of the EIS (and updated in Section 5.5.13 of this report) would comprise various combinations of the typical construction activities listed in Table 9-15 of the EIS. As such, there is no separate assessment of the early work.

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The supplementary construction noise and vibration assessment includes rock breaking on Lookout Road. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

Construction hours

As discussed in Section 5.4.4 of the EIS, Roads and Maritime is seeking approval for proposed extended construction hours in accordance with the considerations in the *Interim Construction Noise Guideline* (Department of Environment and Climate Change 2009). If approved this would permit construction activities between the hours of 6am to 7pm (Monday to Friday), 7am to 5pm (Saturday) and no work on Sundays or public holidays.

Following exhibition of the EIS, receipt of submissions, further review of constructability issues for the project and consultation with DP&E, Roads and Maritime has refined the approach to the proposed extended construction hours as detailed in Section 5.4.5. The refined approach would limit construction activities carried out in the weekday extended morning hours to those which do not result in noise levels above the relevant construction noise management level at the nearest affected sensitive residential receiver.

The proposed extended construction hours would result in significant benefits to the greater community, including:

- An overall construction period reduction by three to four months
- Reduced duration of disruptions to road users, particularly on McCaffrey Drive, Lookout Road, Croudace Street and Newcastle Road
- Reduced duration of public's exposure to changed traffic conditions and interaction with construction traffic
- Reduced timeframe of exposure of surrounding sensitive receivers, in particular the John Hunter Hospital precinct, to construction noise, vibration and dust
- Earlier completion of the project and improved traffic and safety performance.

The *Interim Construction Noise Guideline* also recognises there are some situations where specific construction work may need to be carried out outside of the recommended standard construction hours. The following are the categories of work which might be carried out outside the recommended standard hours and/or proposed extended construction hours:

- Delivery of oversized plant or structures that the police or other authorities determine require special arrangement to transport along public roads
- Emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- Maintenance and repair of public infrastructure where disruption to essential services and/or considerations of worker safety do not allow work within standard hours
- Work where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours.

In accordance with these considerations, work outside standard construction hours, including night time works, would be required. In particular work in and around the northern and southern interchanges would be required to minimise disruptions to traffic.

Construction vibration

Potential construction vibration impacts were assessed in in Section 9.4.1 of the EIS and the noise and vibration assessment (GHD 2016b, Appendix G of the EIS). Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

The assessment considered a range of typical construction equipment as detailed in Table 9-22 of the EIS which are expected to be used during construction of the project. The assessment identified that during construction, subject to the type and size of equipment used during construction, predicted vibration levels would exceed the structural damage criteria at structures within 18 metres of certain construction activities.

As stated in Section 9.3.4 of the EIS and the noise and vibration assessment (GHD 2016b, Appendix G of the EIS), sensitive equipment is defined in BS 5228.2 *Code of Practice for noise and vibration control on construction and open sites: Part 2 Vibration* (British Standards 2009). The list does not include equipment typically found in the home occupation activity within the residence on Lookout Road.

The proposed early work activities identified in Section 5.5.2 of the EIS (and updated in Section 5.5.13 of this report) would comprise various combinations of the typical construction equipment listed in Table 9-22 of the EIS. As such, there is no separate assessment of the early work.

The updated construction noise and vibration assessment includes rock breaking on Lookout Road. This work may be carried out during standard construction hours, proposed extended hours or out of hours in accordance with Section 5.4.4 of the EIS in order to minimise disruptions to traffic.

Rock breaking meets the definition of intermittent vibration as defined in *Assessing Vibration: A Technical Guideline* (DEC 2006) as *'Intermittent vibration can be defined as interrupted periods of continuous (e.g. a drill) or repeated periods of impulsive vibration (e.g. a pile driver), or continuous vibration that varies significantly in magnitude*.'

Consistent with the EIS, the updated construction vibration assessment (Section 6.4 and Appendix D) has identified that, subject to the equipment used, there would be exceedances of the human comfort levels and structural damage criteria (within 18 metres of certain construction activities), including properties in Lookout Road.

The construction vibration assessment was carried out in accordance with the SEARs, and in particular the EPA approved *Assessing Vibration: A Technical Guideline* (DEC 2006). This guideline references *British Standard (BS) 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)* (British Standards 1993) for the assessment of human response to construction vibration. Further information is also derived from *BS 5228.2 – 2009, Code of Practice for noise and vibration on construction and open sites – Part 2: Vibration* (British Standards 2009).

AS 2670.1 – 2001 Evaluation of human exposure to whole-body vibration Part: General requirements (incorporating Amendment No. 1, reconfirmed 2016) (Standards Australia 2013) is not directly relevant to road construction projects and presents values for human perception in measurement units not directly comparable to those in BS 6472 – 1992 and BS 5228.2 – 2009. It does reference *AS ISO 2631.2 2014 Mechanical vibration and shock - Evaluation of human exposure to whole-body vibration Part 2: Vibration in buildings (1 Hz to 80 Hz)* (Standards Australia 2014b), which does not present any specific criteria, but discusses adverse comment may occur for vibration levels slightly in excess of perception levels, however significantly higher vibration magnitudes can be tolerated in certain situations such as construction projects.

Based on the concept design, it is currently not proposed to relocate the water main within the existing easement through the property on Lookout Road. This would be achieved by construction of a thrust block to the south of the property within the existing easement to enable a right angle turn across Lookout Road. In the event Hunter Water Corporation determine a thrust block is not permitted, then a section of the existing water main located within the existing easement would need to be replaced. This work could result in the generation of construction vibration.

It is currently not proposed to carry out blasting near residences on Lookout Road.

To address potential construction vibration impacts, environmental management measures would be implemented as detailed in Section 9.5 of the EIS including the preparation of a construction noise and vibration management plan as part of the construction environmental management plan. Specific measures will include:

- Building condition surveys will be conducted at receivers (as required) within 18 metres of proposed vibration generating activities (buildings and other structures)
- Notification of the proposed construction activities by letterbox drop will be carried out for all occupied buildings within 18 metres of vibration generating activities
- Where construction work will be located within 18 metres of any buildings vibration monitoring will be carried out at the beginning of the given construction activity. Where measurements indicate building damage criteria are exceeded, vibration generating activities are to immediately halt and alternative low-vibration work practices will be investigated and implemented
- A documented review will be carried out to determine if alternative methods can be implemented, where construction activity involving vibration intensive plant occurs:
  - Within 18 metres of buildings
  - Within the sensitive equipment buffer distances
  - Or if any monitoring indicates levels are excessive.

The construction contractor will be responsible for rectification of any damage caused during construction, which is demonstrated to be due to their (or their sub-contractors) activities.

Construction noise mitigation

Section 9.5 of the EIS identifies a range of management measures which will be implemented during construction to address the potential impacts of construction noise and vibration, including consultation with affected receivers. These include standard construction practices to minimise potential impacts which would be documented in a construction noise and vibration management plan.

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

Consistent with the EIS, the updated noise and vibration assessment identifies a preliminary mitigation scenario. Selection of the noise mitigation option, or combination of options, is carried out where feasible and reasonable in accordance with the *Noise Mitigation Guideline* (Roads and Maritime 2015a).

As stated in Section 9.4.3 of the EIS, the building does qualify for consideration for noise mitigation to address operational noise. As stated in Section 9.5 of the EIS, the noise assessment and preliminary mitigation scenario will be re-evaluated at the detailed design stage and is subject to change. This may result in more or less receivers qualifying for consideration of noise mitigation. This will take into account any further refinement of the design and where required, feedback from consultation with affected residents. Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

4.9.3 Operational noise and vibration

Submission numbers

6, 14, 32, 40, 44, 53, 65, 66, 75, 109, 128, 139, 149, 158

Issue description

In summary, the respondents raised the following issues:

- Raised concerns regarding noise impacts on the hospital precinct
- Raised concerns about potential noise impacts due to the closeness of the southbound off-ramp at the northern interchange to residences. Commented the project does not include any noise barriers or other improvements to address road traffic noise and requested noise mitigation if the design is not amended
- Raised concerns about traffic noise impacts on residences in Birchgrove Drive near the northern interchange and requested clarification the proposed low noise pavement and noise barriers would be retained in the detailed design of the project
- Commented the project does not provide noise barriers for residents of Sygna Close, Dangerfield Drive and Birchgrove Drive localities and these should be built now rather than waiting for post construction monitoring
- Commented the installation of noise barriers on the northbound off-ramp at the northern interchange would not mitigate heavy vehicle noise because the exhausts are elevated
- Suggested the project should retain a vegetated buffer on the north-eastern side of the northern interchange to reduce noise impacts or provide noise barriers and this has not been considered in the EIS
- Suggested noise barriers should be provided on all sides of the northern interchange
- Commented the on and off-ramps at the northern interchange are too close to Jesmond Park and will increase noise
- Concerned the project will result in noise impacts to residences in the Rankin Park area and noise barriers should be installed along Lookout Road
- Noted the residence was not identified as sensitive residential receiver in the EIS
- Commented due to current topography the residence is shielded from the majority of traffic noise from Lookout Road. The demolition of houses and excavation of land in the area around the current Lookout Road and McCaffrey Drive intersection will expose the property to increased traffic noise
- Commented the residence is not exposed to high levels of road traffic noise from Lookout Road due to design features which have been adopted. Expressed concerns about potential increased noise levels from road traffic and heavy vehicle engine (compression) braking and requested noise mitigation
- Commented the project incorporates features and management measures to minimise noise impacts. Further consideration is required for:
  - Existing levels of noise should be measured before construction
  - Minimisation of grades to limit engine noise
  - Excavation of cuttings to place the road below the ground level where close to residences

  - Construction of earth mounds to deflect and absorb noise and vibration
  - Planting of vegetation to absorb noise
  - Erection of noise barriers to minimise road noise
  - Mitigation of residences.
- Following completion of construction periodic monitoring of noise levels should be conducted to ensure the levels fall within design projections and acceptable levels and contingency provided to make any improvements necessary
- Concerned the southbound off-ramp at the northern interchange is too close to residences and will result in vibration causing potential building damage and sleep disturbance.

Response

The noise and vibration assessment (GHD 2016b, Appendix G of the EIS) carried out a comprehensive assessment of potential noise and vibration impacts to surrounding receivers, including the John Hunter Hospital precinct. The results of the assessment are summarised in Chapter 9 of the EIS.

Following exhibition of the EIS and receipt of submissions, additional noise and vibration assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the updated noise and vibration assessment (GHD 2018b) are provided in Section 6.4 and Appendix D.

During development of the concept design presented in the EIS (Chapter 5 of the EIS) road grades were minimised as far as practicable, however due to the steep topography some sections of steeper road grade are required. Where the bypass traverses ridgelines, cuttings are required and these would assist in shielding sensitive receivers from road traffic noise.

The noise modelling takes into account existing and proposed topography. As a result, the future scenarios represent the modified topography due to the project, including cuts and fills. The noise modelling also takes into account existing buildings and including other structures such as fences. Where buildings are proposed to be demolished as part of the project, as is the case for a number located on the western side of Lookout Road near the southern interchange, these have been removed from the model for future scenarios.

Predicted noise levels – John Hunter Hospital precinct

Consistent with the EIS, the updated assessment identifies that during operation the project may exceed the relevant internal noise criteria at some of the buildings in the John Hunter Hospital precinct. Additional detailed noise assessment (including internal and external noise monitoring) would be required at the hospital to determine the transmission loss through the relevant building facades. As stated in Section 9.5 of the EIS, this will be carried out during detailed design.

A review of potential noise mitigation options for the John Hunter Hospital precinct (Section 9.4.3 of the EIS) identified at-property treatments, if required subject to the internal noise monitoring were the only feasible and reasonable measures for these buildings.

Roads and Maritime will continue to liaise with NSW Health Infrastructure and Hunter New England Local Health District regarding potential noise impacts due to the project.

Predicted noise levels – residential and non-residential receivers

The updated assessment identifies that during operation the project may exceed the relevant noise criteria at a number of sensitive residential and non-residential receivers and that of these 49 (including those within the John Hunter Hospital precinct) qualified for consideration for mitigation.

Most of these receivers are situated around the northern interchange with Newcastle Road (noise catchment area NCA2, NCA4 and NCA5). Other receivers are located to the west of the project including receivers in the area of Birchgrove Drive, Minimbah Close and Bellinger Close (NCA6), which are away from existing major roads. Receivers in the John Hunter Hospital precinct (NCA14) and isolated receivers near the southern interchange (NCA13) also qualify for consideration of mitigation measures.

The assessment identified there would be no exceedances of the relevant criteria at other receivers surrounding the project and as a result, consideration of mitigation is not required.

Roads and Maritime acknowledges a number of properties located to the west of the project, in the general vicinity of Atherton Close, Bond Close and Slade Close in the suburbs of Rankin Park and New Lambton Heights were not identified in the EIS as sensitive receivers. These receivers have now been included in the updated assessment and the results are presented in Section 6.4 and Appendix D. The updated assessment identified these receivers do not qualify for consideration for mitigation.

Roads and Maritime acknowledges internal noise levels for individual residences would vary according to building construction materials and orientation. However, in accordance with relevant guidelines the noise assessment is based on external noise levels and monitoring has confirmed residences along Lookout Road are exposed to high levels of existing road traffic noise.

As stated in Section 9.4.2 of the EIS, modelling of potential heavy vehicles engine (compression) braking indicates there could be exceedances in NCA13 due to the northbound flyover. However the incidence of these events is difficult to predict for a new road due to individual vehicle characteristics and driver behaviour. It should also be considered the heavy vehicle percentage on the bypass is predicted to be less than three per cent, which is a low proportion when compared to typical values of 10 per cent or more for highways.

As stated in Section 9.5 of the EIS, during detailed design Roads and Maritime will investigate opportunities to further refine grades where possible and assess the need for installation of signage to limit use of compression brakes by heavy vehicles. A review of L_{Amax} events including heavy vehicle engine (compression) braking would be included in the post construction operational noise assessment.

Predicted noise levels – Jesmond Park

Consistent with the EIS, the updated assessment assessed potential operational noise impacts to recreational areas in the study area, including Jesmond Park. The assessment identified these receivers would experience either no appreciable change (less than 1.1 dB(A) increase), or lower road traffic noise levels in 2030 with construction of the project, when compared to the no build scenario. This is due to the use of a low noise pavement and reduced traffic volumes along some existing roads. Recreational areas located on the existing route of Lookout Road (north of the southern interchange), Croudace Street and Newcastle Road would experience the greatest benefits.

Operational noise mitigation

Consistent with the EIS, the updated assessment provides a detailed assessment of the operational noise mitigation options. The assessment conducted a review of reasonable and feasible measures to mitigate operational noise in accordance with the *Noise Mitigation Guideline* (Roads and Maritime 2015a). Options considered were:

- Low noise road pavement surfaces
- Noise mounds
- Noise barriers (noise walls)
- At-property treatments.

Dense vegetation can provide a small amount of noise mitigation. As noted in *ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation* (ISO 1996), Annex AA.1 Foliage 'foliage of trees and shrubs provides a small amount of attenuation, but only if it is sufficiently dense to completely block the view along the propagation path, i.e. when it is impossible to see a short distance through the foliage.' While standard is applicable for industrial noise, the principles concerning minimal noise attenuation from vegetation are relevant for road traffic noise. Vegetation density is also likely to vary significantly over time depending on seasonal and weather factors. For these reasons, foliage is not a standard measure to mitigate noise from road projects.

Noise barriers were considered as part of the overall noise mitigation for the project. However, based on a reasonable and feasible assessment they are not included in the preliminary noise mitigation scenario to the north-east of the northern interchange due to the reasons stated in Section 3.7.6 of the updated noise and vibration assessment. Sensitive receivers at this location would be subject to consideration for at-property treatments.

The preliminary mitigation scenario for the project is:

- Low noise pavements consisting of stone mastic asphalt for all new pavement areas where feasible
- Construction of Noise Barrier 3 (about three metres high and 437 metres long)
- Construction of Noise Barrier 4 (about 3.5 metres high and 760 metres long)
- At-property treatments for 37 sensitive receivers located:
  - Along the existing Jesmond to Shortland section of the Newcastle Inner City Bypass, to the east and west of the project
  - Along Newcastle Road to the east and west of the project
  - In the John Hunter Hospital precinct
  - On Lookout Road near the southern interchange.

The predicted operational noise levels (Section 9.4.2 of the EIS) includes noise sources from cars and heavy vehicles, including exhaust heights as detailed in Table 3-5 of the noise and vibration assessment (GHD 2016b, Appendix G of the EIS). Noise barriers are designed to reduce the road traffic noise to the relevant criteria as far as is reasonable and feasible. The assessment predicts the noise barriers on the bypass and northbound off-ramp at the northern interchange would adequately mitigate road traffic noise, including heavy vehicles, in 2030.

The noise assessment and preliminary mitigation scenario (including barrier heights and locations) will be re-evaluated at the detailed design stage and is subject to change. This may result in more or less receivers qualifying for consideration of noise mitigation. This will take into account any further refinement of the design and where required, feedback from consultation with affected residents. Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario before, or as soon as possible during construction, to assist with mitigation of construction noise levels (Section 9.4.1 of the EIS).

Post construction noise monitoring

As stated in Section 9.5 of the EIS, to confirm the findings of the assessment a post-construction noise monitoring program (including simultaneous traffic counts) will be carried out within 12 months of project opening once traffic flows have stabilised. Monitoring locations will be selected along the project at/near the monitoring locations carried out in this assessment.

Operational vibration

Section 9.4.2 of the EIS and the noise and vibration assessment (GHD 2016b, Appendix G of the EIS) assessed potential operational vibration impacts associated with the project. Rubber tyres and suspension systems provide vibration isolation between a vehicle mass and the road. The possibility of vibration events is further reduced for smooth (without potholes, cracks, or manhole covers) roads. Therefore, there are no expected operational vibration impacts associated with the project.

4.10 Landscape character and visual impact

4.10.1 Lighting

Submission numbers

139, 149

Issue description

In summary, the respondents raised the following issues:

- Commented the project incorporates features and management measures to minimise light pollution. Further consideration is required for:
  - Existing levels of light pollution should be measured before construction starts
  - Lighting should have minimal light spill to surrounding areas
  - The construction phase should use practices to minimise lighting impacts
  - Monitoring of light pollution during construction and operation and implementation of measures to address issues
- Expressed concerns about lighting impacts during construction works and requested provision of curtains to block construction lighting.

Response

As discussed in Section 5.3.20 of the EIS, lighting of the project would be provided for safety reasons. Lighting is not required on the project alignment, but would be provided at interchanges and associated ramps, Newcastle Road, Lookout Road, McCaffrey Drive and on shared paths, including the shared path bridge (Bridge 7) and overpass bridge (Bridge 8) and underpass arrangement for the Jesmond Park shared path. Lighting would be provided in accordance with *AS/NZS 1158 Lighting for Roads and Public Spaces* (Standards Australia 2010).

Specific property works, such as curtains, are the responsibility of the property owners. As stated in Sections 7.5 and 10.5 of the EIS, in order to minimise potential impacts of lighting to local fauna and visual amenity, where safe and practicable to do so the following would be implemented:

- All permanent lighting will be designed to minimise light spill to surrounding habitat as far as practicable
- Down-lights and motion sensor lighting will be used where possible during construction in order to reduce light spill
- Construction lighting will be located to minimise potential impacts to surrounding residents.

The CEMP will include procedures for the management of complaints during construction including complaints about construction lighting.

During operation, Roads and Maritime operating and maintenance procedures would ensure all lighting is operating effectively.

4.10.2 Visual amenity

Submission numbers

6, 14, 32, 53, 128, 139, 149, 158, 173

Issue description

In summary, the respondents raised the following issues:

- Raised concerns regarding the loss of visual amenity for the hospital precinct
- A number raised concerns regarding visual impacts associated with the northern interchange as follows:
  - Concerned about the potential impacts of the northbound off-ramp at the northern interchange on residences in Birchgrove Drive and requested further information on proposed landscaping and if the concrete walls will include etching on the side facing the residences

  - Requested the EIS commitment to provide native vegetation screening between the project and residences in Birchgrove Drive be implemented
  - Requested concrete noise barriers, rather than transparent noise barriers, be used on both the bypass and northbound off-ramp at the northern interchange to provide better noise attenuation and to protect the privacy of residents near the bypass
  - Concerned about potential loss of privacy due to the closeness of the southbound off-ramp at the northern interchange to residences. Commented the project does not include any measures to address privacy
- A number raised concerns regarding visual impacts associated with the fill batter to the west of Lookout Road (fill batter 1) as follows:
  - Concerned the clearing of vegetation for the fill batter will result in a visual impacts for nearby residences and requested a visual barrier be constructed
  - Commented the EIS understates the landscape character and visual impact to the property as clearing of vegetation will remove all existing screening. The resident requested:
    - Re-evaluation of the landscape character and visual impact
    - Appropriate landscaping of the fill batter (fill batter 1) to screen views of the project while retaining distant views. The landscaping must be carried out as soon as the fill batter work is finished to minimise visual impacts and to stabilise the slope
    - Appropriate landscaping of the existing fill slope to be carried out as soon as the fill batter work is finished to minimise visual impacts and to stabilise the slope
- Raised concern regarding the widening of Lookout Road and loss of existing screening vegetation. Requested construction of a visual barrier (eg wall) and associated landscaping fronting Lookout Road
- Commented further consideration is required for:
  - Excavation of cuttings to place the road below ground level near residential areas
  - Planting of vegetation to reduce visual impact.

Response

Chapter 10 of the EIS and the Urban Design, Landscape Character and Visual Impact Assessment (Ki Studio 2016, Appendix H of the EIS) assess the potential visual impact of the project. As a result of the project design refinements (Chapter 5), the Urban Design, Landscape Character and Visual Impact Assessment has been updated and is summarised in Section 6.5 and provided in Appendix E.

The assessment included consideration of key viewpoints to the project and the overall landscape character in which the project is located. The assessment was carried out in accordance with the SEARs and:

- *Guideline for Landscape Character and Visual Impact Assessment* (Roads and Maritime 2013b)
- *Beyond the Pavement, Urban Design Policy Procedures and Design Principles* (Roads and Maritime 2014a)
- *Bridge Aesthetics* (Roads and Maritime 2012a)
- *Landscape Guideline* (Roads and Traffic Authority 2008).

John Hunter Hospital precinct

The visual impact assessment considered 18 viewpoints, including two (viewpoints 4 and 5) within the John Hunter Hospital precinct. The assessment concluded that for these viewpoints, the visual impact would be negligible due to views to the project being limited to minor filtered views, mainly from higher levels of the buildings, and these would be screened by the proposed landscaping. For viewpoint 5 the assessment also identified there would be low to moderate impacts at night due to minor filtered views of light glare from street lighting.

Northern interchange

The visual impact assessment included two viewpoints (viewpoints 8 and 9) located at representative locations to the west of the northern interchange. The assessment concluded that for these viewpoints, the visual impact would be high (viewpoint 8) and moderate (viewpoint 9) as elements of the northern interchange, including potential noise walls, would be visible.

The proposed noise barrier treatments identified in Section 10.2.1 of the EIS are indicative only and would be further refined during detailed design in consultation with affected residents. Roads and Maritime acknowledges potential privacy concerns associated with transparent noise barrier and this will be taken into consideration. The proposed etching would be located on the road side. Etching is not proposed on the residential side as it is proposed to screen the noise barriers with native vegetation.

The clearing footprint for the project has been minimised as far as practicable to enable safe construction and operation of the project and to retain existing native vegetation. As a result a strip of existing native vegetation would be retained between the northbound off-ramp at the northern interchange and residences to the west. This would assist to minimise the visual impact.

Roads and Maritime acknowledges the clearing of existing planted vegetation in the existing road corridor to the north-east of the northern interchange would reduce the privacy for residents in the neighbouring block of residential units. Due to the arrangement of the northern interchange there is limited space available within the road corridor to carry out landscaping. During detailed design, Roads and Maritime would review feasible and reasonable measures to address privacy concerns in consultation with the affected property owners.

During detailed design the northern interchange layout will be reviewed including opportunities to refine the layout. This will include investigating opportunities to move the southbound off-ramp to the south-west further away from residential properties and to refine the layout of the northbound off-ramp. Refer to Sections 4.3.1 and 4.3.4 for further discussion regarding the selection of the preferred option for the project alignment and northern interchange layout.

Lookout Road and fill batter 1

Chapter 10 of the EIS and the Urban Design, Landscape Character and Visual Impact Assessment (Ki Studio 2016, Appendix H of the EIS) assess the potential visual impacts of the project. The assessment included consideration of key viewpoints to the project and the overall landscape character in which the project is located. The visual impact assessment considered 18 viewpoints and the landscape character assessment considered 19 landscape character zones. The identified viewpoints and landscape character zones were selected to be representative of the local setting and are not intended to show the most highly affected or least affected receivers. Roads and Maritime acknowledges there will be some receivers which will be more highly impacted than those identified in the EIS and conversely, some would be less impacted than identified in the EIS.

A new viewpoint has been added to represent the two properties located on the western side of Lookout Road and is discussed further in Section 6.5 and provided in Appendix E.

Any planted vegetation located in the construction footprint for the project would be removed during construction of the project. Landscaping within the proposed road corridor would be carried out in accordance with the landscape plans provided in Appendix C. If construction of the project requires removal of a boundary fence which is located on the proposed road corridor boundary, this would be replaced by Roads and Maritime. Landscape plantings within private property are the responsibility of individual property owners.

Further discussion regarding the design of Fill Batter 1 is provided in Section 4.4.2

Landscaping

Roads and Maritime acknowledges the clearing of native vegetation for construction of the project could result in some residences being exposed to views of elements of the project. The clearing footprint for the project has been minimised as far as practicable to enable safe construction and operation of the project and to retain existing native vegetation. To address potential visual impacts landscaping of the project is proposed as detailed in the Urban Design, Landscape Character and Visual Impact Assessment (Ki Studio 2016, Appendix H of the EIS). The landscape plan will include vegetation screening for highly impacted viewpoints where possible.

As a result of the project design refinements (Chapter 5), the Urban Design, Landscape Character and Visual Impact Assessment has been updated and is summarised in Section 6.5 and provided in Appendix E. The concept landscaping plan would be further refined during detailed design.

Visual impacts of the project will be mitigated by implementation of the landscape strategy. Physical visual barriers, such as walls, are not proposed.

Where the bypass traverses ridgelines cuttings are required to maintain consistent operational posted speed limits and these would assist in shielding sensitive receivers from views of the project.

4.11 Land use and property

4.11.1 Land use

Submission numbers

14, 139

Issue description

In summary, the respondents raised the following issues:

- Why did Newcastle City Council approve development in Birchgrove Drive and why has Roads and Maritime Services had no consideration of the potential impacts to the residences in Birchgrove Drive
- In the EIS the business and residence is classified as parkland in Figure 11-1 Land use
- In the EIS (Figure 11-4) the residence has been categorised as a commercial receiver and assessed as such.

Response

A corridor for the project has been identified in local environmental planning instruments since 1957. The approval of developments in the area surrounding the project is the responsibility of Newcastle City Council.

Chapter 4 of the EIS describes the various alternatives to the project considered as part of the project development process and explains how and why the project was selected as the preferred option.

The EIS and supplementary/updated assessments carried out for this report (Chapter 6) has considered the potential impacts to all surrounding residential areas, including those in Birchgrove Drive and Lookout Road, and recommended environmental management measures to minimise the impacts. The assessment included:

- Traffic and transport
- Noise and vibration including a preliminary noise mitigation scenario which includes noise barriers near to Birchgrove Drive
- Landscape character and visual impact including a preliminary landscape strategy
- Socio-economic, land use and property
- Air quality

- Hazards and risk.

Roads and Maritime acknowledges the mapping provided in Figure 11-1 of the EIS incorrectly maps an area immediately to the west of the project on Lookout Road as parkland and not as residential. It is noted Figures 11-2 and 11-3 of the EIS do clearly show these areas as being zoned residential and privately owned.

Refer to Section 4.9.1 for discussion regarding the classification of the home occupation on Lookout Road.

4.11.2 Property

Submission numbers

14, 32, 44, 75, 127, 139

Issue description

In summary, the respondents raised the following issues:

- Concerned about the potential impacts of the northbound off-ramp at the northern interchange on residences in Birchgrove Drive and requested further information from Roads and Maritime to provide to prospective purchasers of properties
- Commented residents in Birchgrove Drive near the northern interchange have not been offered compensation due to the impacts of the northbound off-ramp
- Questioned what will Roads and Maritime do regarding loss of property values and property acquisition if the northbound off-ramp at the northern interchange is not modified
- Concerned about potential loss of property value and rental value due to the closeness of the southbound off-ramp at the northern interchange to residences
- Stated residents located to the north-east of the northern interchange should be compensated for loss of views
- Commented Roads and Maritime has not provided a resident with any detailed information about the proposed property acquisition and noted Roads and Maritime had already acquired other properties on Lookout Road. Suggested DP&E should not approve the project until Roads and Maritime provide an acceptable in-principle agreement which outlines fair compensation for property acquisition including consideration of a potential land swap
- Commented due to the landscape changes and vegetation clearing for the project associated with the fill batter on Lookout Road, property values will be impacted.

Response

The project would involve direct property impacts as detailed in Section 5.3.21 of the EIS. Due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road (Section 5.4.2), there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road (Section 5.5.4). Updated property impact information is provided in Section 5.5.5.

Property acquisition for the proposal is scheduled to be completed after environmental approval of the project. All property acquisition, including appropriate compensation, will be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime 2014b) and the *Land Acquisition (Just Terms Compensation) Act 1991*. Roads and Maritime will continue to consult with all directly affected landholders during the detailed design stage when property acquisition requirements are confirmed.

Roads and Maritime also recognises neighbouring property owners may be impacted. Many aspects influence property values such as location and use. It is recognised properties affected by the project may be difficult to market before completion of construction due to uncertainty of environmental impacts. Property owners cannot receive financial compensation if they are only adjacent to a new or upgraded road, including if a property decreases in value. The *Roads Act 1993* only provides for Roads and Maritime to acquire land required for road purposes (called

'directly affected' land). New or widened roads can have impacts due to their proximity, such as increased noise or visual impacts. Roads and Maritime must identify the effects of a road project on adjoining communities and propose measures to reduce these environmental or social effects where possible. While Roads and Maritime does not provide financial compensation it does its best to reduce impacts. This has been carried out as part of the EIS. Roads and Maritime will continue to consult with neighbouring landholders and the broader community throughout the detailed design and construction phases in order to manage potential indirect impacts.

A number of properties have already been acquired by Roads and Maritime as owner initiated acquisition in accordance with the Roads and Maritime preferred option acquisition policy. These properties were directly affected by the preferred option as displayed in 2007.

4.12 Socio-economic impacts

Submission numbers

139

Issue description

In summary, the respondent raised the following issues:

- Commented the project would have a significant impact on the home music business during both construction and operation due to changes in parking, access, traffic conditions, noise and vibration, air quality, visual amenity and public utility works.

Response

Potential socio-economic impacts to businesses in the study area are assessed in Chapter 11 of the EIS and supplementary/updated assessments carried out for this report (Chapter 6).

As discussed in Section 4.9.1, given the home music business is located within a residential premises, the EIS assessed it as both a residential and commercial receiver throughout all relevant sections of the EIS. However, following exhibition of the EIS, Roads and Maritime has carried out further investigations and identified the home music business cannot be classified as a commercial receiver as commercial businesses are prohibited in the land zoning under the Newcastle Local Environment Plan 2012. As such, it is now classified as a home occupation and is not considered further as a commercial receiver. The building is still considered a residential receiver and has been assessed as such. Consistent with the EIS, specific measures that will be implemented for all sensitive receivers including the home occupation activity will include:

- Further consultation during detailed design
- Further consultation during pre-construction including during development of the construction environmental management plan, construction noise and vibration management plan and construction traffic management plan
- Notifications and further consultation during construction
- Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario (to be confirmed during detailed design) before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

While not considered a commercial receiver, in relation to the home occupation, the assessment has considered potential impacts relating to traffic and access, amenity (noise and vibration, air quality and visual impacts) and disruptions to utilities based on the assessment of these issues in other chapters of the EIS. Roads and Maritime acknowledges there would be impacts to the home occupation activity as a result of construction and operation of the project and will implement a range of environmental management measures as detailed in Chapter 22 of the EIS and Chapter 7 of this report.

As stated in Section 6.4.2 of the EIS, Roads and Maritime will continue to consult with the community and stakeholders during detailed design and construction. This will include all residents

and local businesses, including the home occupation activity within the residence on Lookout Road which could be affected by the project to manage the identified potential impacts.

4.13 Flooding and drainage

Submission numbers

82

Issue description

In summary, the respondent raised the following issues:

- The EIS does not contain any information regarding drainage and control of stormwater runoff.

Response

Section 5.3.9 and Figure 5-14 of the EIS describes the drainage infrastructure which would be installed as part of the project. The stormwater drainage system would include cross drains, pavement drains and longitudinal catch drains and has been designed to capture and convey stormwater drainage from the project to the surrounding ephemeral drainage lines and existing stormwater infrastructure.

The project also includes additional controls for the management of flooding (Section 5.3.9 of the EIS) and stormwater quality (Section 5.3.10 of the EIS) with potential impacts assessed in Chapters 12 and 13 of the EIS.

Following exhibition of the EIS and receipt of submissions, the drainage design has been refined (Section 5.5.2) and additional flood modelling and water quality assessment (Sections 6.7 and 6.8 respectively) have been carried out to address the design refinements (Chapter 5) and to respond to submissions.

4.14 Water quality

Submission numbers

149

Issue description

In summary, the respondent raised the following issues:

- Commented construction activities would result in increased levels of run off pollution. Suggested the construction phase should use practices to minimise impacts to the environment and eliminate damage to resident's property.

Response

Potential water quality impacts during construction of the project were assessed in Section 13.4.3 of the EIS and the water quality and watercourse assessment (GHD 2016d, Appendix K of the EIS). The identified potential impacts will be managed through implementation of the water quality management strategy (Section 13.5 of the EIS), including erosion and sedimentation measures such as clean water diversions, sedimentation basins and environmental management measures detailed in Section 13.6 of the EIS.

Following exhibition of the EIS and receipt of submissions, the construction phase and operational water management system has been refined (Sections 5.5.11 and 5.4.3 respectively) and a supplementary water quality assessment has been carried out to address the design refinements (Chapter 5) and to respond to submissions. The results of the supplementary assessment are provided in Section 6.8 and Appendix G.

4.15 Air quality

4.15.1 Construction air quality

Submission numbers

14, 139, 149

Issue description

In summary, the respondents raised the following issues:

- Concerned about the potential impacts of the northbound off-ramp at the northern interchange on residences in Birchgrove Drive and requested further information on what measures will be implemented to address construction air quality impacts
- Expressed concerns about potential impact of reduced air quality on physical and emotional wellbeing. Commented the EIS did not correctly identify the most adverse health effects of particulate matter and requested:
  - Continuous monitoring (internal and external) during construction and cessation of construction activities when recorded levels are above relevant guidelines
  - Regular cleaning of the house during construction
  - Provision of air conditioners, air purifiers and ventilation systems
  - Compensation for anticipated damage to recording equipment
- Detailed particulate matter dispersion modelling should have been conducted for the project. Due to local topography air movement near the residence differs to that recorded at Nobby's headland. A detailed survey of air currents in the local area should be carried out
- The EIS does not give any information on the chemical characteristics of the fill material and the associated air quality risks
- Commented the construction contractor should not be responsible for management of construction air quality due to competing interests
- Commented construction activities would result in increased levels of dust pollution and appropriate measures should be implements such as:
  - Turning off machinery when not in use
  - Positioning stationary machinery away from residential areas
  - Regular monitoring of air pollution during the construction phase and taking corrective action where pollution approaches unacceptable levels.

Response

An assessment of potential air quality impacts during construction was provided in Chapter 17 of the EIS. It involved:

- Identifying the location, type and intensity of major construction activities including construction machinery, earthworks, stockpiling and major compound areas (blending, crushing, stockpiling and if required, asphalt/concrete batching)
- Identifying the main sources and types of air emissions during construction
- Identifying the location of the nearest sensitive receivers to construction activities
- Describing the potential air quality impacts during construction and outlining how these impacts would be managed and mitigated.

Due to the project design refinements, the air quality assessment has been reviewed and is included in Section 6.11.

The assessment identified potential impacts associated with earthworks, including fill areas throughout the project, and proposed management measures to address the potential impacts.

The EIS (Section 17.3.1) acknowledges there can be health and amenity effects from airborne dust and does not imply any stated effects are the most adverse.

The assessment considered local meteorological conditions represented by recorded data from the Bureau of Meteorology weather station at Nobbys Head. While there would be highly localised and minor variances to the wind conditions due to topography and other features, the prevailing conditions recorded at Nobbys Head would dominate the conditions in the area surrounding the project.

Section 13.3.2 of the EIS provides information on the chemical characteristics of the soils in the area, and apart from some isolated areas of elevated contaminants, which would be managed appropriately during construction, there are no identified significant issues. As such, the material to be disturbed during earthworks for the project is not expected to have any significant characteristics which would indicate it would represent any significant concerns for health or property.

The assessment identified with implementation of the proposed management measures, no significant air quality impacts were expected. Therefore, detailed modelling of construction air emissions is not considered necessary and is consistent with other similar projects completed in NSW.

Section 17.4 of the EIS identifies environmental management measures which will be implemented during construction to monitor and manage dust emissions in accordance with a construction environmental management plan. If required, monitoring would be carried out in accordance with the *Approved Methods for the Sampling and Analysis of Air Pollutants in NSW* (DEC 2005b) and the environment protection licence issued by EPA

Management measures identified in Section 17.4 of the EIS and any additional approval conditions provided by DP&E or EPA will be implemented by the construction contractor in accordance with an approved construction environmental management plan and an environment protection licence issued by EPA. Roads and Maritime will approve the construction environmental management plan and will carry out an active role in monitoring the performance of the contractor against the requirements of the construction environmental management plan. An independent Environmental Representative would also likely be appointed by DP&E who will be responsible for monitoring the performance of the construction contractor. The construction environmental management plan will also contain procedures for the management of community complaints, which provide an avenue for monitoring and evaluation of the performance of the construction contractor.

4.15.2 Operational air quality

Submission numbers

65, 149, 158

Issue description

In summary, the respondents raised the following issues:

- Expressed concern the on and off-ramps at the northern interchange are too close to Jesmond Park and will increase traffic pollution
- Commented the project incorporates features and management measures to minimise air pollution. Further consideration is required for:
  - Existing levels of air pollution levels should be measured before work starts
  - Minimisation of gradient changes of the roadway to limit exhaust pollution
- Following completion of construction periodic monitoring of air quality should be conducted to ensure the levels fall within design projections and acceptable levels and contingency provided to make any improvements necessary
- The proposed northbound off-ramp at the northern interchange will result in increased dust pollution.

Response

Chapter 4 of the EIS describes the various alternatives to the project considered as part of the project development process and explains how and why the project was selected as the preferred option. This included an assessment of alternatives for the arrangement of the northern interchange.

An assessment of potential air quality impacts was provided in Chapter 17 of the EIS. Due to the project design refinements, an updated air quality assessment has been carried out and is included in Section 6.11. The assessment included modelling and assessment of vehicle emissions in accordance with *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the Approved Methods) (NSW Department of Environment and Conservation (DEC) 2005a). The Approved Methods includes impact assessment criteria for a range of pollutants set on the basis of scientific studies of air quality and human health from all over the world, as well as the standards set by other organisations, such as the World Health Organization.

Predictions of pollutant concentrations were made using the Roads and Maritime *Tool for Roadside Air Quality* (TRAQ) (Sinclair Knight Merz (SKM) 2012). TRAQ has been designed as a 'first-pass' screening assessment and uses a conservative approach to estimate pollutant concentrations near a roadway (TRAQ Manual, Roads and Maritime Services 2012c). The model has been used extensively in NSW and is currently accepted by regulatory agencies as an appropriate conservative model for forecasting near field ground level pollutant concentrations from traffic on major roads.

Air emissions during operation of the proposal were identified to consist of products of combustion (exhaust) and particulate matter. Emissions assessed were:

- Carbon monoxide (CO)
- Oxides of nitrogen (NOx)
- Particulate matter (PM_{10}).

Air emissions were modelled at the kerb and at 10 metres from the kerb. The modelling predicted the emissions would comply with the impact assessment criteria outlined in the Approved Methods.

The project has been designed to minimise road gradients as far as possible however, due to the topography some areas of steeper gradients are required.

Due to regional and local contributors to the airshed (refer to Section 17.2.1 of the EIS), carrying out air quality monitoring in the vicinity of the project is unlikely to provide meaningful baseline data. Based on the operational air quality modelling conducted for the project no significant adverse air quality impacts are predicted and as a result the need for ongoing monitoring is not considered necessary.

4.16 Hazards and risk

Submission numbers

149

Issue description

In summary, the respondent raised the following issues:

- Commented the project makes suitable provision for access to emergency services and construction of fire trails to provide satisfactory access in events such as a bushfire.

Response

Noted.

4.17 Out of scope

Submission numbers

9, 19, 44, 138

Issue description

In summary, the respondents raised the following issues:

- The EIS does not address traffic issues associated with existing traffic lights between Bennetts Green and Sandgate
- Suggested improvements at the existing University Drive interchange to reduce congestion including possible new connection roads
- Suggested existing roads near the northern interchange including Robert Street, Steel Street and Robinson Avenue should be modified to improve traffic movements
- Roads and Maritime need to construct a major north-south highway standard road between Nelsons Bay and Swansea, crossing the Hunter River at Sandgate and connecting with Cormorant Road.

Response

Roads and Maritime is seeking approval to construct the fifth section of the Newcastle Inner City Bypass between Rankin Park and Jesmond. The project will provide continuity for the Newcastle Inner City Bypass between Bennetts Green and Sandgate.

The removal of existing traffic lights on other sections of the Newcastle Inner City Bypass is beyond the scope of the project.

Measures to address existing congestion issues at the University Drive interchange on the existing Jesmond to Shortland section of the Newcastle Inner City Bypass is beyond the scope of the project.

Improvements to Robert Street, Steel Street and Robinson Avenue is beyond the scope of the project. The project is predicted to carry up to 31,300 vehicles per day in 2020 and up to 34,500 in 2030. As a result, there would be a corresponding reduction in traffic on Newcastle Road by about 24 per cent. This would substantially improve traffic flow and reduce travel times along Newcastle Road and would potentially provide improved access out of side streets.

The project has been designed to be consistent with surrounding free flowing sections of the Newcastle Inner City Bypass. The upgrade of the entire Newcastle inner City Bypass to a higher standard of road and extension through to Cormorant Road on Kooragang Island is beyond the scope of the project.

As discussed in Section 8.3.2 of the EIS, as part of the Roads and Maritime Inner Newcastle Traffic Study, preliminary investigations were carried out to the south of the Rankin Park to Jesmond connection with Lookout Road. The primary focus of the study was to inform future road network planning in inner Newcastle. The community was invited to comment on the Inner Newcastle Traffic Study in July and August 2014. The feedback and suggestions received have been considered to prioritise future projects and seek funding.

5 Preferred infrastructure report

Roads and Maritime has refined a number of aspects of the project as exhibited in the EIS, primarily in response to issues raised during the EIS exhibition period. Design refinements have also arisen through the ongoing review of the concept design and consultation with other government agencies.

In accordance with section 5.17 of the EP&A Act, a preferred infrastructure report has been prepared for the project. This chapter describes changes proposed to the project to minimise its environmental impact and/or to deal with issues raised during the assessment of the State significant infrastructure application.

Design refinements are presented in this chapter and include a description of the:
- EIS design associated with each design refinement
- Proposed design refinement.

This chapter does not assess potential impacts associated with the proposed design refinements. These are provided in Chapter 6.

5.1 EIS project scope

Key features of the project scope as presented in the EIS include (Figure 1-2):
- New road with two lanes in each direction, separated by a median
- Three interchanges, consisting of:
  - Northern interchange providing access to Newcastle Road and the existing Jesmond to Shortland section of the Newcastle Inner City Bypass. The full interchange provides all movements to/from the bypass and Newcastle Road
  - Hospital interchange providing access between the John Hunter Hospital precinct and the bypass. The half interchange provides access to/from the north
  - Southern interchange providing access to Lookout Road and the existing Kotara to Rankin Park section of the Newcastle Inner City Bypass. The bypass would travel under McCaffrey Drive. The half interchange provides connection in both directions on Lookout Road
- Structures along the road to allow for drainage, animal and bushwalker access
- Tie in and upgrades to connecting roads, including Lookout Road, McCaffrey Drive and Newcastle Road
- Large cut and fill embankments due to steep and undulating terrain
- Pedestrian and cycling facilities, including a shared path bridge over Newcastle Road
- Noise barriers and/or architectural treatment, as required
- Permanent operational water quality treatment measures.

A more detailed description of the project is found in the *Newcastle Inner City Bypass – Rankin Park to Jesmond Environmental Impact Statement* (EIS) prepared by Roads and Maritime Services in November 2016 (Roads and Maritime Services 2016e).

5.2 Summary of design refinements

There are two types of design refinements:
- Main design refinements
- Minor design refinements.

These are described in the following sections and key refinements are shown in Figure 5-1.

5.2.1 Main design refinements

The main design refinements are:

- Hospital interchange layout:
  - The addition of south-facing ramps results in a full interchange with both north and south-facing ramps, providing access between the bypass and the hospital precinct
- Pedestrian and cyclist facilities
  - Jesmond Park shared path – an overpass bridge (Bridge 8) and underpass arrangement would now be provided at the northern interchange to provide an east-west grade separated shared path for both pedestrians and cyclists
  - Hospital interchange – the shared path crossing of the southbound off-ramp would now be controlled by traffic lights
  - Southern interchange – a new northbound cycleway connection from Lookout Road to the bypass would be provided for on-road cyclists
  - Southern interchange – a new southbound cycleway crossing controlled by traffic lights would be provided from the bypass to Lookout Road for on-road cyclists
  - McCaffrey Drive – the proposed pedestrian footpath on the northern side would now be replaced with a wider shared path for use by both pedestrians and cyclists
  - Lookout Road and McCaffrey Drive intersection – the pedestrian crossings on the left turn lane from McCaffrey Drive onto Lookout Road, and across Lookout Road would now both be shared path crossings controlled by traffic lights
  - Shared path bridge over Newcastle Road – the connections either side of the shared path bridge (Bridge 7) over Newcastle Road have been refined to improve connectivity with existing shared paths.
- Water quality treatment structures:
  - Refinement and inclusion of additional treatment measures with permanent operational water quality structures increased from five to eight
- Construction work:
  - New/adjusted construction compounds including access and utility connections
  - Refinement of the proposed extended construction hours to limit construction activities carried out during the morning.

5.2.2 Minor design refinements

The minor design refinements are mostly adjustments needed to accommodate the main design refinements described in Section 5.2.1 and are:

- Bridges
  - Adjustments to the cross section of Bridge 2 to allow for the McCaffrey Drive shared path
  - Widening of Bridge 3 to allow for the full hospital interchange.
- Flooding and drainage:
  - Adjustments to the project drainage design
  - Refinement of the proposed flood mitigation work near the northern interchange, to allow for the grade separation of the Jesmond Park shared path
- Cuttings and embankments:
  - Adjustments to the estimated cut and fill volumes required for the project
- Proposed road corridor:
  - Minor adjustments to the proposed road corridor
- Property acquisition:
  - Minor adjustments to the property acquisition requirements for the project
- Noise mitigation work:
  - Adjustments to the preliminary operational noise mitigation scenario
- Directional signage:
  - Addition of directional signage on the surrounding road network
- Construction work:
  - Minor adjustments to the construction footprint
  - Minor adjustments to potential construction lease areas

- Adjustments to earthworks, erosion and sediment control and construction materials
- Refinement of the early work construction activities.

5.3 The project

The key features of the project (including the proposed design refinements) (Figure 5-1) include:

- New road with two lanes in each direction, separated by a median
- Three interchanges, consisting of:
  - Northern interchange providing access to Newcastle Road and the existing Jesmond to Shortland section of the Newcastle Inner City Bypass. The full interchange provides all movements to/from the bypass and Newcastle Road
  - Hospital interchange providing access between John Hunter Hospital precinct and the bypass. The full interchange provides all movements to/from the bypass
  - Southern interchange providing access to Lookout Road and the existing Kotara to Rankin Park section of the Newcastle Inner City Bypass. The bypass would travel under McCaffrey Drive. The half interchange provides connection in both directions on Lookout Road
- Structures along the road to allow for drainage, animal and bushwalker access
- Tie in and upgrades to connecting roads, including Lookout Road, McCaffrey Drive and Newcastle Road
- Large cut and fill embankments due to steep and undulating terrain
- Pedestrian and cycling facilities, including a shared path bridge over Newcastle Road and grade separation of the existing east-west Jesmond Park shared path at the northern interchange
- Noise barriers and/or architectural treatment, as required
- Permanent operational water quality measures.

Ancillary work to facilitate construction of the project (Figure 5-8), including:

- Adjustment, relocation and/or protection of public utilities and services
- Mine subsidence treatment, as required
- Temporary construction facilities, including sedimentation basins, compounds and stockpile sites
- Temporary and permanent access tracks
- Concrete/asphalt batching plant, as required.

LEGEND

- Proposed road corridor
- Dedicated fauna culvert
- Proposed shared path
- Proposed northbound cycleway connection
- Fauna escape point
- Arboreal crossing (rope bridge)
- Permanent fencing
- Proposed fire trail
- Existing fire trail
- Proposed retaining wall
- Existing footpath
- Operational water quality treatment structure
- Existing traffic lights
- Proposed traffic lights
- Existing bus stop
- Existing bus stop to be removed
- Existing bus stop to be relocated
- Relocated bus stop

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill

Rankin Park to Jesmond

Figure 5-1a
The project

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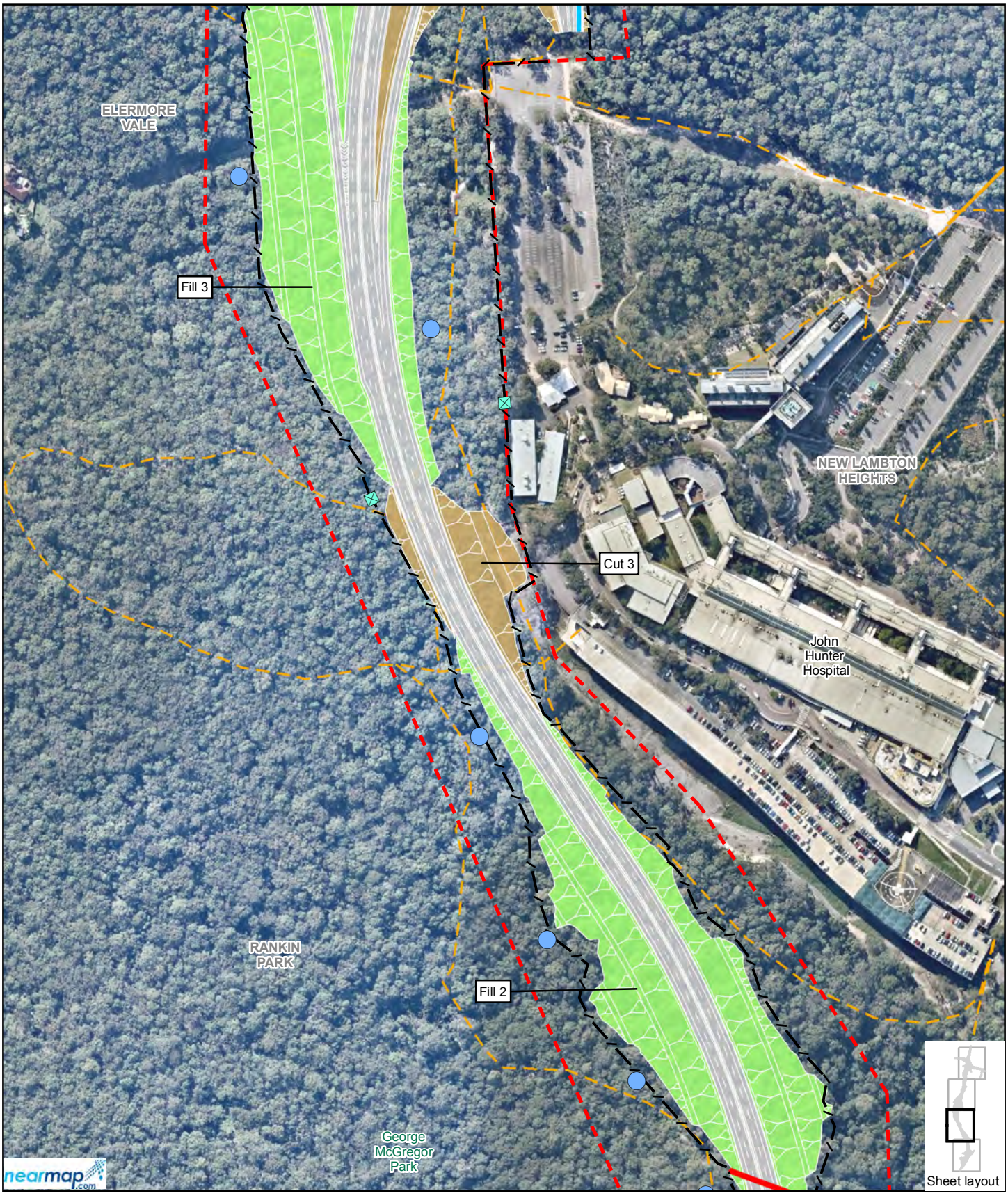
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways/ footpaths, 2016; LPI: DTDB, 2012.



LEGEND

- Proposed road corridor
- Dedicated fauna culvert
- Existing shared path
- Proposed shared path
- Fauna escape point
- Permanent fencing
- Existing fire trail
- Operational water quality treatment structure

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Design
- Pavement
- Earthworks cut
- Earthworks fill

Rankin Park to Jesmond

Figure 5-1b
The project

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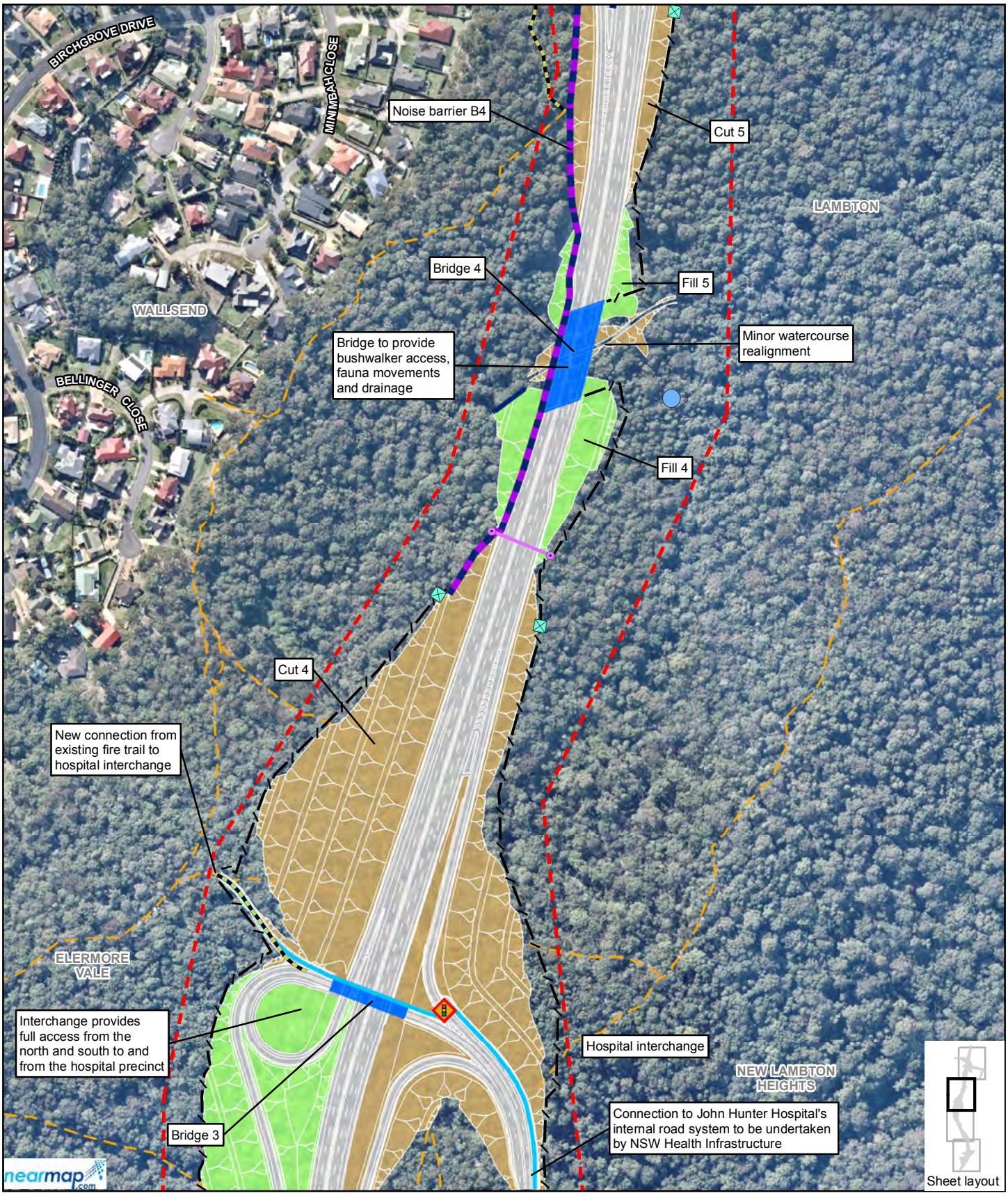

LEGEND

- Proposed road corridor
- Existing shared path
- Proposed shared path
- Fauna escape point
- Arboreal crossing (rope bridge)
- Permanent fencing
- Potential noise barrier
- Proposed fire trail
- Existing fire trail
- Proposed retaining wall
- Operational water quality treatment structure
- Proposed traffic lights

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill

Rankin Park to Jesmond

Figure 5-1c
The project

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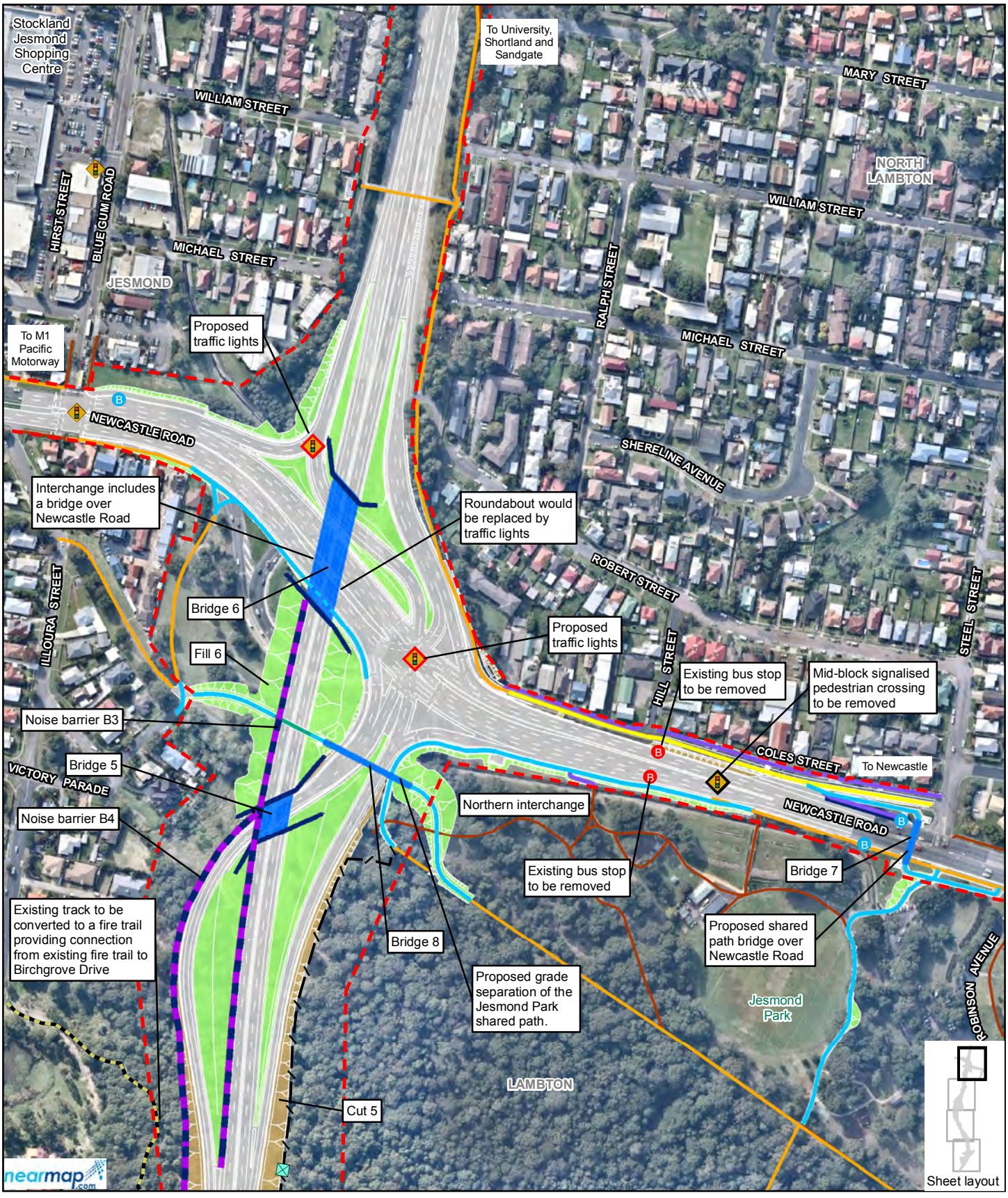
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways/ footpaths, 2016; LPI: DTDB, 2012.



LEGEND

- Proposed road corridor
- Existing shared path
- Proposed shared path
- Proposed on-road cycleway
- Proposed shared path underpass
- Fauna escape point
- Permanent fencing
- Potential noise barrier
- Proposed fire trail
- Proposed retaining wall
- Proposed footpath
- Existing footpath
- Existing traffic lights
- Existing traffic lights to be removed
- Proposed traffic lights
- Existing bus stop
- Existing bus stop to be removed

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill

Rankin Park to Jesmond

Figure 5-1d
The project

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR003_TheProject_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways/ footpaths, 2016; LPI: DTDB, 2012.

5.4 Main design refinements

5.4.1 Hospital interchange layout

EIS design

The EIS design of the hospital interchange would consist of:

- Access to/from the north which includes a southbound off-ramp to exit the bypass and enter the hospital precinct and a northbound on-ramp to exit the hospital precinct and enter the bypass
- A bridge over the bypass would include a shared path for pedestrians and cyclists on its northern side, providing a connection between the hospital precinct and residential areas to the west.

The hospital interchange would be connected via a new access road to provide for connection to the hospital's internal road system. NSW Health Infrastructure would carry out any required road work in the hospital's internal road system to accommodate traffic movements to/from the interchange including any design, environmental assessment and construction related activities.

Proposed design refinement

The proposed design refinement to the hospital interchange consists of:

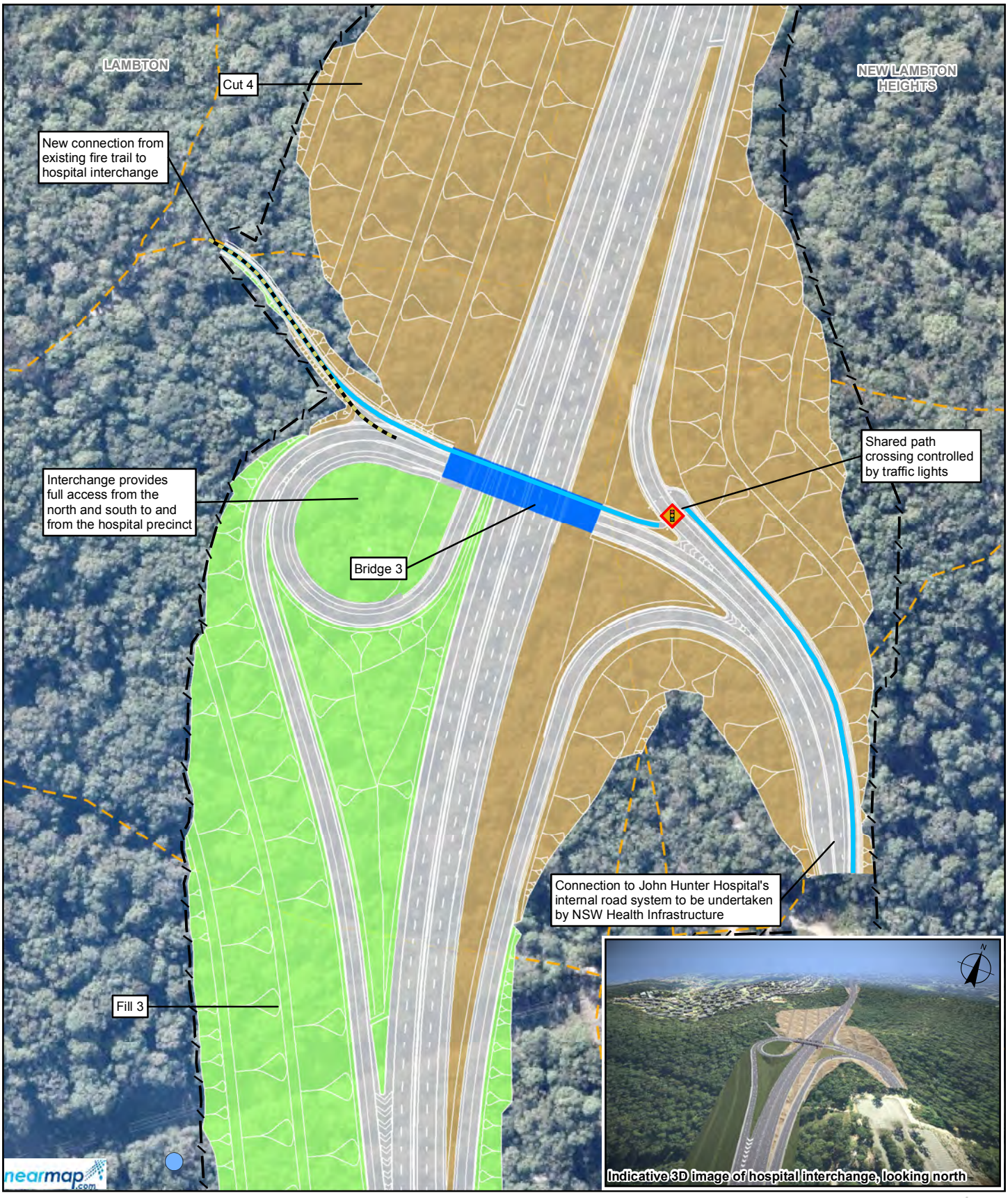
- Access to/from the south which includes a southbound on-ramp to enter the bypass and exit the hospital precinct and a northbound off-ramp to exit the bypass and enter the hospital precinct
- Widening of the bridge (Bridge 3) over the bypass to provide an additional traffic lane, as discussed in Section 5.5.1.

The hospital interchange would now be a full interchange with both north and south-facing ramps as shown in Figure 5-2.

NSW Health has committed to providing $13 million to cover the additional costs associated with the design, environmental assessment and construction of the south-facing ramps. The interchange would provide access to and from the north and south for use by all hospital users including public, staff and emergency services.

The hospital interchange would provide connections from the bypass and the hospital precinct via:

- Southbound off-ramp – southbound traffic on the bypass would diverge to the left to exit the bypass to the hospital precinct
- Southbound on-ramp – traffic leaving the hospital precinct would diverge to the left and enter the bypass to travel in a southbound direction
- Northbound on-ramp – traffic leaving the hospital precinct would travel west over the main project alignment on Bridge 3 and enter an anti-clockwise loop to the left before travelling under Bridge 3 next to the projects northbound alignment. The on-ramp would then merge with the project's two northbound lanes
- Northbound off-ramp – northbound traffic on the bypass would diverge to the left to exit the bypass and travel east over the main project alignment on Bridge 3 to enter the hospital precinct.



LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Proposed shared path
- Proposed fire trail
- Existing fire trail
- Permanent fencing
- Operational water quality treatment structure
- Proposed traffic lights

Sheet layout

Paper Size A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-2
Hospital interchange

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR004_HospitalInterchange_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways, 2016; LPI: DTDB, 2012.

5.4.2 Pedestrian and cycling facilities

As described in Section 5.3.14 of the EIS, the project would incorporate facilities for pedestrians and cyclists. The proposed facilities were designed in accordance with the *NSW Bicycle Guidelines* (Roads and Traffic Authority 2005). The provision for pedestrian and cyclist connectivity are consistent with the on-road and off-road routes through the study area proposed in the *Newcastle Cycling Strategy and Action Plan* (The City of Newcastle 2012).

Following exhibition of the EIS, receipt of submissions and further consultation with stakeholders, the proposed pedestrian and cyclist facilities have been refined as described in the following sections.

Jesmond Park shared path

EIS design

At the northern interchange, the project as presented in the EIS (Section 5.3.14 and Figure 5-1 of the EIS) severs the free-flow east-west shared path through Jesmond Park. This shared path currently links to the pedestrian crossings across Newcastle Road at Blue Gum Road intersection, which provides connections to the north and the retail outlets at Jesmond including Stockland Jesmond Shopping Centre.

The EIS design maintained the east-west connection at the northern interchange via:

- New shared paths connecting to the traffic lights at the new intersection on Newcastle Road associated with the northern interchange
- Three traffic light controlled pedestrian crossings for east-west movements to/from the Jesmond Park shared path.

Proposed design refinement

The project would now provide a grade separated shared path consisting of an overpass bridge (Bridge 8) and underpass arrangement, which would connect with existing shared paths as shown in Figure 5-3.

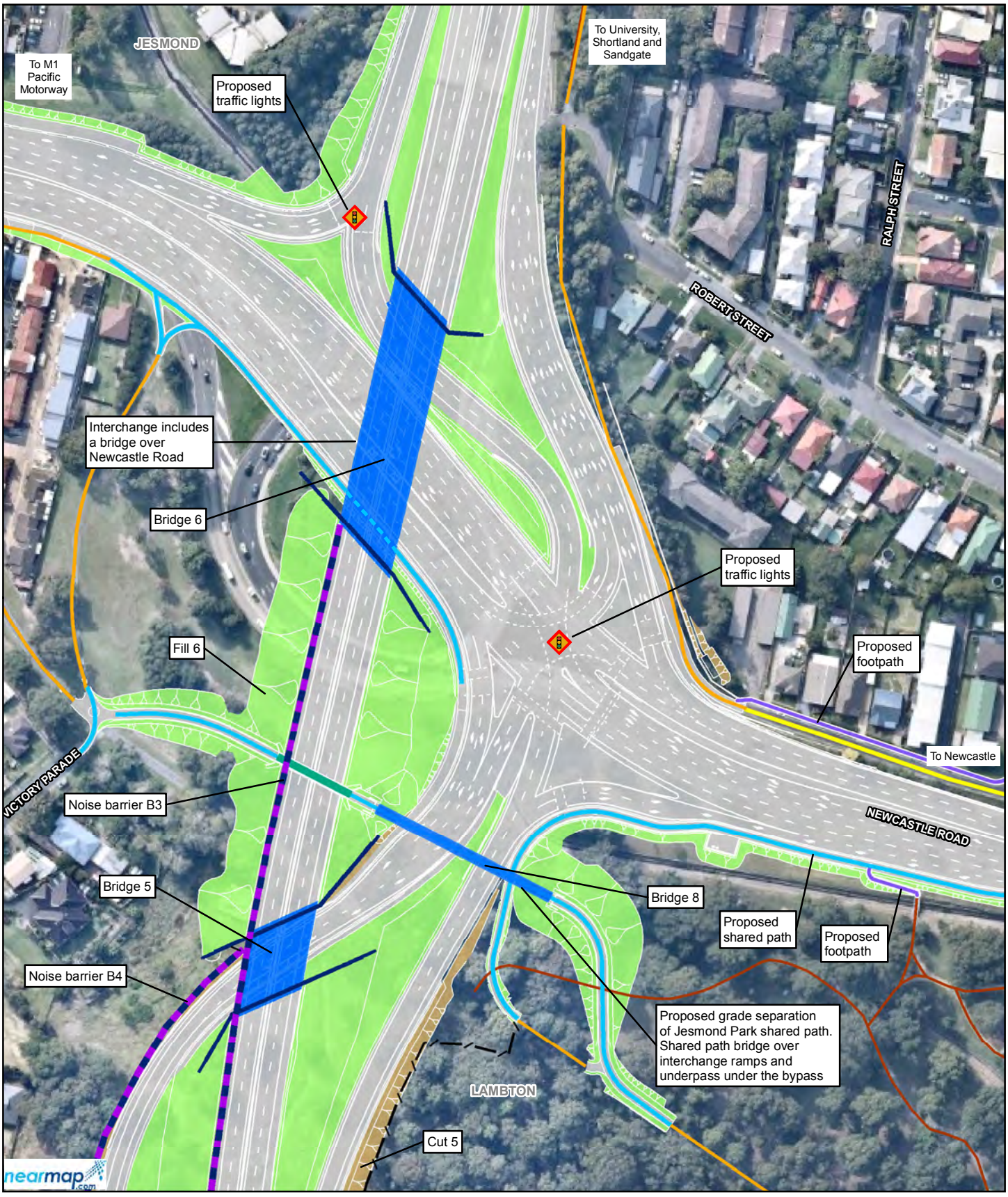
This means pedestrians and cyclists do not need to cross the project via traffic lights for east-west movements. This would provide access to the Newcastle Road and Blue Gum Road intersection via Illoura Street. Refer to Section 5.5.1 for further information regarding the design of the overpass bridge and underpass arrangement.

The three traffic light controlled crossings on the southern side of the northern interchange (as proposed in the EIS design) would be retained in the refined design, to provide for wheelchairs and mobility impaired persons, and as an alternative route for pedestrians and cyclists.

The new Bridge 8 (Figure 5-4) would be a two span steel arch structure and about 77 metres in length. One support pier would be located between the northbound off-ramp and southbound on-ramp.

The bridge would include:

- A bridge deck spanning the on/off-ramps with a 3.6 metre path width and throw screens
- Three and a half metre wide shared path on the approaches to the bridge and underpass
- Connection to the existing Jesmond Park shared path to the east and via an underpass under the main project alignment to the west. The underpass would be about 3.6 metres wide, 2.7 metres high and 34 metres long.



LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Existing shared path
- Proposed shared path
- Proposed on-road cycleway
- Proposed shared path underpass
- Potential noise barrier
- Proposed retaining wall
- Permanent fencing
- Existing footpath
- Proposed footpath
- Proposed traffic lights

Sheet layout

Paper Size A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-3

Jesmond Park shared path grade separation

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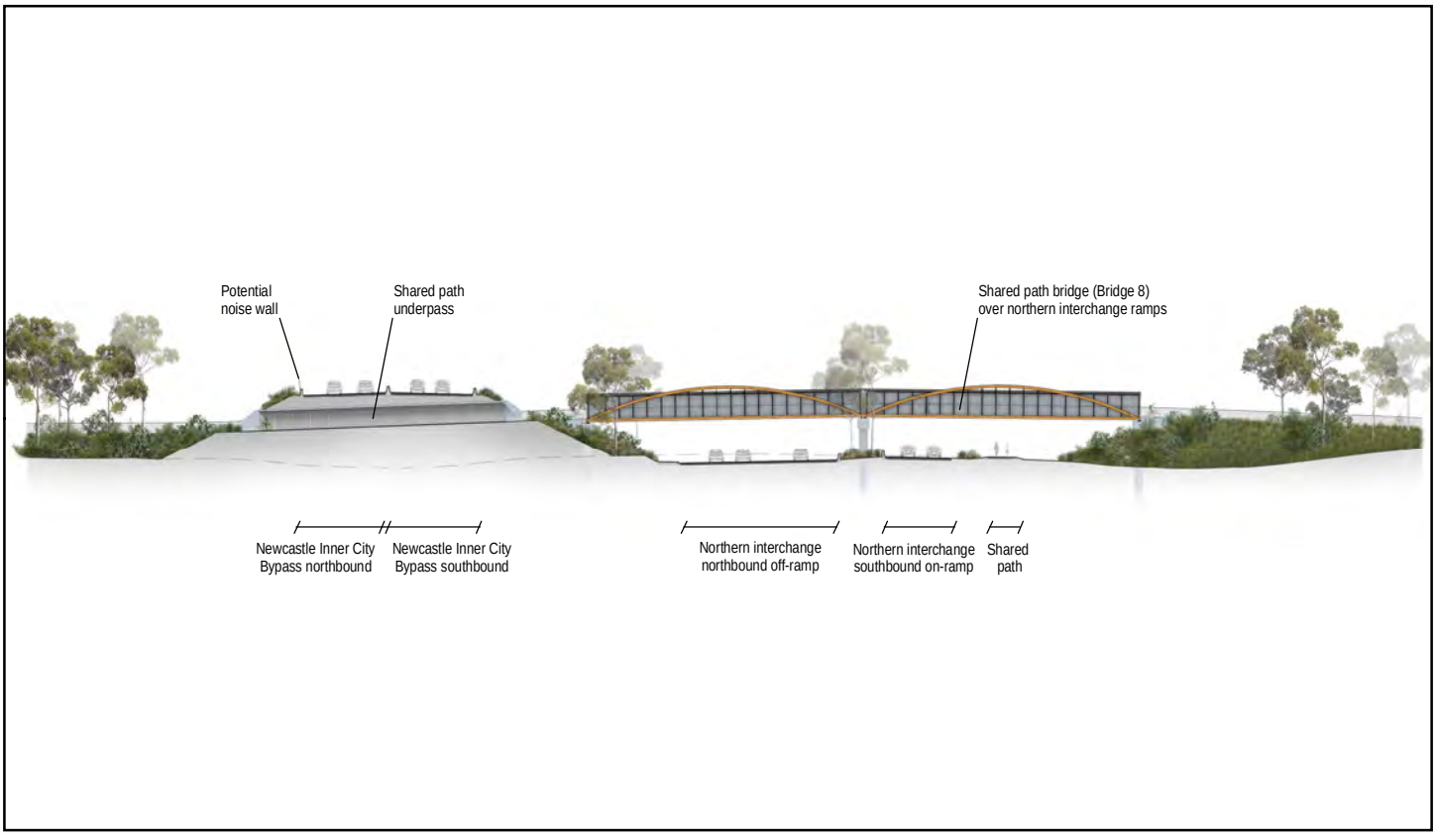
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways, 2016; LPI: DTDB, 2012.

Indicative 3D image of Bridge 8 - shared path bridge at northern interchange, looking south



Elevation of Bridge 8, looking north

Paper Size A4

Not to scale

Rankin Park to Jesmond

Figure 5-4
Bridge 8

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR006_Bridge8_0.mxd
Data source: Aurecon: Cross section / 3d image, 2016.

Hospital interchange – shared path crossing

EIS design

In the EIS design, at the hospital interchange a new shared path would be provided on the northern side of the hospital access road, crossing the main project alignment on Bridge 3. An uncontrolled (ie no traffic lights) crossing point would provide access across the southbound off-ramp for use by pedestrians and cyclists (Section 5.3.5 and Figure 5-5 of the EIS). The path would provide access to existing off-road tracks and suburbs such as Elermore Vale and Wallsend to the west of the project.

Pedestrians and cyclists would be required to give way to vehicles travelling on the off-ramp and appropriate signage and street lighting would be provided. Warning signs (shared path crossing ahead or similar) would be provided on the off-ramp to advise vehicles of the shared path crossing at an appropriate distance from the crossing to suit the off-ramp speed limit of 50 kilometres per hour.

Proposed design refinement

The project would now provide traffic lights at the crossing point for use by pedestrians and cyclists as shown in Figure 5-2 so pedestrians and cyclists do not need to give way to vehicles.

Southern interchange – northbound cycleway connection

EIS design

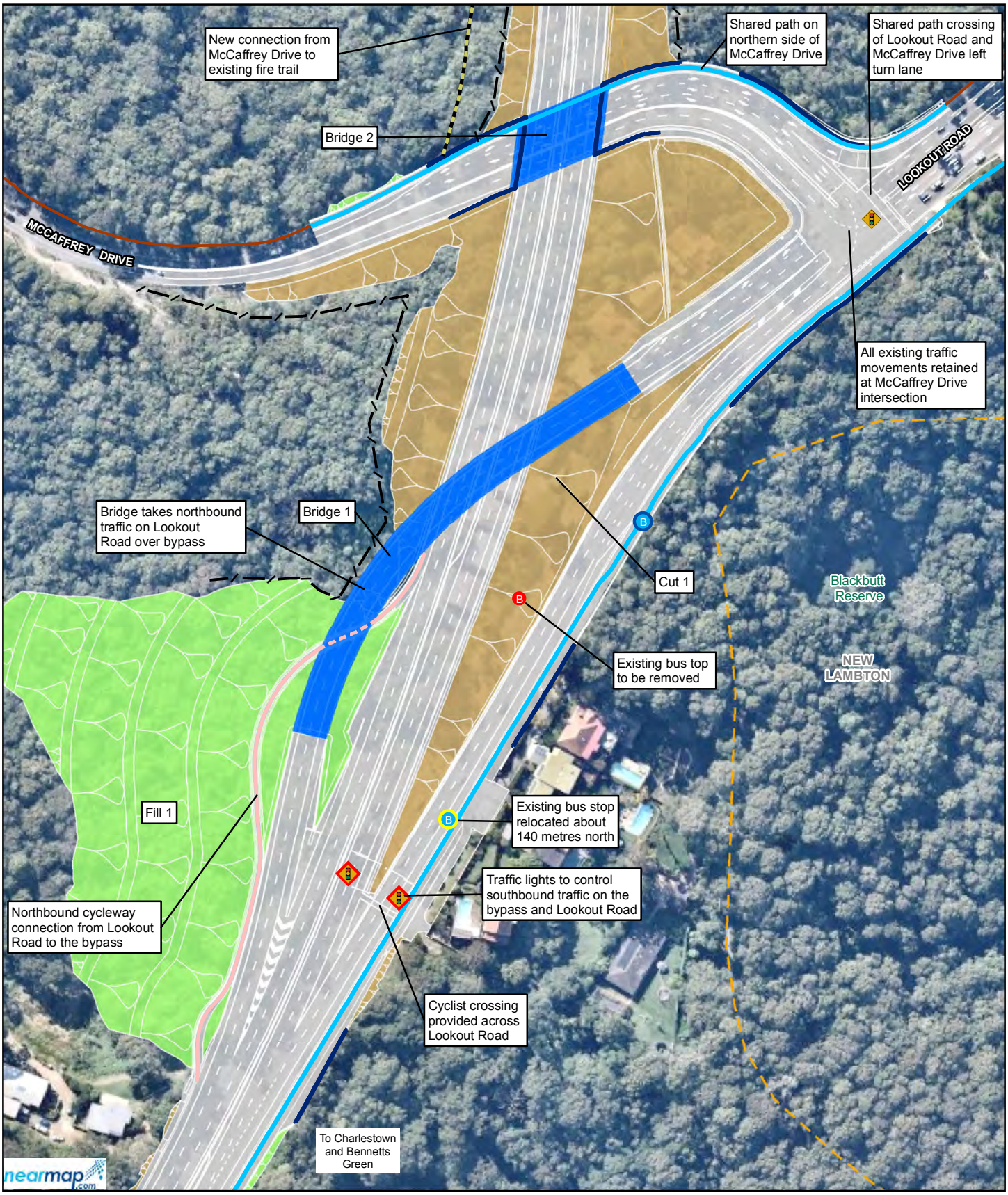
In the EIS design, at the southern interchange, northbound on-road cyclists seeking to remain on the bypass would need to cross the two northbound exit traffic lanes associated with the Lookout Road flyover (Bridge 1) (Section 8.3.2 of the EIS).

Proposed design refinement

The project would now provide a new northbound cycleway connection (one way only) as shown in Figure 5-5. This enables northbound on-road cyclists to exit Lookout Road and pass beneath the flyover before re-joining the northbound road shoulder of the bypass.

The cycleway would be located on a bench on the fill batter (fill batter 1) to the west of the Lookout Road flyover. This would require minor widening of the bench, resulting in a minor widening of the overall fill batter slope by about five metres. The cycleway would be two metres wide and about 225 metres long.

This design refinement eliminates potential conflict between northbound on-road cyclists and traffic exiting the bypass on the Lookout Road flyover. The cycleway would not be available for use by pedestrians.



LEGEND

- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Proposed shared path
- Proposed northbound cycleway connection
- Proposed fire trail
- Existing fire trail
- Proposed retaining wall
- Permanent fencing
- Existing footpath
- Existing traffic lights
- Proposed traffic lights
- Existing bus stop to be removed
- Existing bus stop to be relocated
- Relocated bus stop

Sheet layout

Paper Size A4

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-5

Southern interchange – pedestrian and cyclist facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR007_SouthernInterchange_0.mxd

Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways, 2016; LPI: DTDB, 2012.

Southern interchange – southbound cycleway crossing

EIS design

In the EIS design, at the southern interchange, the movement of southbound cyclists on the bypass across Lookout Road was proposed to be provided via an uncontrolled crossing when the traffic on Lookout Road would be at a stop (Section 8.3.2 of the EIS). This would enable southbound on-road cyclists to cross Lookout Road to access the road shoulder to remain on-road or access the proposed shared path on the eastern side of Lookout Road.

Proposed design refinement

A traffic light controlled (one way only from west to east) cyclist crossing would now be provided across Lookout Road to enable on-road cyclists to access the road shoulder of Lookout Road to remain on-road or access the proposed shared path on the eastern side of Lookout Road (Figure 5-5). All on-road cyclists on the bypass would be required to cross at this location, avoiding potential for conflict with southbound traffic on Lookout Road.

McCaffrey Drive – shared path

EIS design

The EIS design replaced the existing footpath located on the northern side of McCaffrey Drive with a two metre wide footpath together with a 1.5 metre road shoulder for on-road cyclists (Section 5.3.14 and Figure 5-1 of the EIS). These works are associated with the upgrade of the Lookout Road and McCaffrey Drive intersection which forms part of the project.

Proposed design refinement

The existing footpath would now be replaced with a three metre wide shared path for use by both pedestrians and cyclists as shown in Figure 5-5. The shared path would be three metres wide and would connect with existing footpaths on Lookout Road and McCaffrey Drive.

The shared path would connect with existing footpaths on Lookout Road and McCaffrey Drive, and with pedestrian and cyclist facilities at the intersection (as described in the following section). The cross section of Bridge 2 has also been refined to suit this design refinement, as discussed in Section 5.5.1.

Lookout Road and McCaffrey Drive intersection – shared path crossing

EIS design

In the EIS design, at the Lookout Road and McCaffrey Drive intersection the project would remove the existing traffic light controlled pedestrian crossing on the western side and the existing traffic light controlled shared path crossing on the southern side. The existing traffic light controlled pedestrian crossing on the northern side of the intersection would be retained (Section 5.3.14 of the EIS).

Proposed design refinement

The existing pedestrian only crossing point on the northern side of the Lookout Road and McCaffrey Drive intersection would now be replaced with a shared path crossing for use by both pedestrians and cyclists as shown in Figure 5-5. The existing crossing of the left turn lane from McCaffrey Drive onto Lookout Road, would also now be a shared path crossing controlled by traffic lights.

Newcastle Road – shared path bridge (Bridge 7)

EIS design

In the EIS design, a new shared path bridge (Bridge 7) over Newcastle Road to the west of Steel Street would be provided replacing the existing mid-block traffic light controlled pedestrian crossing on Newcastle Road, near Hill Street (Section 5.3.14 and Figure 5-1 of the EIS). The shared path bridge would be linked to the existing off-road facilities on either side of Newcastle Road.

On the southern side of Newcastle Road, a new shared path through Jesmond Park on the eastern side of the sports field would connect the existing east-west Jesmond Park shared path to the Bridge 7 ramp at the intersection of Newcastle Road and Robinson Avenue.

Proposed design refinement

Following further consultation with stakeholders the arrangements for the shared path connection between Bridge 7 and the Jesmond Park shared path has been refined. Between the sports field and Newcastle Road the shared path would now continue to the north-east passing under the Bridge 7 ramp connecting to an existing shared path on the southern side of Newcastle Road opposite Steel Street. This design refinement reduces impact to the north-east corner of Jesmond Park.

The proposed connection is shown in Figure 5-7.

5.4.3 Water quality treatment structures

EIS design

To assist with ongoing water quality control during operation of the project, the EIS design proposed to retain and modify five of the construction sedimentation basins as operational water quality treatment structures. These structures would capture about 24.8 hectares of the project operational area.

A typical layout for these operational water quality treatment structures is provided in Figure 5-6.

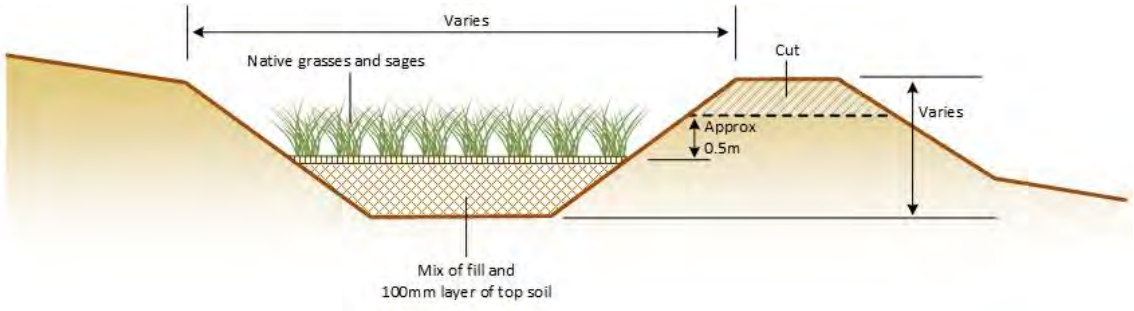


Figure 5-6 Typical operational water quality treatment structure

These structures would receive first flush flows from the road drainage system before discharge to the nearby ephemeral watercourses.

Proposed design refinement

To assist with ongoing water quality control during operation of the project it is now proposed to retain and modify eight of the construction sedimentation basins as operational water quality treatment structures, as shown in Figure 5-1. Vegetated swales are also proposed to be constructed along batters as operational water quality treatment structures. Vegetated swales are proposed to be constructed where batter grades are suitable (where batter grades are between one and five per cent). These structures would capture stormwater runoff from all operational areas of the project (excluding existing roads).

The additional operational water quality treatment structures would further assist to reduce potential pollutants from entering the downstream sensitive receiving environments, creek lines and bushland areas immediately surrounding the project, to provide ongoing water quality improvement.

Further detail is provided in Section 6.8 and the supplementary water quality and watercourse assessment (Appendix G).

LEGEND

- Design
- Bridge
- Pavement
- Earthworks fill
- Existing shared path
- Proposed shared path
- Proposed on-road cycleway
- Proposed retaining wall
- Existing footpath
- Proposed footpath
- Existing bus stop

Sheet layout

Paper Size A4

0 3.75 7.5 15 22.5 30

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-7
Newcastle Road – shared path bridge (Bridge 7)

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR008_NewcastleRd_SharedPath_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways, 2016; LPI: DTDB, 2012.

5.4.4 Construction compounds

EIS design

Three areas were identified in the EIS for potential use as construction compounds (referred to as construction compounds A, B and C) to facilitate construction of the project (Section 5.4.5 and Figure 5-18 of the EIS).

Proposed design refinement

Overview

Following exhibition of the EIS and further review of constructability issues for the project, three additional construction compounds are now proposed resulting in a total of six construction compounds as follows:

- Construction compound A – main site compound (no change since EIS exhibition)
- Construction compound B – minor boundary adjustments to match minor refinement of the construction footprint
- Construction compound C – minor boundary adjustments to match minor refinement of the construction footprint
- Construction compound D – new compound located near the eastern end of Jesmond Park on the southern side of Newcastle Road
- Construction compound E – new compound located near the intersection of Coles Street and Steel Street on the northern side of Newcastle Road
- Construction compound F – new compound near the southern interchange on the western side of Lookout Road.

Compounds A, B and C would be used for the duration of main construction activities. Compounds D and E would only be required during the early work phase associated with construction of the shared path bridge (Bridge 7) over Newcastle Road. Compound F would be used during both the early work and main construction phases.

The locations of the construction compounds are shown in Figure 5-8 and a description is provided in the following sections. They have been located based on:

- Topography and accessibility to construction areas
- Minimising impacts on native vegetation and residential areas where possible
- Clearance above the 20-year ARI event flood level where possible or a contingency plan to manage flooding would be prepared and implemented.

The proposed uses of the construction compounds are provided in Table 5-1. It should be noted these are indicative only and would require further refinement based on the needs of the construction contractor. Construction staging would influence the use of construction compounds.

Access to the construction compounds would mostly be via the proposed construction access roads as described in Section 5.4.11 of the EIS and/or nearby roads. As required, the compounds would be connected to nearby utility services.

Construction of the project would require other areas within the construction footprint to be used for a range of ancillary facilities such as stockpiling, materials handling / laydown, lunch rooms, temporary portable offices, portable toilets and general construction support activities. These would generally be located near to key areas of construction activity (eg bridges) and would be located to minimise potential impacts to sensitive receivers where practicable.

Table 5-1 Potential use for identified construction compounds

Compound areas	A	B	C	D (early work)	E (early work)	F (early work)	F (main work)
Main site compound area	Yes			Yes		Yes	
Materials handling and processing	Yes			Yes	Yes	Yes	Yes
Crushing plant	Yes						
Stockpile site	Yes		Yes	Yes		Yes	Yes
Batching plant	Yes						
Bridge girders/ components	Yes	Yes	Yes	Yes	Yes		Yes
Site offices	Yes	Yes	Yes	Yes		Yes	Yes
Deliveries	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Parking	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Construction support activities	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Compound A

Compound A is about 3.6 hectares in area (consistent with the EIS) (it is noted there was a typographical error in the EIS which stated the area was 3.5 hectares) and is located to the west of the existing carpark, at the northern end of the John Hunter Hospital precinct (Figure 5-8). Main access to this site compound would be via construction access road 1, with secondary accesses via Kookaburra Circuit construction access road 2 and construction access road 4.

This compound would be used for the full duration of project construction.

Compound B

Compound B is about 1.3 hectares (increased by about 0.05 hectares) (it is noted there was a typographical error in the EIS which stated the area was 1.5 hectares) in area and is located next to the northern interchange (Figure 5-8). Access to this construction compound would be via a temporary access arrangement from or near the existing Jesmond roundabout.

This compound would be used for the full duration of project construction.

Compound C

Compound C is about 1.7 hectares in area (increased by about 0.06 hectares) and is located next to the northern interchange (Figure 5-8). Access to this construction compound would be via a temporary access arrangement from or near the existing Jesmond roundabout.

This compound would be used for the full duration of project construction.

Compound D

Compound D (new compound) is about 0.2 hectares in area and is located near the eastern end of Jesmond Park on the southern side of Newcastle Road (Figure 5-8). Access to this construction compound would be via Robinson Avenue and/or temporary access arrangement from Newcastle Road.

This compound would only be required during the early work phase associated with construction of the shared path bridge (Bridge 7) over Newcastle Road.

Compound E

Compound E (new compound) is about 0.1 hectares in area and is located near the intersection of Coles Street and Steel Street on the northern side of Newcastle Road (Figure 5-8). Access to this construction compound would be via Steel Street, Coles Street and/or temporary access arrangement from Newcastle Road.

This compound would only be required during the early work phase associated with construction of the shared path bridge (Bridge 7) over Newcastle Road.

Compound F

Compound F (new compound) is about 0.9 hectares in area and is located near the southern interchange on the western side of Lookout Road (Figure 5-8). Access to this construction compound would be via Lookout Road and/or McCaffrey Drive.

This compound would be required during both the early work and main construction phase. However, as it is located within the footprint of the new road infrastructure it would not be used for the full duration of main work construction although other construction support activities may be ongoing at this location.

Assessment against standard criteria

The former Department of Planning and Infrastructure (now Department of Planning and Environment (DP&E)) published draft conditions for State significant linear infrastructure approvals in March 2012. These conditions outline the expected criteria which would be applied to the project's ancillary facilities (site compounds). These conditions state the location of ancillary facilities shall:

a. Be located more than 50 metres from a waterway
b. Be located within or next to land where State significant infrastructure is being carried out
c. Have ready access to the road network
d. Be located to minimise the need for heavy vehicles to travel through residential areas
e. Be sited on relatively level land
f. Be separated from nearest residences by at least 200 metres (or at least 300 metres from a temporary batching plant)
g. Not require vegetation clearing beyond that already required by the State significant infrastructure
h. Not impact on heritage items (including areas of archaeological sensitivity) beyond those already impacted by the State significant infrastructure
i. Not unreasonably affect the land use of nearby properties
j. Be above the 20-year ARI flood level unless a contingency plan to manage flooding is prepared and implemented
k. Provide sufficient area for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard construction hours.

Table 5-2 provides an assessment of the proposed construction compounds against the standard criteria.

As required by DP&E, where the criteria cannot be met, an assessment demonstrating there would be no significant adverse impact from the ancillary facility's construction or operation has been provided.

Potential impacts from the construction compounds are detailed in the EIS and where there are additional impacts, in Chapter 6 of this report. Measures to mitigate the impacts are summarised in Chapter 7. No additional management measures have been identified in addition to those provided in Chapter 7.

Table 5-2 Assessment of construction compounds against standard condition criteria

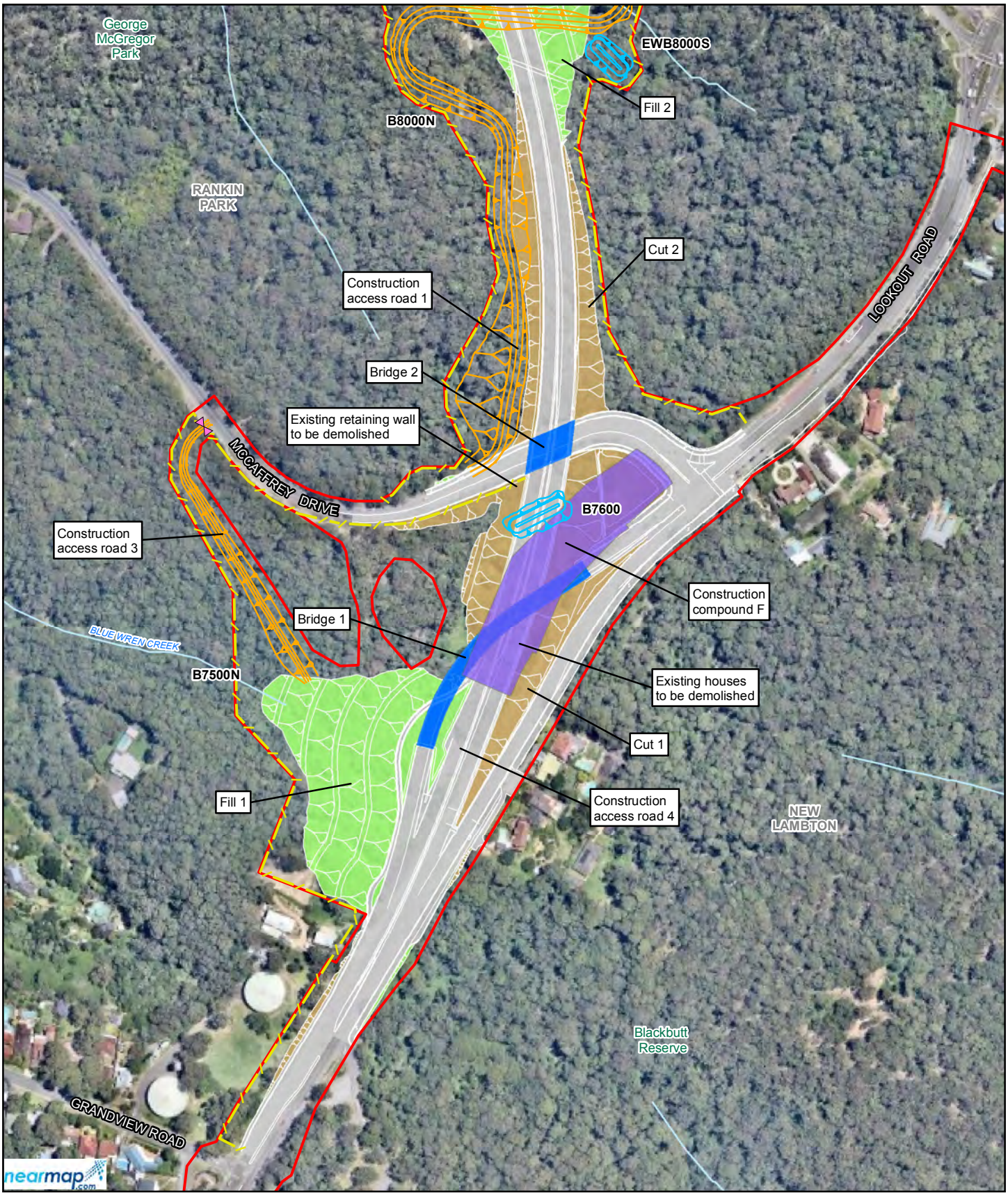
Construction compound	a	b	c	d	e	f	g	h	i	j	k
Compound A	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Compound B	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Compound C	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Compound D	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Compound E	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y
Compound F	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y

Table 5-3 discusses the criteria which would not be met by the site compounds and how the mitigation and management measures developed for the project address these.

Table 5-3 Relevant environmental management measures for site compounds

Standard assessment criteria	Exception to requirement	Relevant environmental management measure
a) Be located more than 50 m from a waterway	Construction compounds B and D are located next to Dark Creek. At these locations, Dark Creek is a concrete lined channel running between Jesmond Park and Newcastle Road. Construction compound E is located about 30 metres from the concrete lined Dark Creek channel in Jesmond Park. Newcastle Road is located between the compound and Dark Creek. Construction compound F is located about 40 metres from an unnamed ephemeral watercourse. McCaffrey Drive is located between the compound and the watercourse.	A soil and water management plan would be prepared as part of the construction environmental management plan. This plan would specify a range of measures to be implemented to manage potential impacts to watercourses (Chapter 7).
f) Be separated from nearest residences by at least 200 metres	The following construction compounds are located near to residences: • Construction compound B is located about 75 metres from residences located on Coles Street, Jesmond • Construction compound C is located about 10 metres from residences located on Illoura Street and Victory Parade, Jesmond • Construction compound D is located about 25 metres from residences located on Robinson Avenue, Lambton • Construction compound E is located about 10 metres from residences located on Coles Street, Jesmond • Construction Compound F is located about 50 metres from residences located on Lookout Road, Rankin Park.	A construction noise and vibration management plan would be prepared as part of the construction environmental management plan. This plan would specify a range of measures to manage and mitigate noise and vibration impacts from use of the construction compounds (Chapter 7). The construction environmental management plan will include measures for the management of air emissions (Chapter 7).

Standard assessment criteria	Exception to requirement	Relevant environmental management measure
g) Not require vegetation clearing beyond that already required for the State significant infrastructure	Construction compounds A, B and C are located next to the project, but would require vegetation clearing which is not required for any structures associated with the project.	A flora and fauna management plan would be prepared as part of the construction environmental management plan. This plan would specify a range of measures to manage and mitigate impacts to biodiversity from clearing required for the construction compounds (Chapter 7). The clearing required for these compounds has been included in the biodiversity offsets for the project (Section 6.2 and Chapter 7).



LEGEND

- Construction footprint
- Construction compound
- Construction access tracks
- Construction sedimentation basin
- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Watercourse
- Construction gate
- Construction fence

B8100S Construction sedimentation basin number

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

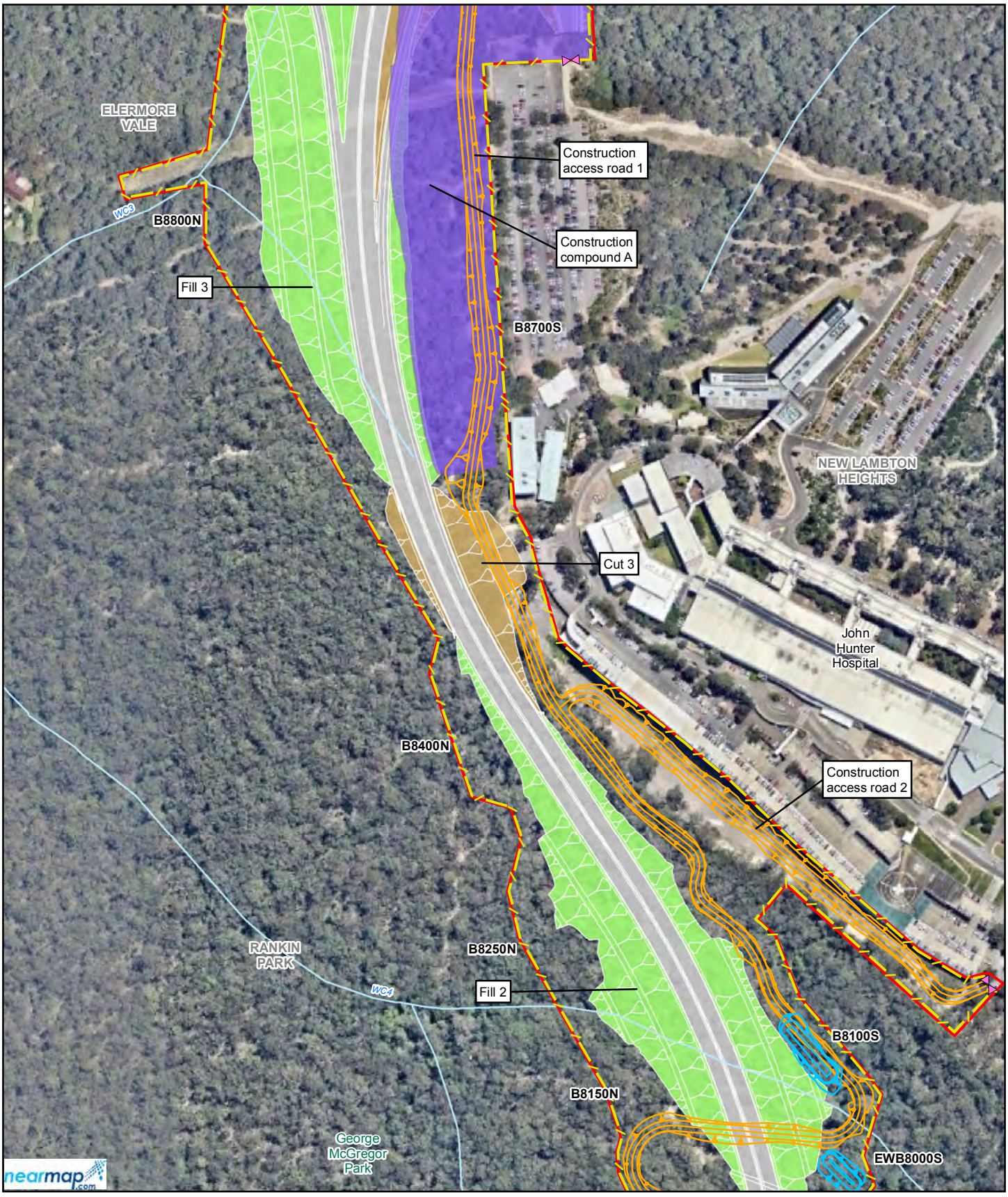
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-8a
Construction ancillary facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR009_ConstructionActivities_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Water quality structures, 2016; LPI: DTDB, 2012.



LEGEND

- Construction footprint
- Construction compound
- Construction access tracks
- Construction sedimentation basin
- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Watercourse
- Construction gate
- Construction fence
- **B8100S** Construction sedimentation basin number

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

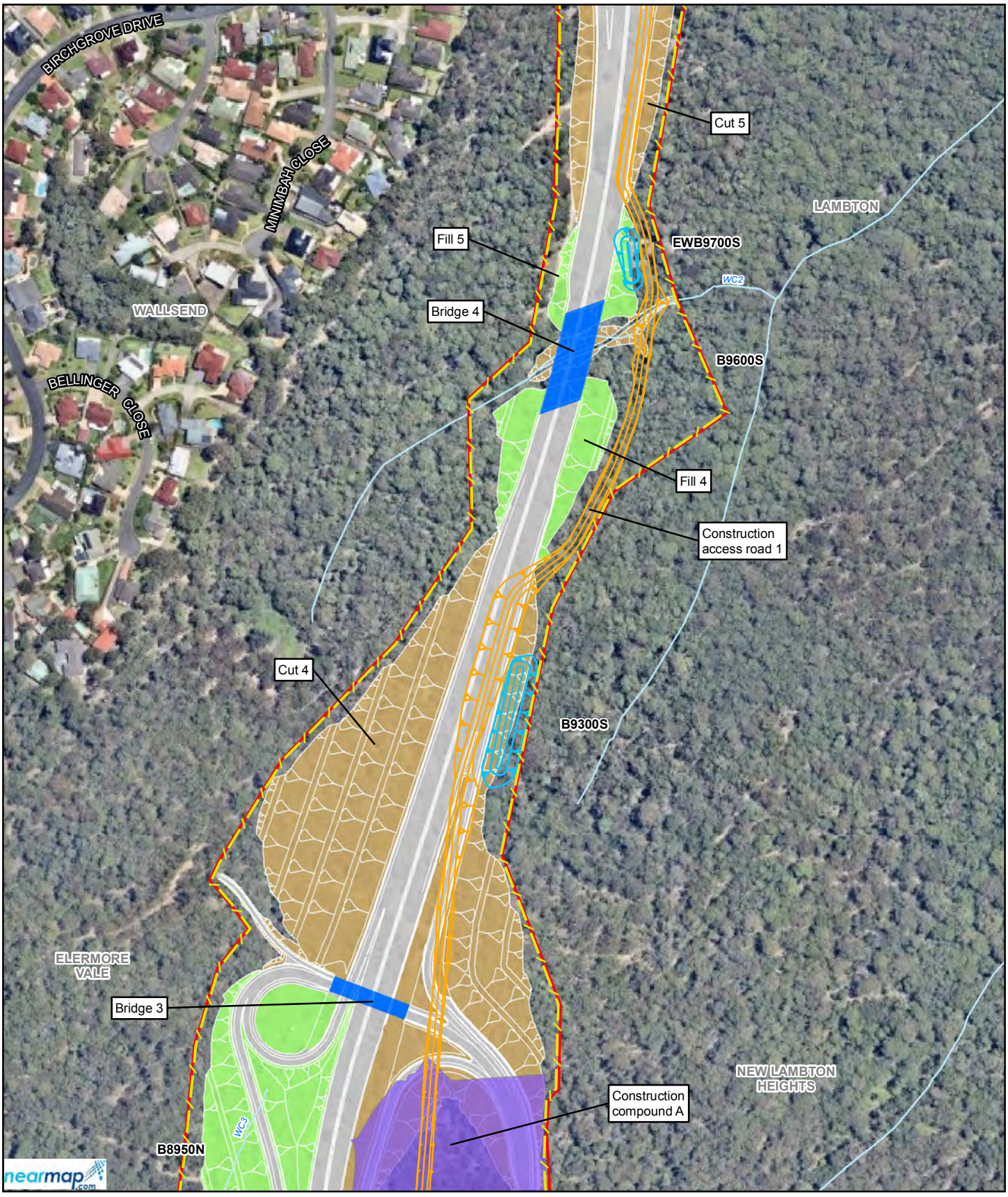
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-8b
Construction ancillary facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR009_ConstructionActivities_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Water quality structures, 2016; LPI: DTDB, 2012.



LEGEND

- Construction footprint
- Construction compound
- Construction access tracks
- Construction sedimentation basin
- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Watercourse
- Construction fence
- **B8100S** Construction sedimentation basin number

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-8c
Construction ancillary facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR009_ConstructionActivities_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Water quality structures, 2016; LPI: DTDB, 2012.

LEGEND

- Construction footprint
- Construction compound
- Construction access tracks
- Construction sedimentation basin
- Design
- Pavement
- Bridge
- Earthworks cut
- Earthworks fill
- Watercourse
- Construction fence
- **B8100S** Construction sedimentation basin number

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-8d
Construction ancillary facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR009_ConstructionActivities_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Water quality structures, 2016; LPI: DTDB, 2012.

5.4.5 Workforce and work hours

EIS design

In the EIS, Roads and Maritime was seeking approval for proposed extended construction hours for general construction activities as follows:

- Monday to Friday: 6am to 7pm
- Saturday: 7am to 5pm
- Sunday and public holidays: no work.

These were based on standard construction hours plus an additional time of two hours each day from Monday to Friday and five hours on Saturdays.

Proposed design refinement

Following exhibition of the EIS, receipt of submissions, further review of constructability issues for the project and consultation with DP&E, Roads and Maritime has refined the approach to the proposed extended construction hours as shown in Table 5-4.

Table 5-4 Proposed extended construction hours

Period	Construction activities
Monday to Friday: 6am to 7pm	• 6am to 7am: construction activities which do not result in noise levels above the relevant construction noise management level at the nearest affected sensitive residential receiver • 7am to 7pm: general construction activities
Saturday: 7am to 5pm	General construction activities
Sundays and public holidays	No work

The *Interim Construction Noise Guideline* (DECC 2009) recognises there are some situations where construction work may need to be carried out outside of the recommended standard construction hours. This includes public infrastructure work which shorten the length of the project and are supported by the affected community.

In reference to public infrastructure work, it is considered approval for this project to extend the hours of work outside of the recommended standard hours would result in significant benefits to the greater community. These benefits would include:

- An overall construction period reduction by three to four months
- Reduced duration of disruptions to road users, particularly on McCaffrey Drive, Lookout Road, Croudace Street and Newcastle Road
- Reduced duration of public's exposure to changed traffic conditions and interaction with construction traffic
- Reduced timeframe of exposure of surrounding sensitive receivers, in particular the John Hunter Hospital precinct, to construction noise, vibration and dust
- Earlier completion of the project and improved traffic and safety performance.

The proposed extended construction hours would only apply to general construction activities. If required, blasting would only be carried out during the recommended standard construction hours.

5.5 Minor design refinements

5.5.1 Bridges

Bridge 2

Bridge 2 carries McCaffrey Drive over the main project alignment, providing grade separation between McCaffrey Drive and the bypass.

EIS design

In the EIS design, the bridge would provide two westbound lanes and three eastbound lanes travelling to the Lookout Road and McCaffrey Drive intersection. Two of these lanes would turn right (southbound on Lookout Road) and one would turn left (northbound on Lookout Road) at the intersection.

The cross section of the bridge included a two metre wide footpath on the northern side, a 1.5 metre wide northern shoulder, five 3.5 metre wide traffic lanes and a 1.5 metre wide southern shoulder.

Proposed design refinement

The cross-section of the bridge has now been refined to provide for the proposed shared path on the northern side of the bridge as described in Section 5.4.2.

The cross section of the bridge now consists of a three metre wide shared path (instead of a two metre wide footpath) on the northern side, a 0.5 metre wide northern shoulder (instead of 1.5 metres), five 3.5 metre wide traffic lanes and a 1.5 metre wide southern shoulder.

All other features of Bridge 2 are as described in Section 5.3.7 of the EIS.

The refined design for Bridge 2 is shown in Figure 5-9.

Bridge 3

Bridge 3 forms part of the hospital interchange and is required to provide a grade separation between the proposed new hospital access road to/from the hospital precinct and the bypass.

EIS design

In the EIS design, the bridge would provide one westbound lane for traffic exiting the hospital precinct to join the bypass in a northbound direction.

The cross section of the bridge included one metre wide shoulders, one 3.5 metre wide traffic lane and a three metre wide shared path on its northern side, which would provide access to bushland and residential areas either side of the project.

Proposed design refinement

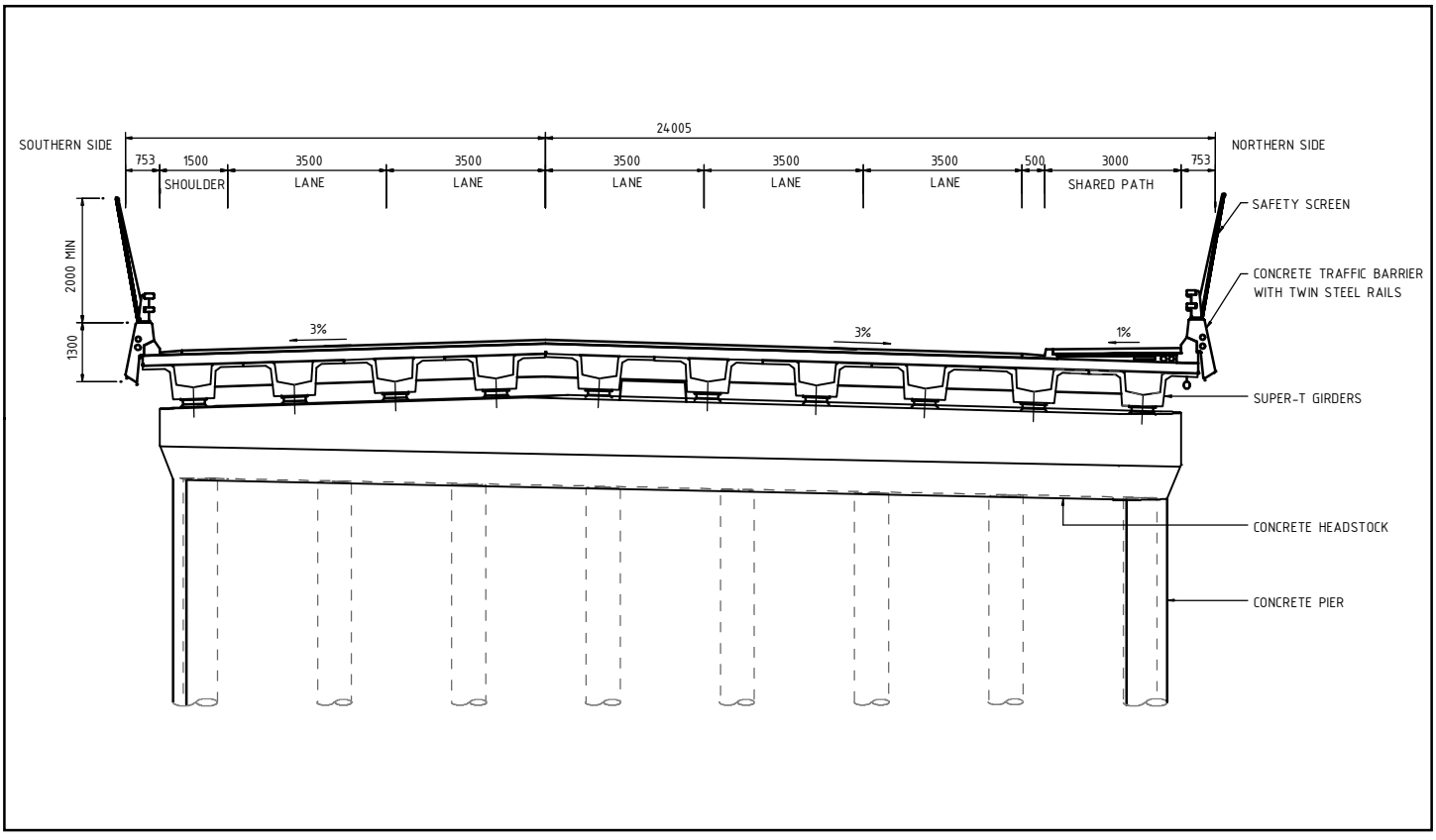
The cross-section of the bridge has now been refined to provide an additional traffic lane as part of the full interchange arrangement as described in Section 5.4.1.

The cross section of the bridge now consists of one metre wide shoulders and two 3.5 metre wide lanes (instead of one 3.5 metre wide lane) to accommodate traffic to/from the hospital precinct. The three metre wide shared path on the northern side would be retained in the refined design.

All other features of Bridge 3 are as described in Section 5.3.7 of the EIS.

The refined design for Bridge 3 is shown in Figure 5-10.

Indicative 3D image of Bridge 2 - McCaffrey Drive, looking north



Elevation of Bridge 2, looking west

Paper Size A4

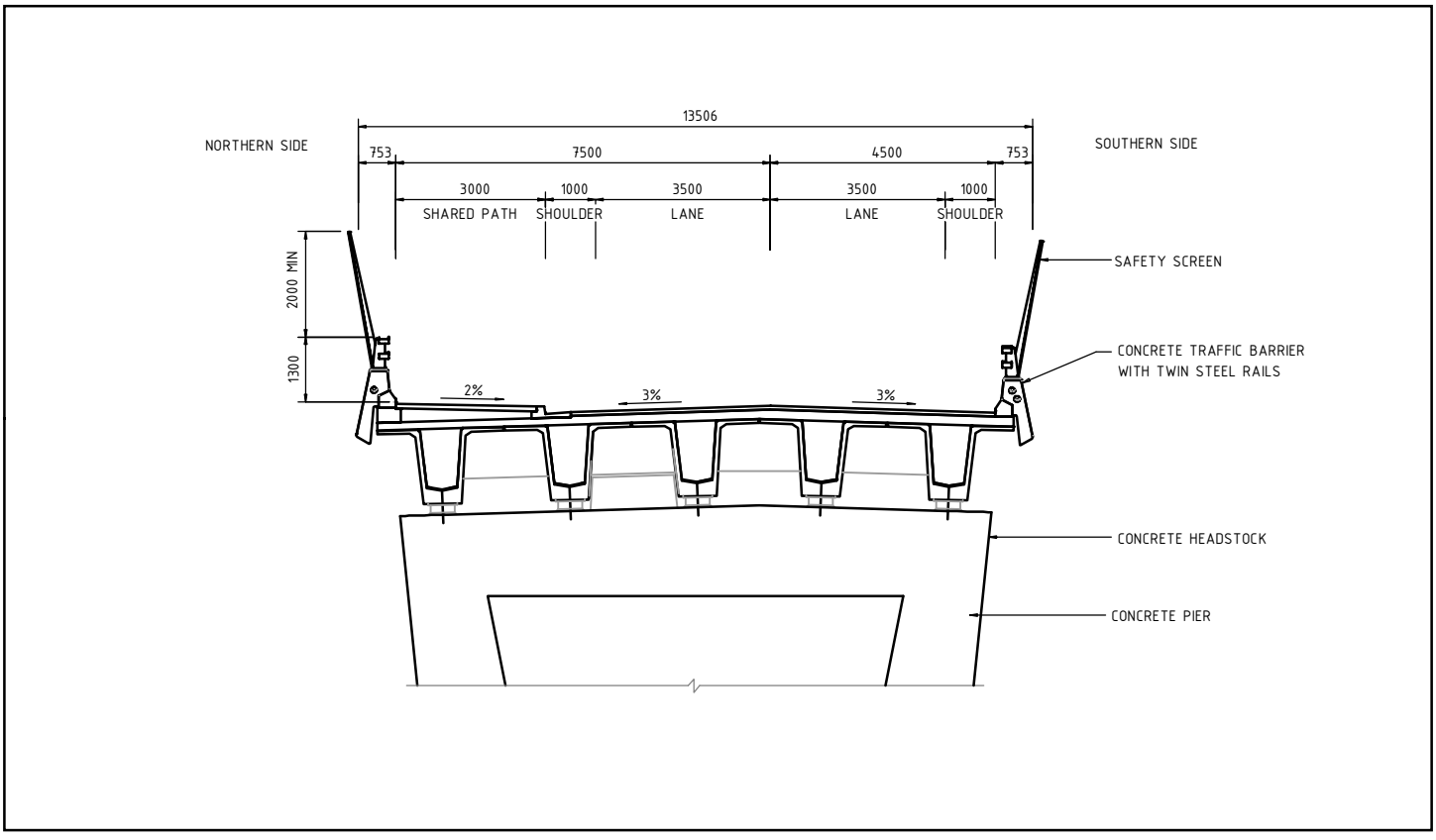
Not to scale

Rankin Park to Jesmond

Figure 5-9
Bridge 2

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR010_Bridge2_0.mxd
Data source: Aurecon: Cross section / 3d image, 2016.

Indicative 3D image of Bridge 3 - hospital interchange, looking north



Elevation of Bridge 3, looking east

Paper Size A4

Not to scale

Rankin Park to Jesmond

Figure 5-10
Bridge 3

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR011_Bridge3_0.mxd
Data source: Aurecon: Cross section / 3d image, 2016.

5.5.2 Flooding and drainage

Drainage and stormwater management

EIS design

The EIS design (Section 5.3.9 and Figure 5-14 of the EIS) provided a range of drainage infrastructure which would be installed or adjusted for the project including:

- Cross drains – would allow water to move from one side of the project to the other without crossing the road surface
- Pavement drains – would capture runoff generated from the project's road pavement and convey the water to existing drainage systems. These existing drainage systems eventually discharge to Ironbark Creek and Dark Creek, or their tributaries
- Longitudinal catch drains – would be located on the upstream or downstream of a road and on the benches of large cuts and fills to prevent water from flowing into nearby areas.

The project's stormwater system would discharge to existing piped stormwater drainage systems where possible or discharge to watercourses. The drainage system has been designed to provide sufficient capacity to capture and convey flows to receiving creeks or tributaries.

Proposed design refinement

Due to the design refinements discussed in this report the proposed drainage infrastructure has now been refined as shown in Figure 5-11. The refined design is consistent with that described in the EIS and includes minor changes to cross drains, pavement drains and longitudinal catch drains to reflect other design refinements including the:

- Hospital interchange layout (Section 5.4.1)
- Grade separation of the Jesmond Park shared path (Section 5.4.2).

The drainage infrastructure would generally comply the design criteria provided in Section 5.3.9 of the EIS.

Flood mitigation work

EIS design

The EIS design included the following flood mitigations work at the northern interchange (Section 5.3.9 and Figure 5-14 of the EIS):

- South-east of the northern interchange – installation of a bund at the western extent of Jesmond Park. A new culvert would also be installed around the western edge of the interchange before crossing Newcastle Road and connecting into the existing concrete channel to the north-west of the northern interchange associated with Dark Creek
- North-east of the northern interchange – installation of a bund along the eastern edge of the southbound off-ramp. To complement this:
  - Installation of a culvert and water inlet structure to drain water behind this bund
  - Minor grading/profiling would be carried out in the garden area of private residential land next to the southbound off-ramp to ensure water drains to the inlet structure (in consultation with property owners)
- South-west of the northern interchange – a longitudinal catch drain and water inlet structure would be constructed to direct flows into the new culvert from the south-east.

The proposed flood mitigation work would result in substantial improvement to flood immunity for the road network at the northern interchange including Newcastle Road from less than a 5 year ARI event to a 100 year ARI event.

Proposed design refinement

Due to the design refinements discussed in this report the proposed flood mitigation work has now been refined as shown in Figure 5-11 and consists of:

- South-east of the northern interchange – installation of a bund at the western extent of Jesmond Park. To complement this:
  - A new culvert would be installed beneath the on and off-ramps to connect the existing concrete channel (Dark Creek) to the existing culvert which passes beneath the existing roundabout
  - A new culvert and water inlet structure would be installed and pass beneath the on and off-ramps and bypass before following the western edge of the interchange, crossing Newcastle Road and connecting into the existing concrete channel via a section of new culvert to the north-west of the northern interchange associated with Dark Creek
- North-east of the northern interchange – installation of a bund along the eastern edge of the southbound off-ramp. To complement this:
  - Installation of a culvert and water inlet structure to drain water behind this bund
  - Minor grading/profiling would be carried out in the garden area of private residential land next to the southbound off-ramp to ensure water drains to the inlet structure (in consultation with property owners)
- South-west of the northern interchange – a longitudinal catch drain, culvert beneath the fill embankment for the shared path and water inlet structure would be constructed to direct flows into a new culvert from the south-east.

The proposed design refinements would still result in improved to flood immunity for the road network at the northern interchange including Newcastle Road from less than a 5 year ARI event to a 100 year ARI event, consistent with the EIS.

LEGEND

- Design
- Watercourse
- Pavement drainage
- Cross drainage
- Longitudinal catch drains
- Operational water quality structure
- Existing culvert
- Proposed water inlet structure
- Proposed culvert
- Flood mitigation bund

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

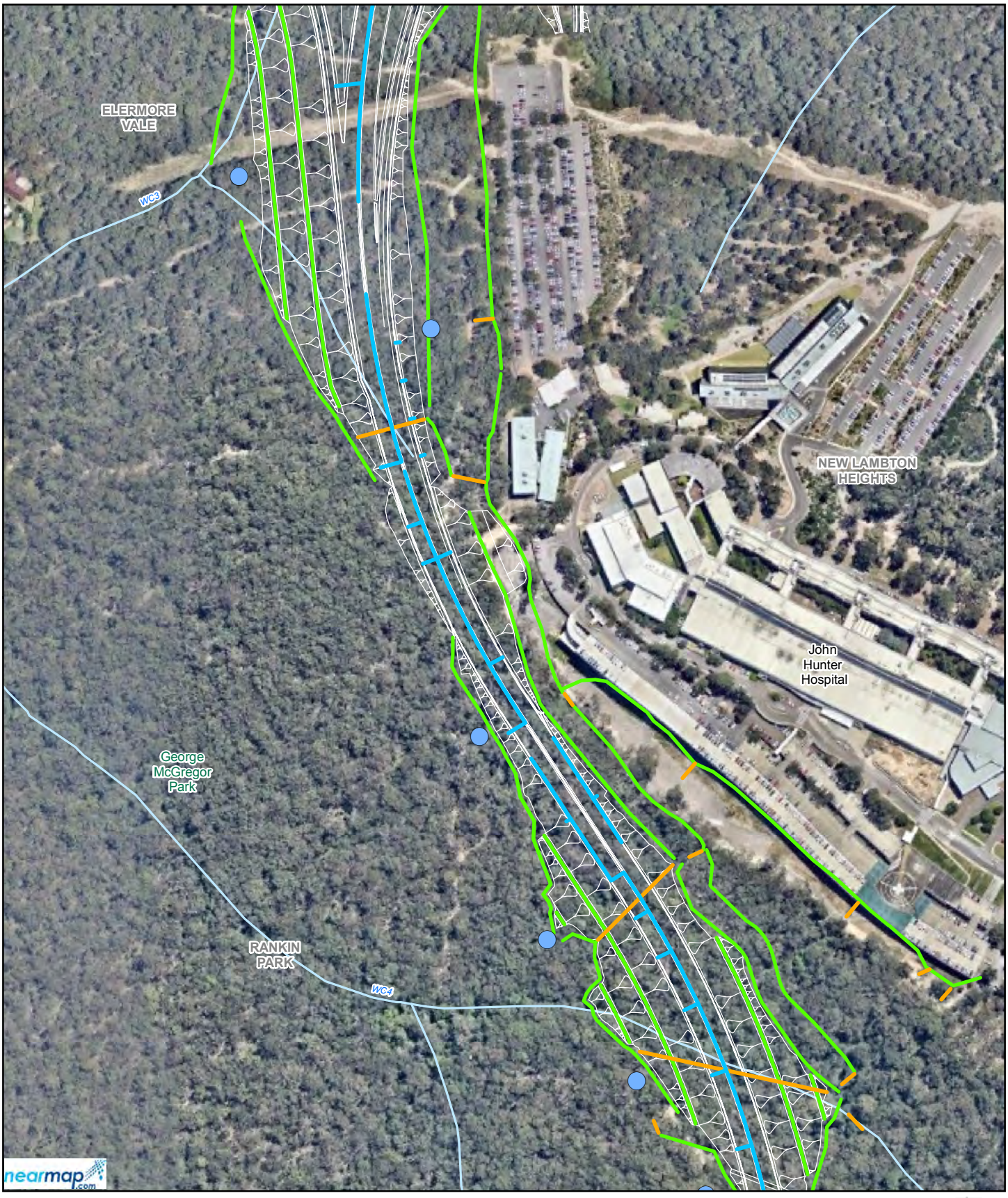
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-11a
Drainage infrastructure

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR012_Drainage_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / Flood / Drainage data, 2016; LPI: DTDB, 2012.



LEGEND

- Design
- Watercourse
- Pavement drainage
- Cross drainage
- Longitudinal catch drains
- Operational water quality structure
- Existing culvert
- Proposed water inlet structure
- Proposed culvert
- Flood mitigation bund

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

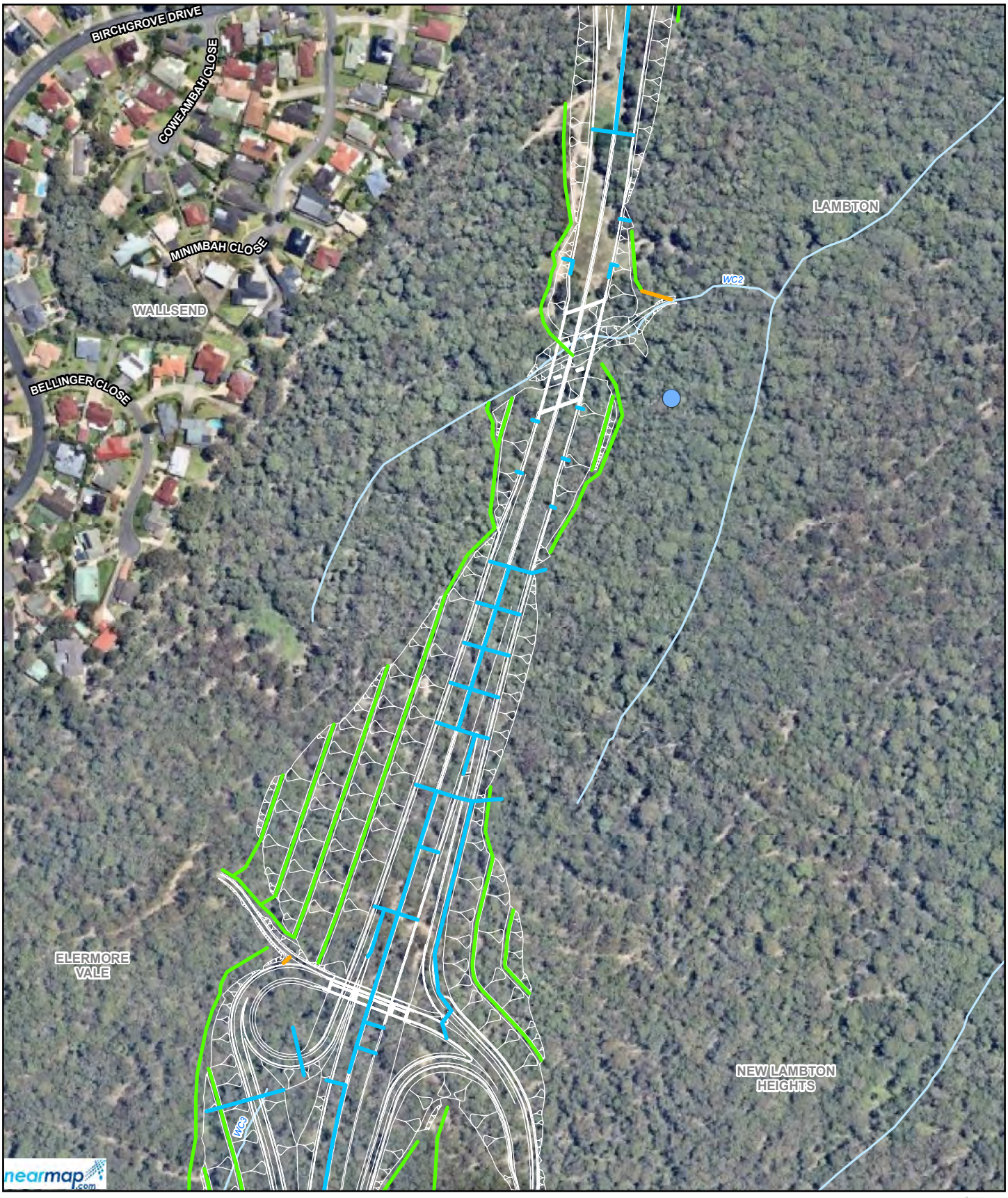
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-11b
Drainage infrastructure

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR012_Drainage_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / Flood / Drainage data, 2016; LPI: DTDB, 2012.



LEGEND

- Design
- Watercourse
- Pavement drainage
- Cross drainage
- Longitudinal catch drains
- Operational water quality structure
- Existing culvert
- Proposed water inlet structure
- Proposed culvert
- Flood mitigation bund

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

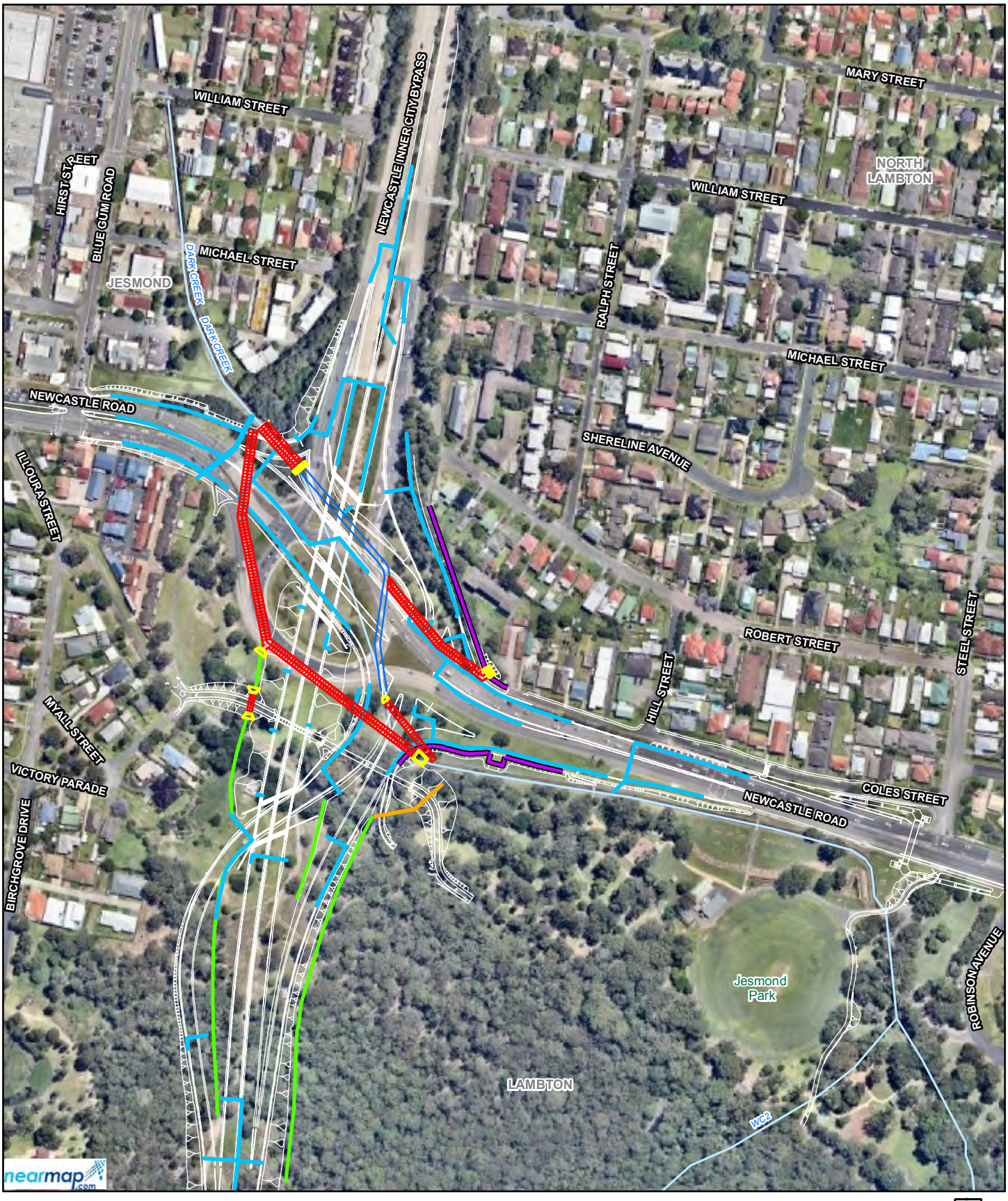
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-11c
Drainage infrastructure

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR012_Drainage_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / Flood / Drainage data, 2016; LPI: DTDB, 2012.



LEGEND

- Design
- Watercourse
- Pavement drainage
- Cross drainage
- Longitudinal catch drains
- Operational water quality structure
- Existing culvert
- Proposed water inlet structure
- Proposed culvert
- Flood mitigation bund

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-11d
Drainage infrastructure

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR012_Drainage_DDP_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / Flood / Drainage data, 2016; LPI: DTDB, 2012.

5.5.3 Cuttings and embankments

EIS design

In the EIS design, a number of excavations (referred to as cuts) and embankments (referred to as fills) were required along the main project alignment due to the undulating topography (Section 5.3.11 and Figure 5-1 of the EIS).

Proposed design refinement

Due to the project design refinements described in this report, there has been adjustment of the required cut and fill volumes. All cuts and fills would still be constructed in accordance with the design criteria identified in Section 5.2.2 of the EIS.

Areas of cut and fill are shown in Figure 5-1 and detailed in Table 5-5. In Table 5-5 the change as a result of the design refinements is indicated in brackets. Further description of the proposed earthworks associated with cuts and fills are detailed in Section 5.5.10.

Table 5-5 Cut/fill details

No.	Location	Cut (cubic metres)	Fill (cubic metres)	Height or depth (metres)	Length (metres)	Width (metres)
Fill 1	Southern interchange - approach to Bridge 1	-	145,000 (+23,000)	45 (+5)	190	145 (+5)
Cut 1	Southern interchange - main project alignment south of McCaffrey Drive	175,000	-	18	300	120
Cut 2	Southern interchange - main project alignment north of McCaffrey Drive	88,000	-	12	270	65
Fill 2	Main project alignment south-west of John Hunter Hospital precinct	-	283,000	23	540	120
Cut 3	Main project alignment west of John Hunter Hospital precinct	39,000	-	19	210	75
Fill 3	Main project alignment, south of hospital interchange	-	357,000 (+106,000)	25	500	120 (+15)
Cut 4	Hospital interchange and main project alignment to the north	603,000 (+15,000)	-	25	480	200
Fill 4	Southern approach to Bridge 4	-	43,000	14	150	90

No.	Location	Cut (cubic metres)	Fill (cubic metres)	Height or depth (metres)	Length (metres)	Width (metres)
Fill 5	Northern approach to Bridge 4	-	14,000	13	110	65
Cut 5	On and off-ramps to the south of the northern interchange	114,000 (+24,000)	-	8	420	100
Fill 6	Northern interchange - approach to Bridge 6	-	95,000 (+5000)	10	530	65
Total		1019,000 (+39,000)	937,000 (+134,000)			

5.5.4 Proposed road corridor

EIS design

In the EIS design, the proposed road corridor is defined as the final operational road reserve and has been developed to encompass the entire operational footprint of the project (Section 5.3.4 and Figure 5-1 of the EIS). The proposed road corridor includes:

- Main project alignment
- Interchanges and ramps
- Road fill embankments and cuttings
- Culverts and drainage structures
- Water quality control structures
- Landscaping
- Maintenance access
- Fencing.

The width of the proposed road corridor for the main project alignment through the bushland varies between about 120 metres and 320 metres, with increases in width associated with deep cuttings and high embankments.

Proposed design refinement

Due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road (Section 5.4.2), there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road. There are no other changes to the proposed road corridor. The width of the proposed road corridor as described in the EIS has not changed as a result of the proposed design refinements.

The refined proposed road corridor is shown in Figure 5-12.

LEGEND

Refined proposed road corridor

EIS proposed road corridor

Paper Size A4

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-12
Proposed road corridor

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR013_ProposedRoadCorridor_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways/ footpaths, 2016; LPI: DTDB, 2012.

5.5.5 Property acquisition and transfer of ownership

EIS design

In the EIS design, the total area of property acquisition was about 57.7 hectares (Section 5.3.21 and Figure 5-17 of the EIS).

Most of the land which would be impacted by the project is designated as a road corridor for the project and is either already owned by Roads and Maritime, or by other government agencies. A number of other properties have also been acquired by Roads and Maritime during planning for the project.

Proposed design refinement

As discussed in Section 5.4.2, due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road, there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road. As a result there would be a slight increase in the area of acquisition from about 57.7 hectares to about 57.8 hectares. The additional area would impact Jesmond Park which is owned by Newcastle City Council as detailed in Table 5-6 and shown in Figure 5-13. In Table 5-6 the minor increase is shown on brackets.

All other direct property impacts detailed in Section 5.3.21 of the EIS have not changed.

The extent of property acquisition would be confirmed during detailed design. Land acquisition will be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime 2014b) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Table 5-6 Direct property impacts

Property ID	Lot and DP	Total area of lot (hectares)	Area of lot directly impacted (hectares)	Percentage of lot directly impacted
18	Lot 1 DP396221 (Jesmond Park)	8.34	0.3 (+0.05)	3.6% (+0.6%)

LEGEND

- Property acquisition
- Lot boundaries
- Impacted lot
- Proposed road corridor

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-13
Direct property impacts – Jesmond Park

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR014_PropertyImpacts_JesmondPark_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Proposed Road Corridor 2016; LPI: DTDB, 2012.

5.5.6 Noise mitigation work

EIS design

In the EIS design (Section 5.3.19 of the EIS), a total of 50 sensitive receivers qualified for consideration for mitigation and the preliminary mitigation scenario for the project was:

- Low noise pavements consisting of stone mastic asphalt for all new pavement areas where feasible
- Construction of Noise Barrier 3 (about three metres high and 437 metres long)
- Construction of Noise Barrier 4 (about 3.5 metres high and 760 metres long)
- At-property treatments for 37 sensitive receivers located:
  - Along the existing Jesmond to Shortland section of the Newcastle Inner City Bypass, to the east and west of the project
  - Along Newcastle Road to the east and west of the project
  - In the John Hunter Hospital precinct
  - On Lookout Road near the southern interchange.

Proposed design refinement

Due to the design refinement associated with the hospital interchange layout (Section 5.4.1) and review of submissions, an updated noise and vibration assessment was carried out (Section 6.4 and Appendix D). A total of 49 sensitive receivers now qualify for consideration for mitigation. As a result the preliminary mitigation scenario for the project was reviewed and now includes:

- Low noise road pavements consisting of stone mastic asphalt for all new pavement areas where feasible
- Construction of Noise Barrier 3 (about three metres high and 437 metres long)
- Construction of Noise Barrier 4 (about 3.5 metres high and 760 metres long)
- At-property treatments for 35 sensitive receivers located:
  - Along the existing Jesmond to Shortland section of the Newcastle Inner City Bypass, to the east and west of the project
  - Along Newcastle Road to the east and west of the project
  - In the John Hunter Hospital precinct
  - On Lookout Road near the southern interchange.

While the number of receivers which qualify for consideration for noise mitigation has changed slightly, the overall preliminary mitigation scenario is still valid.

The noise assessment and preliminary mitigation scenario (including barrier heights and locations) will be re-evaluated at the detailed design stage and is subject to change. This may result in more or less receivers qualifying for consideration of noise mitigation. This will take into account any changes to the design and where required, feedback from consultation with affected residents. Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

5.5.7 Directional signage

EIS design

In the EIS design, directional signage would be provided to advise of key destinations, place names and routes (Section 5.3.20 of the EIS).

Proposed design refinement

While originally envisaged in the EIS design, for clarity, directional signage (possibly including variable message signs), would also be installed outside the project area (eg on other sections of the Newcastle Inner City Bypass, Newcastle Road and surrounding road network) to provide advance notice to motorists. This would include any required utility connections.

5.5.8 Construction footprint

EIS design

In the EIS design, the area contained within the construction footprint was about 63.1 hectares (Section 5.4.1 and Figure 5-18 of the EIS). It is noted there was a typographical error in the EIS which stated the area within the construction footprint was about 64.2 hectares.

Proposed design refinement

Due to project design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road and grade separation of the Jesmond Park shared path (Section 5.4.2), there has been some slight adjustments to the construction footprint.

As a result the area contained within the construction footprint has increased from about 63.1 hectares to about 63.2 hectares. The refined construction footprint is shown in Figure 5-14.

The construction footprint represents the anticipated maximum area of disturbance which would occur from construction of the project. This includes the area required for temporary work such as sedimentation basins, drainage channels, access roads, construction compounds and ancillary sites. Some areas of the construction footprint are located outside the proposed road corridor (Section 5.5.4) and these areas would be subject to leasing or other arrangements between Roads and Maritime and the landowner (Section 5.5.9).

The construction footprint has been established to minimise vegetation clearing while providing sufficient room to allow the project to be constructed in a safe manner. The construction footprint would be subject to refinement during detailed design and construction. Some factors which could affect the final construction footprint includes the location and size of sedimentation basins, the construction methodology, and arrangements made with directly affected landowners.

Subject to any conditions of approval for the project, detailed design and confirmation of construction staging and methodology, there may be a need for minor construction activities outside the construction footprint such as:

- Temporary safety signage and traffic control
- Temporary revised road signage
- Adjustments to existing drainage infrastructure/watercourses
- Re-sheeting and/or line marking of existing roads at tie ins
- Installation of nest boxes
- Improvements to existing roads to access compounds
- Minor utility relocations or connections.

LEGEND

Refined construction footprint

EIS construction footprint

Paper Size A4

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-14
Construction footprint

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR015_ConstructionFootprint_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways/ footpaths, 2016; LPI: DTDB, 2012.

5.5.9 Construction lease areas

EIS design

In the EIS design, it was identified construction of the project would require temporary leasing of land (or other temporary arrangements) for ancillary facilities and construction work.

In the EIS design, the total area of construction lease areas was about 2.7 hectares (Section 5.4.5 and Figure 5-19 of the EIS).

Proposed design refinement

Due to refinements to the construction footprint (Section 5.5.8), potential construction lease areas have been adjusted as detailed in Table 5-7 and shown in Figure 5-15. In Table 5-7 the change as a result of the design refinements is indicated in brackets.

Areas which have been adjusted and are proposed to be leased listed in Table 5-7 are:

- Construction compound B and Bridge 8 (including associated shared paths) (item L1)
- Construction compound D and Bridge 7 (including associated shared paths) (item L3)
- Construction compound C and Bridge 8 (including associated shared paths) (item L8).

As a result, the total area of construction lease areas is now about 2.8 hectares. All other potential construction lease areas detailed in Section 5.4.5 of the EIS have not changed.

Refer to Section 6.6 for an updated assessment of impact associated with potential leasing of land.

Table 5-7 Potential construction lease areas

Map ID	Lot and DP	Existing land use	Ownership	Total area of lot (hectares)	Area of lot directly impacted (hectares)	Percentage of lot directly impacted
L1	Lot 1 DP627240	Shared path	Newcastle City Council	0.77	0.09 (+0.04)	12% (+6%)
	Lot 1 DP396221	Jesmond Park		8.34	0.64 (+0.06)	8% (+1%)
L3	Lot 1 DP396221	Jesmond Park	Newcastle City Council	8.34	0.57 (-0.03)	7% (no change)
	Lot 1 DP238564	Shared path		0.87	0.01 (no change)	1% (no change)
L8	Lot 2 DP627240	Shared path	Newcastle City Council	0.42	0.04 (new area)	10%
	n/a	Road corridor		0.01	0.01 (new area)	100%

LEGEND

- Proposed road corridor
- Construction footprint
- Watercourse
- Lease area (or other arrangement)
- Lot boundaries
- Impacted lot

Sheet layout

Paper Size A4

0 12.5 25 50 75 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 5-15
Potential construction lease areas

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH05_SR016_ConstructionLeaseAreas_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Water quality structures, 2016; LPI: DTDB, 2012. Created by: tmorton, fmackay

5.5.10 Earthworks

EIS design

In the EIS design, a number of excavations (referred to as cuts) and embankments (referred to as fills) were required along the main project alignment due to the undulating topography (Section 5.3.11 and Figure 5-1 of the EIS). The indicative quantities of the various material types generated during excavations by the project were detailed in Section 5.4.7 of the EIS.

Proposed design refinement

Due to the project design refinements described in this report there has been refinement of the required cut and fill volumes as described in Section 5.5.3 and shown in Figure 5-1.

The refined indicative quantities of the various material types generated during excavations by the project are listed in Table 5-8. The refined indicative earthworks fill volumes required by the project are shown in Table 5-9. In Table 5-8 and Table 5-9 the change as a result of the design refinements is indicated in brackets.

Table 5-8 Cut volumes

Item No.	Cut material description	Cut volume (cubic metres)	%
1	Suitable for general fill	421,000 (+21,000)	41
2	Suitable for upper zone formation	200,000 (+5000)	20
3	Suitable for select material zone	112,000 (+2000)	11
4	Coal	102,000 (+7000)	10
5	Tuffaceous materials	184,000 (+4000)	18
Total		1019,000 (+39,000)	100

Table 5-9 Fill volumes

Item No.	Fill material description	Fill volume (cubic metres)	%
1	General fill (cut/fill)	891,000 (+130,000)	95
2	Upper zone formation	46,000 (+4000)	5
Total		937,000 (+134,000)	100

Table 5-8 and Table 5-9 shows that with the refinements the project would indicatively generate about 82,000 cubic metres of surplus material from cuts (decreased from 177,000 cubic metres in the EIS design). There is potential as the detailed design is developed grade lines will be adjusted to further balance the cut and fill requirements. Where a surplus of cut materials still occurs, this material could be used in a number of ways through the project, such as to flatten batters or to provide visual screenings.

Surplus material which is not able to be used on-site as part of the project would be reused or disposed of in the following order of priority:

- Transfer to other nearby Roads and Maritime projects for immediate use
- Transfer to an approved Roads and Maritime temporary stockpile site for future use during projects or routine maintenance
- Transfer to a Roads and Maritime approved site for reuse on concurrent private/local government project (with appropriate approvals as required)
- Disposal at an approved materials recycling or licensed waste disposal facility
- As otherwise provided for by the relevant waste legislation.

The process for management of excess material would be detailed in a resource and waste management plan which would form part of the construction environmental management plan.

It is predicted about 40,700 cubic metres (increased from 38,000 cubic metres in the EIS design) of surplus material which is unsuitable for use in fill may have to be disposed off-site.

5.5.11 Erosion and sediment controls

EIS design

In the EIS design, during construction, about 16 sedimentation basins would be installed to capture sediment laden runoff from construction areas (Section 5.4.9 and Figure 5-18 of the EIS).

Proposed design refinement

Due to other design refinements, during construction there will be still be about 16 sedimentation basins but some would be in new locations to capture sediment laden runoff from construction areas (Figure 5-8).

Further details are provided in Section 6.8.

5.5.12 Construction materials

EIS design

Construction of the project would require a range of materials to be transported to and within the construction footprint and compound/stockpile areas (Section 5.4.12 of the EIS). Typical construction materials would include concrete, asphalt, water and fuel/electricity.

Proposed design refinement

Due to the project design refinements described in this report there has been minor refinement of the estimated usage of concrete, asphalt and water as described in this section.

Concrete

Construction of the project would require about 13,000 cubic metres of concrete (12,000 cubic metres in the EIS design). This would most likely be supplied from external sources or could involve the establishment of a batching plant on-site (as discussed in Section 5.4.5 of the EIS). Concrete would be required for bridge and drainage structures, kerbs and medians.

Asphalt

Construction of the project would require about 57,000 tonnes of asphalt (55,000 cubic metres in the EIS design). This would most likely be supplied from external sources or could involve the establishment of a batching plant on-site (as discussed in Section 5.4.5 of the EIS). Asphalt would be used to construct road surfaces.

Water

Water would be required for the various construction activities including:

- Compacting and stabilising earthworks
- Suppressing dust
- Watering landscaped areas
- On-site concrete batching
- Concrete curing
- Washing plant and machinery
- Site amenities.

Water supply would be sourced from the Hunter Water Corporation potable water network at the Jesmond roundabout at the northern end of the project and/or Lookout Road at the southern end of the project. Alternatively, water would also be sourced from another suitable source. Consultation would be carried out with Hunter Water Corporation during the detailed design stage regarding potential water use requirements. The final connection points and arrangement of potable water supply would be determined by the construction contractor.

Indicative water requirements to facilitate construction have been estimated and are provided in Table 5-10. In Table 5-10 the change as a result of the design refinements is indicated in brackets.

Table 5-10 Indicative water requirements for construction

Construction activity	Estimated water consumption during construction (mega litres)
Bulk earthworks	26 (+1)
Dust suppression	5 (no change)
Landscape watering	4 (no change)
Road surface construction	5 (no change)

5.5.13 Early work

EIS design

Early work is activities which take place before the main construction work and provide a benefit to the timing and/or sequencing to the overall project. In the EIS design (Section 5.5.2 of the EIS), the following activities have been identified as potential early work for the project:

- Utility relocations along Lookout Road
- Shared path along the eastern edge of Lookout Road
- Demolition of houses on Lookout Road
- Mine remediation
- Preloading to the south of Newcastle Road
- Construction of Bridge 7 and associated shared path and pedestrian footpath and utility relocations/work
- Archaeological salvage program of Hollywood Shanty Town
- Removal of pre-existing waste

- Access and preparation activities required to carry out the early work and associated with the project, such as establishment of erosion and sedimentation controls, fencing and vegetation clearing (including endangered ecological community)
- At-property acoustic treatments.

Proposed design refinement

Due to the design refinements and additional assessments (Chapter 6), consultation with DP&E and following review of submissions and a further review of constructability issues for the project, Roads and Maritime has now identified the following activities as potential early work for the project:

- Installation of directional and project signage
- Establishment of construction compounds
- Construction of safe site access from the surrounding road network
- Geotechnical investigations
- Utility relocations along Lookout Road (including rock breaking as required)
- Shared path along the eastern edge of Lookout Road
- Demolition of houses on Lookout Road
- Mine remediation
- Soil preloading to the south of Newcastle Road
- Construction of Bridge 7 and associated shared path and pedestrian footpath and utility relocations/work
- Archaeological salvage program of Hollywood Shanty Town
- Removal of pre-existing waste and contamination
- Access and preparation activities required to carry out the early work and associated with the project, such as establishment of erosion and sedimentation controls, fencing and vegetation clearing (including endangered ecological community)
- At-property acoustic treatments
- Installation of environmental mitigations and controls
- Archaeological collection and/or salvage program of Aboriginal heritage
- Provision of utilities to compounds.

6 Additional assessment

6.1 Overview

This chapter provides a summary of additional assessments carried out by Roads and Maritime since exhibition of the EIS. The additional assessments were carried out in response to submissions and to assess the potential impacts associated with the design refinements described in Chapter 5.

A review was carried out to determine where additional assessment may be required (Table 6-1). The aspects reviewed correspond with those presented in the EIS.

Table 6-1 Additional assessment scoping

Design refinement	Biodiversity	Traffic and transport	Noise and vibration	Landscape character and visual impact	Socio-economic, land use and property	Flooding and drainage	Soils, contamination and water quality	Groundwater	Aboriginal heritage	Other
Hospital interchange layout	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pedestrian and cycling facilities	Y	Y	Y	Y	Y	Y	Y		Y	Y
Water quality treatment structures						Y	Y		Y	
Construction compounds	Y	Y	Y	Y	Y	Y	Y		Y	Y
Workforce and work hours			Y		Y					
Bridges		Y	Y	Y						Y
Flooding and drainage design					Y	Y	Y			
Cuttings and embankments								Y		Y
Proposed road corridor	Y				Y				Y	

Design refinement	Biodiversity	Traffic and transport	Noise and vibration	Landscape character and visual impact	Socio-economic, land use and property	Flooding and drainage	Soils, contamination and water quality	Groundwater	Aboriginal heritage	Other
Property acquisition and transfer of ownership					Y					
Noise mitigation work			Y		Y					
Directional signage	Y		Y	Y						
Construction footprint	Y		Y	Y	Y		Y		Y	Y
Construction lease areas	Y				Y				Y	
Earthworks										Y
Erosion and sediment controls							Y			
Construction materials										Y
Early work			Y		Y					

Where required, updated or supplementary technical papers have been prepared and are appended to this report. Updated technical papers present the same level of assessment and content as carried out for the EIS. These were prepared at the request of government agencies or where there were a large amount of numerical changes to tabulated results as a result of design refinements. Supplementary technical papers have been prepared where the changes to the potential impacts as a result of design refinements are relatively simple.

The technical papers do not provide a comparison of potential impacts (ie EIS design compared with proposed refined design) however, this is provided in the corresponding section in this chapter.

Table 6-2 provides a summary of updated and supplementary technical papers prepared for the project.

Table 6-2 Summary of updated and supplementary technical papers

EIS technical paper	Assessment approach
Technical Paper 1 – Biodiversity Assessment Report	An updated technical paper has been prepared to assess the design refinements and to address issues raised in the submissions. The results of this assessment are summarised in Section 6.2 and the technical paper is provided in Appendix B.
Technical Paper 2 – Traffic and Transport Assessment	A supplementary technical paper has been prepared to assess the potential change in impacts associated with the design refinements, in particular the hospital interchange layout. The results of this assessment are summarised in Section 6.3 and the technical paper is provided in Appendix C.
Technical Paper 3 – Noise and Vibration Assessment	An updated technical paper has been prepared to assess the design refinements and to address issues raised in submissions. The results of this assessment are summarised in Section 6.4 and the technical paper is provided in Appendix D.
Technical Paper 4 – Urban design, Landscape Character and Visual Impact Assessment	An updated technical paper has been prepared to assess the design refinements. The results of this assessment are summarised in Section 6.5 and the technical paper is provided in Appendix E.
Technical Paper 5 – Socio-economic Assessment	The potential change in impacts as a result of the design refinements are relatively minor when compared with those identified in the EIS. As such, this technical paper has not been updated with an assessment of changes to potential impacts included in Section 6.6.
Technical Paper 6 – Flooding and Drainage Assessment	A supplementary technical paper has been prepared to assess the design refinements, in particular the flood mitigation work at the northern interchange. The results of this assessment are summarised in Section 6.7 and the technical paper is provided in Appendix F.
Technical Paper 7 – Water Quality and Watercourse Assessment	A supplementary technical paper has been prepared to assess the potential change in impacts associated with the design refinements, in particular the water quality treatment structures. The results of this assessment are summarised in Section 6.8 and the technical paper is provided in Appendix G.

EIS technical paper	Assessment approach
Technical Paper 8 – Groundwater Assessment	The potential change in impacts as a result of the design refinements are relatively minor when compared with those identified in the EIS. As such, this technical paper has not been updated with an assessment of changes to potential impacts included in Section 6.9.
Technical Paper 9 – Non-Aboriginal Heritage Assessment	The potential impacts as a result of the design refinements are consistent with those identified in the EIS. As such, this technical paper has not been updated and no further assessment is required.
Technical Paper 10 – Aboriginal Cultural Heritage Assessment Report	To address issues raised by OEH in their submission, Roads and Maritime has carried out additional assessment for Aboriginal heritage. This has identified additional impacts beyond those identified in the EIS. The results of this assessment are summarised in Section 6.10 and the technical paper is provided in Appendix H.

6.2 Biodiversity

6.2.1 Summary

An assessment of potential impacts to biodiversity was included in Chapter 7 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 1 – Biodiversity Assessment Report* (GHD 2016f) was prepared for the project and included in Appendix E of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-3. In their submission, OEH also identified concerns with parts of the biodiversity assessment as detailed in Section 3.6. To respond to these concerns, additional biodiversity field work has been carried out to refine the vegetation mapping and conduct targeted surveys for Green and Golden Bell Frog.

As a result, the potential biodiversity impacts and offset requirements have been reassessed in Section 6.2.2. An updated biodiversity assessment report (GHD 2018a) is provided in Appendix B and all key changes are summarised in the following section. Where the potential impacts are consistent with those identified in the EIS, these are not summarised here but are included in the updated biodiversity assessment report.

Table 6-3 Biodiversity assessment review

EIS consideration	Further assessment required?	Yes/No
Landscape values	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Native vegetation	Due to the refined vegetation mapping and minor adjustments to the construction footprint (Section 5.5.8), impacts to native vegetation and offset requirements have been updated.	Yes
Species and populations	Due to the refined vegetation mapping and minor adjustments to the construction footprint (Section 5.5.8), impacts to threatened fauna species have been updated.	Yes
	The proposed design refinements would not result in any additional impacts to threatened flora species beyond those identified in the EIS.	No
Aquatic habitat and species	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Groundwater dependent ecosystems	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Indirect impacts	Due to the refined vegetation mapping and minor adjustments to the construction footprint (Section 5.5.8), indirect impacts have been updated.	Yes
Cumulative impacts	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Matters of national environmental significance	Due to the refined vegetation mapping and minor adjustments to the construction footprint (Section 5.5.8), impacts to Commonwealth listed fauna species have been updated.	Yes
	The proposed design refinements would not result in any additional impacts to Commonwealth listed threatened flora species beyond those identified in the EIS.	No

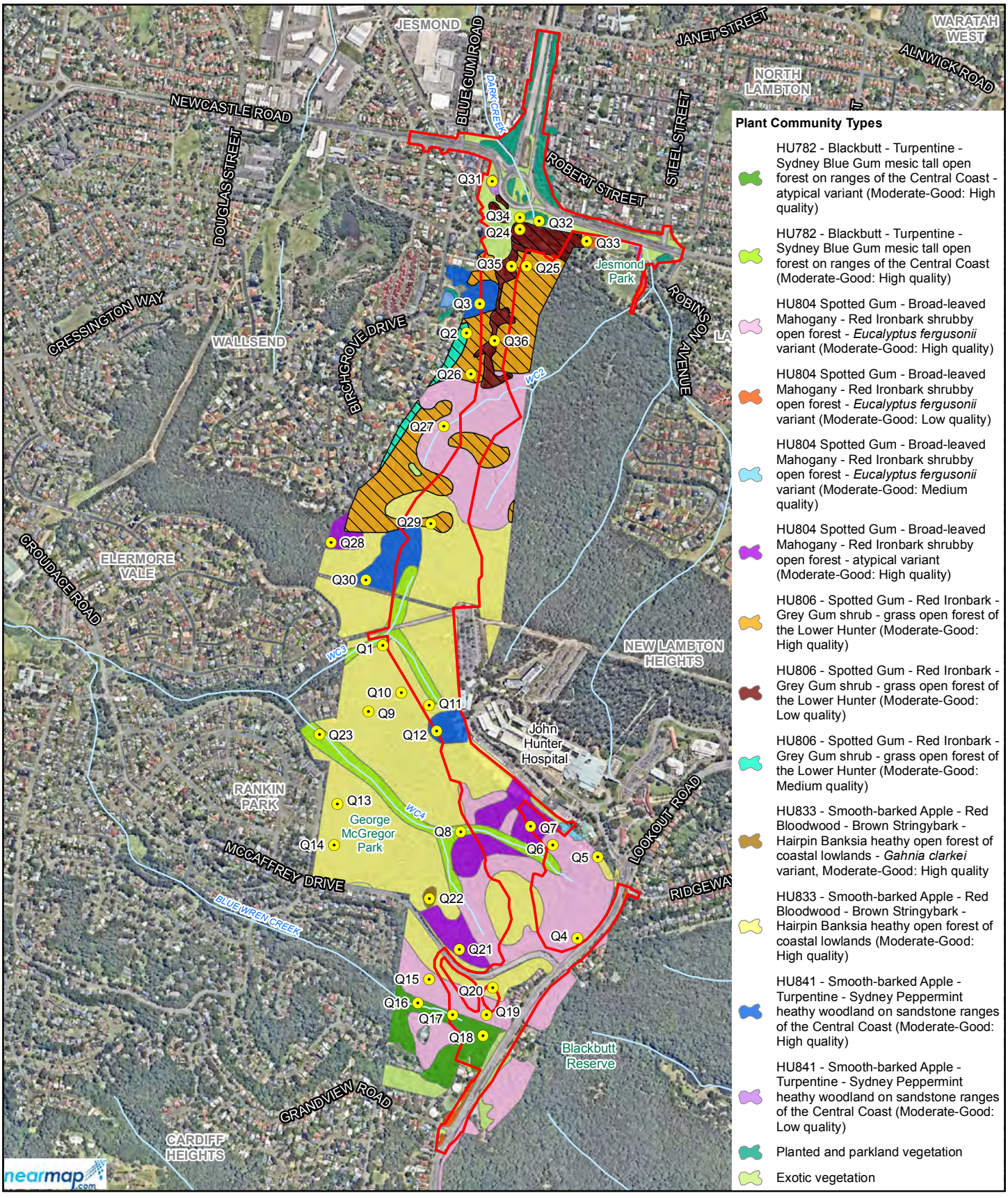
6.2.2 Assessment

Assessment methodology

Following exhibition of the EIS additional biodiversity field work has been carried out as follows:

- An additional six vegetation plots (Q31 to Q36) were surveyed in February 2017 as shown in Figure 6-1
- Further targeted surveys for Green and Golden Bell Frog within the small waterbody in Birchgrove Drive was carried out in February and March 2017.

The additional biodiversity field work was carried out in accordance with the assessment methodology described in Section 7.1 of the EIS and the attached biodiversity assessment report (Appendix B).



Plant Community Types

- HU782 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast - atypical variant (Moderate-Good: High quality)
- HU782 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate-Good: High quality)
- HU804 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - *Eucalyptus fergusonii* variant (Moderate-Good: High quality)
- HU804 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - *Eucalyptus fergusonii* variant (Moderate-Good: Low quality)
- HU804 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - *Eucalyptus fergusonii* variant (Moderate-Good: Medium quality)
- HU804 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - atypical variant (Moderate-Good: High quality)
- HU806 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Moderate-Good: High quality)
- HU806 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Moderate-Good: Low quality)
- HU806 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (Moderate-Good: Medium quality)
- HU833 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - *Gahnia clarkei* variant, Moderate-Good: High quality
- HU833 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (Moderate-Good: High quality)
- HU841 - Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast (Moderate-Good: High quality)
- HU841 - Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast (Moderate-Good: Low quality)
- Planted and parkland vegetation
- Exotic vegetation

LEGEND

- Construction footprint
- Watercourse
- Biobanking Plot
- Endangered Ecological Community (NSW TSC Act) (Lower Hunter Spotted Gum Ironbark Forest)
- Dam

Paper Size A4

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-1

Vegetation and plot survey effort

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR017_Vegetation_0.mxd

Data source: Aurecon: Construction footprint, 2016: PB: Vegetation Mapping / study area, 2015; BELL: EEC 2015; Nearmap: Aerial Imagery, 20160331; LPI: DTDB, 2012.

Existing environment

The existing environment is described in Section 7.2 of the EIS and has been updated in the attached biodiversity assessment report (Appendix B).

As a result of the additional vegetation plots, the mapped vegetation communities in the study area have been refined as shown in Figure 6-1. Since completion of the field surveys which informed the EIS, OEH has revised the vegetation community types (referred to as Biometric Vegetation Types) for the Hunter region. In order to re-calculate the offset credit requirements for the project, the revised vegetation communities have been used. Further information is contained in Section 3.1.2 of the updated biodiversity assessment report (Appendix B).

No Green and Golden Bell Frogs were detected in the small water body in Birchgrove Drive despite carrying out targeted surveys during optimal conditions.

Potential impacts

Impacts on native vegetation

Due to the refined vegetation mapping and minor adjustments to the construction footprint, the project would involve clearing of about 51.8 hectares of vegetation (worst case estimate) compared with 50.1 hectares in the EIS. This is comprised of:

- 43.5 hectares of native vegetation (39.2 hectares in the EIS), including:
  - About 7.1 hectares (4.1 hectares in the EIS) of Lower Hunter Spotted Gum Ironbark Forest endangered ecological community (EEC) listed under the former *Threatened Species Conservation Act 1995* (TSC Act) (now replaced by the *Biodiversity Conservation Act 2016* (BC Act))
- 8.3 hectares (10.9 hectares in the EIS) of exotic, planted and parkland vegetation.

The estimated loss of each of these communities is shown in Table 6-4. The assessment has assumed a worst case estimate, where all areas in the construction footprint would be cleared of vegetation. Where possible, during construction, vegetation clearing would be minimised including the retention of mature or hollow-bearing trees.

The installation of directional signage as described in Section 5.5.7 would be located within road corridors and would not include removal of vegetation of conservation significance.

Table 6-4 Direct vegetation impacts

Vegetation community	Area (ha) within EIS construction footprint	Area (ha) within refined construction footprint	Change (ha)
Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (HU833)	16.8	16.8	No change
Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (HU782)	4.4	4.4	No change

Vegetation community	Area (ha) within EIS construction footprint	Area (ha) within refined construction footprint	Change (ha)
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (HU806) (EEC)	4.1	7.1	+3
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest of the Central Coast (HU804)	12	12.4	+0.4
Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast (HU841)	1.9	2.8	+0.9
Planted and parkland vegetation	0.7	3.2	+2.5
Exotic vegetation	10.2	5.1	-5.1

Impacts on species and populations

The project (including the proposed design refinements) would result in clearing of an additional 1.7 hectares of vegetation that provides habitat for a range of native fauna species (Table 6-4). Consistent with the EIS findings, this includes 27 threatened species (ie there would be no impacts to additional threatened species beyond those identified in the EIS). Further, there would be no additional loss of Powerful Owl roost trees or habitat (hollow-bearing) trees or additional impacts to the Grey-headed Flying-fox camp located in Blackbutt Reserve.

Due to these minor changes, the predicted impacts are consistent with those identified in the EIS.

Indirect impacts

To account for possible indirect impacts such as noise and lighting, a 10 metre disturbance buffer (assuming total clearing) was considered in the EIS and has also been considered in the updated biodiversity assessment report (Appendix B).

The project (including the proposed design refinements) would have indirect impacts on about 7.4 hectares of native vegetation compared with 7.0 hectares in the EIS.

Due to these minor changes, the predicted impacts are consistent with those identified in the EIS.

Matters of national environmental significance

As discussed in Section 7.3.9 of the EIS, five threatened fauna species listed under the EPBC Act occur, or have the potential to occur, in the construction footprint:

- Grey-headed Flying-fox *(Pteropus poliocephalus)* (vulnerable under the EPBC Act)
- Regent Honeyeater (*Anthochaera phrygia (syn. Xanthomyza phrygia)* (endangered under the EPBC Act)
- Swift Parrot (*Lathamus discolour)* (endangered under the EPBC Act)
- Large-eared Pied Bat (*Chalinolobus dwyeri)* (vulnerable under the EPBC Act)
- Spotted-tailed Quoll (*Dasyurus maculatus*) (endangered under the EPBC Act)

- Koala (*Phascolarctos cinereus)* (vulnerable under the EPBC Act).

Updated assessments of significance in accordance with the *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* (Department of the Environment 2013) have been carried out and are provided in the updated biodiversity assessment report (Appendix B).

Consistent with the EIS findings, the project (including the proposed design refinements), would still result in a significant impact to an important population of the Grey-headed Flying-fox during construction and operation. The FBA process has been applied to the project to offset any residual impacts to this species which cannot be avoided or mitigated.

Consistent with the EIS findings, no significant impact was determined for any of the other four threatened species.

Biodiversity offset strategy

An updated biodiversity offset strategy (BOS) has been prepared and is provided in the updated biodiversity assessment report (Appendix B).

Table 6-5 identifies the credit calculations required to offset the project (including the proposed design refinements). The project (including the proposed design refinements) would require 3244 ecosystem credits (2972 in the EIS) and 12,690 species (Black-eyed Susan (*Tetratheca juncea*)) (no change from the EIS) credits.

Table 6-5 Offset requirements for the project

Vegetation community	EIS credits required	Updated credits required	Change
Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (HU833)	1167	1182	+15
Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (HU782)	333	337	+4
Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter (HU806) (EEC)	283	399	+116
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest of the Central Coast (HU804)	1057	1098	+41
Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast (HU841)	132	228	+96

Vegetation community	EIS credits required	Updated credits required	Change
Total ecosystem credit requirements	**2972**	**3244**	**+272**
Black-eyed Susan (*Tetratheca juncea*)	12,690	12,690	No change
Total species credit requirements	**12,690**	**12,690**	**No change**

6.2.3 Additional environmental management measures

No additional environmental management measures are required as a result of the additional assessment.

In response to submissions, additional environmental management measures have been identified and are included in Chapter 7.

6.3 Traffic and transport

6.3.1 Summary

An assessment of potential impacts to traffic and transport was included in Chapter 8 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 2 – Traffic and transport assessment* (Aurecon 2016a) was prepared for the project and included in Appendix F of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-6.

As a result, the potential traffic and transport impacts have been reassessed in Section 6.3.2. A supplementary traffic and transport assessment (Aurecon 2018a) is provided in Appendix C and all key changes are summarised in the following section.

Table 6-6 Traffic and transport assessment review

EIS consideration	Further assessment required?	Yes/No
Construction impacts:		
• Construction access	Due to the proposed new construction compounds (Section 5.4.4), the construction access strategy has been reviewed.	Yes
• Construction traffic volumes	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Temporary traffic management	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

EIS consideration	Further assessment required?	Yes/No
• Property access	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Parking	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Public transport	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Pedestrians and cyclists	Due to the proposed design refinements for pedestrians and cyclists (Section 5.4.2), the potential impacts during construction have been updated.	Yes
• Fire trails	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Operation impacts:		
• Traffic volumes	Due to the refined design for the hospital interchange (Section 5.4.1), there would be a minor redistribution of traffic on the surrounding road network. As such, the predicted traffic volumes have been updated.	Yes
• Network performance	Due to the refined design for the hospital interchange (Section 5.4.1), there would be a minor redistribution of traffic on the surrounding road network. As such, the predicted network performance has been updated.	Yes
• Intersection performance	Due to the refined design for the hospital interchange (Section 5.4.1), there would be a minor redistribution of traffic on the surrounding road network. As such, the predicted intersection performance has been reviewed.	Yes
• Road safety	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Travel times	Due to the refined design for the hospital interchange (Section 5.4.1), there would be a minor redistribution of traffic on the surrounding road network. As such, the predicted travel times have been reviewed.	Yes
• Network changes (eg changes to surrounding roads)	Due to the refined design for the hospital interchange (Section 5.4.1), there would be a minor redistribution of traffic on the surrounding road network. As such, the predicted network changes have been reviewed.	Yes
• Restricted access vehicles	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Public transport	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

EIS consideration	Further assessment required?	Yes/No
• Pedestrians and cyclists	Due to the proposed design refinements for pedestrians and cyclists (Section 5.4.2), the potential impacts during operation have been updated.	Yes
• Property access	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Parking	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Fire trails	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

6.3.2 Assessment

Construction

Construction access

As described in Section 5.4.4, three additional construction compounds are now proposed resulting in a total of six construction compounds (Figure 5-8). Compounds A, B and C would be used for the duration of main construction activities. Compounds D and E would only be required during the early work phase associated with construction of the shared path bridge (Bridge 7) over Newcastle Road. Compound F would be used during both the early work and main construction phases.

While the overall construction access strategy has not changed from that described in the EIS, access to the new compounds would occur as follows:

- Compound D is located near the eastern end of Jesmond Park on the southern side of Newcastle Road. Access to this construction compound would be via Robinson Avenue and/or temporary access arrangement from Newcastle Road
- Compound E is located near the intersection of Coles Street and Steel Street on the northern side of Newcastle Road. Access to this construction compound would be via Steel Street, Coles Street and/or temporary access arrangement from Newcastle Road
- Compound F is located near the southern interchange on the western side of Lookout Road. Access to this construction compound would be via Lookout Road and/or McCaffrey Drive.

Construction access would be managed in accordance with a construction traffic management plan as described in the EIS.

Pedestrians and cyclists

As discussed in Section 8.3.1 of the EIS, during construction, there would be disruptions to pedestrian activity on paths and cyclist activity on shared paths and on-road cycleways, particularly those near Jesmond Park, Newcastle Road, and along Lookout Road and McCaffrey Drive. As discussed in Sections 3.8.2, 4.8.2 and 4.8.4, in order to minimise the impacts to users of the Jesmond Park shared path during construction it is proposed to:

- Construct the new shared path bridge (Bridge 7) over Newcastle Road and associated connections as early work so it can be made available for public use before the closure of the mid-block pedestrian crossing and Jesmond Park shared path
- Provide pedestrian and cyclist access across the construction footprint on the southern side of Newcastle Road for limited periods of time where safe and practical to do so. However, for safety reasons this access would not be available for extended periods as it would be located beneath bridge construction activities and would conflict with proposed construction traffic access to the site

- The proposed new overpass bridge (Bridge 8) and underpass arrangement for the Jesmond Park shared path (Section 5.4.2) would be constructed and open for use as soon as practicable. However, for safety reasons this cannot occur until major construction activities, including compound operations, in the immediate area are completed.

Where possible the duration of closure of existing paths would be limited and alternative safe access would be provided at all times.

As such, the potential impacts during construction are consistent with those described in the EIS.

Operation

Traffic volumes

As described in Section 5.4.1, the hospital interchange would now be a full interchange with both north and south-facing ramps (Figure 5-2).

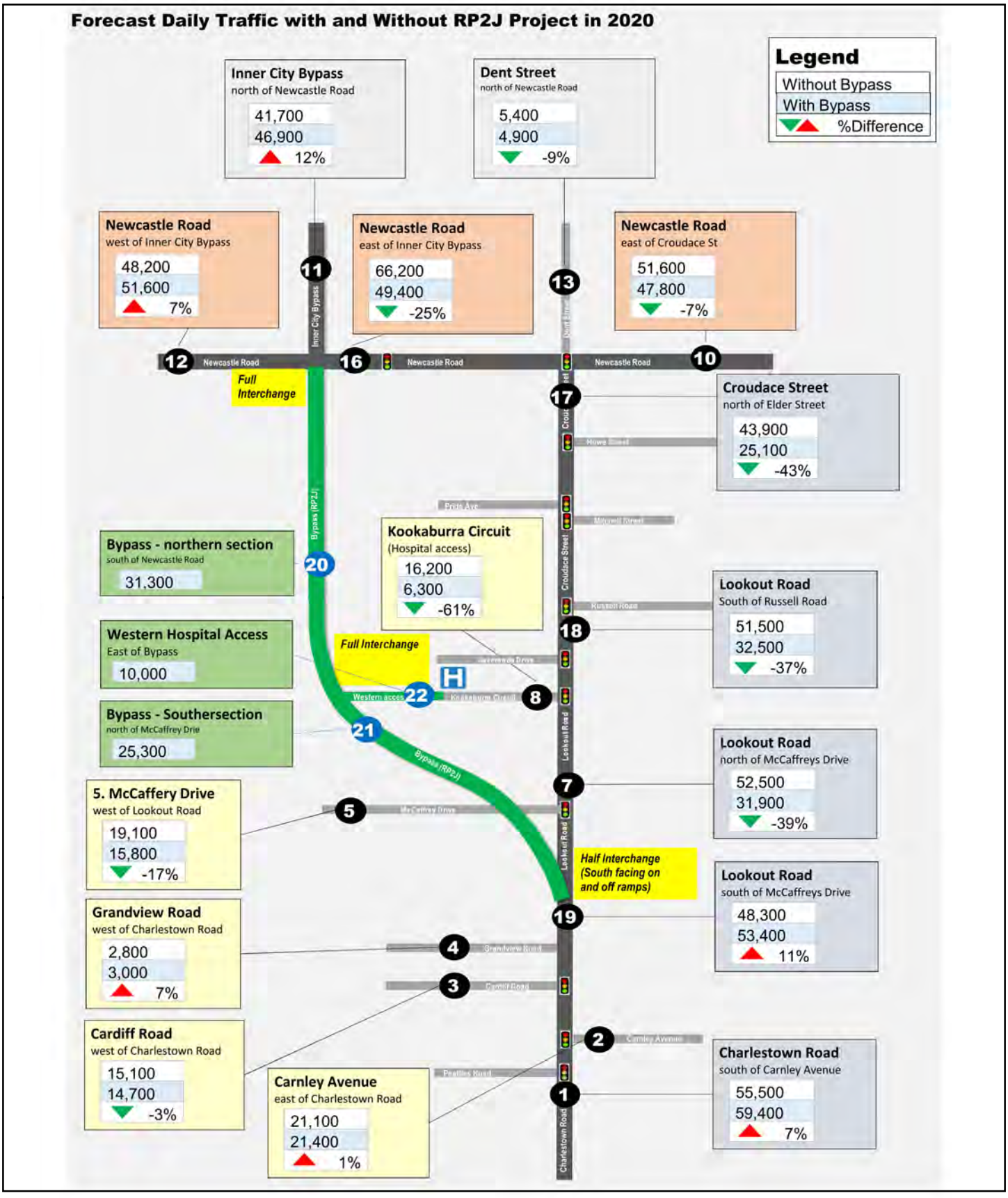
As a result, the new hospital access road is now predicted to carry about 10,000 vehicles per day in 2020 (7800 vehicles per day in the EIS), increasing to about 11,100 vehicles per day in 2030 (8600 in the EIS). This would result in a minor redistribution of traffic on the surrounding road network (when compared to the no project scenario) as follows:

- Lookout Road (north of McCaffrey Drive) is predicted to carry up to 31,900 vehicles per day in 2020 (34,100 in the EIS) and 35,500 vehicles per day in 2030 (38,000 in the EIS)
- Project (north of McCaffrey Drive) is predicted to carry up to 25,300 vehicles per day in 2020 (23,100 in the EIS) and 28,100 vehicles per day in 2030 (25,600 in the EIS)
- Kookaburra Circuit (existing eastern hospital access road) is predicted to carry up to 6300 vehicles per day in 2020 (8500 in the EIS) and 6800 vehicles per day in 2030 (9300 in the EIS).

Consistent with the EIS, the project is predicted to carry up to 31,300 vehicles per day in 2020 and up to 34,500 in 2030. As a result, there would be a corresponding reduction in traffic on the existing route of Lookout Road (by up to 38 per cent), Croudace Street (43 per cent) and Newcastle Road (24 per cent). This would substantially improve traffic flow and reduce travel times along the existing route of Lookout Road, Croudace Street and Newcastle Road.

Updated future traffic volumes (2020 and 2030), both with and without the project are shown in Figure 6-2 and Figure 6-3. The forecasts take into account predicted traffic growth and the potential for changed travel patterns brought about by the improved traffic conditions with the project.

In addition, the new hospital access road would substantially reduce traffic using the existing eastern access via Kookaburra Circuit by about 62 per cent in 2030 (48 per cent in the EIS).



Paper Size A4

Not to scale

Rankin Park to Jesmond

Figure 6-2
Forecast daily traffic with and without the Project in 2020

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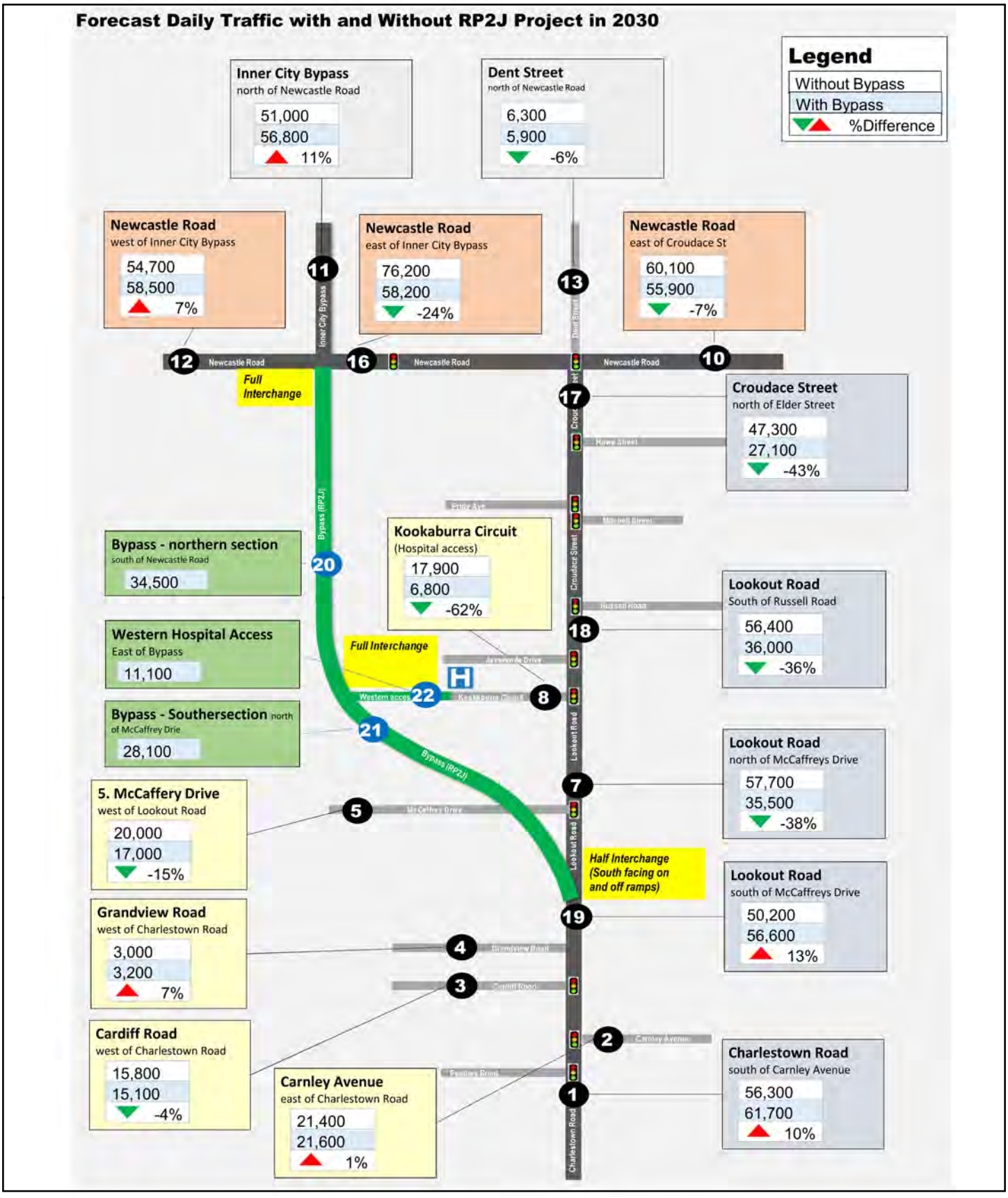
Data source: Aurecon: Traffic forecast image, 2016.



Paper Size A4

Not to scale

Rankin Park to Jesmond

Figure 6-3
Forecast daily traffic with and without the Project in 2030

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Data source: Aurecon: Traffic forecast image, 2016.

Network performance

Updated modelling of the network performance, in terms of total delay and congestion, was carried out and shows:

- Vehicle hours travelled would substantially improve with reductions of up to 33 per cent in 2020 (no change from the EIS) and up to 45 per cent in 2030 (38 per cent in the EIS)
- Total number of stops are reduced by up to 41 per cent in 2020 and 2030 (42 per cent in the EIS)
- Travel times are predicted to improve with average travel speed to increase by up to 34 per cent in 2020 (no change from the EIS) and up to 45 per cent in 2030 (39 per cent in the EIS).

Consistent with the EIS, in summary, the results demonstrate:

- The project would provide major benefits for motorists using the Newcastle Inner City Bypass with substantial reductions in travel time for both northbound and southbound journeys
- The project would improve travel times for north-south trips on the existing route and for east-west trips on Newcastle Road.

Intersection performance

The design refinements would only result in a minor redistribution of traffic within the study area. As such, consistent with the EIS, the project (including the design refinements) would generally improve intersection performance at key existing intersections in 2020 and 2030 in both the morning and afternoon peaks. The existing main access to the John Hunter Hospital precinct (Lookout Road and Kookaburra Circuit intersection) would have a level of service of B (with the project) compared to C in the morning peak and B in the afternoon peak (without the project) in 2030. This is due to the increased volume of traffic using the hospital interchange to enter/exit the John Hunter Hospital precinct.

Travel times

The design refinements would only result in a minor redistribution of traffic within the study area. As such, consistent with the EIS, the project (including the design refinements) would:

- Provide major benefits for motorists using the Newcastle Inner City Bypass with substantial improvements in traffic flow and travel time for both northbound and southbound journeys, relative to the without project scenario
- Improve travel times for north-south trips on the existing route and for east-west trips on Newcastle Road.

Network changes

The provision of a full interchange (with both north and south-facing ramps (Section 5.4.1)) and a new western access road to the John Hunter Hospital precinct would benefit the hospital's operation as it would further reduce traffic volumes at the existing hospital accesses off Lookout Road by up to 2200 vehicles per day in 2020 and 2500 vehicles per day in 2030.

Pedestrians and cyclists

As discussed in Section 5.4.2, the following design refinements have been made to the proposed pedestrian and cyclist facilities provided by the project (Figure 6-4):

- Jesmond Park shared path – an overpass bridge (Bridge 8) and underpass arrangement would now be provided at the northern interchange to provide an east-west grade separated shared path for both pedestrians and cyclists
- Hospital interchange – the shared path crossing of the southbound off-ramp would now be controlled by traffic lights
- Southern interchange – a new northbound cycleway connection from Lookout Road to the bypass would be provided for on-road cyclists
- Southern interchange – a new southbound cycleway crossing from the bypass to Lookout Road would be provided for on-road cyclists
- McCaffrey Drive – the proposed pedestrian footpath on the northern side would now be replaced with a wider shared path for use by both pedestrians and cyclists

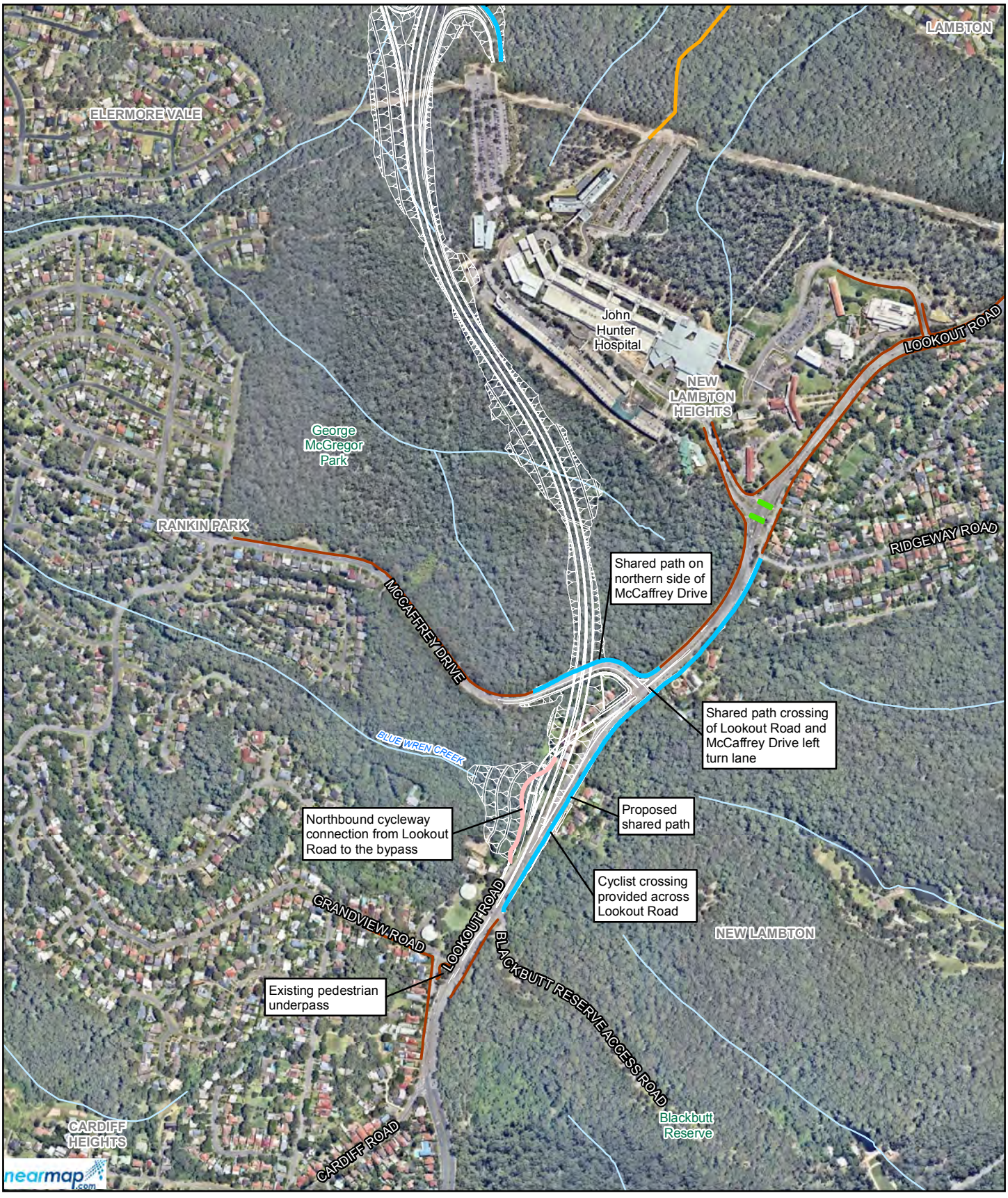
- Lookout Road and McCaffrey Drive intersection – the pedestrian crossing on the left turn lane from McCaffrey Drive onto Lookout Road, and across Lookout Road would now be shared path crossings controlled by traffic lights for use by both pedestrians and cyclists
- Shared path bridge over Newcastle Road – the connections either side of the shared path bridge (Bridge 7) over Newcastle Road have been refined to improve connectivity with existing shared paths.

The project (including the design refinements), would further improve connections to the existing shared paths in the study area and enhance options for walking and cycling. This would improve safety for pedestrians and cyclists.

6.3.3 Additional environmental management measures

No additional environmental management measures are required as a result of the additional assessment.

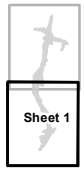
In response to submissions, additional environmental management measures have been identified and are included in Chapter 7.



LEGEND

- Design
- Watercourse
- Existing footpath
- Existing shared path
- Proposed shared path
- Proposed northbound cycleway connection
- Traffic light controlled pedestrian crossing

Sheet layout



Paper Size A4

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-4a

Proposed and existing pedestrian and cyclist facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR020_PedestrianFacilities_DDP_0.mxd

Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Cycleways, 2016; LPI: DTDB, 2012.

LEGEND

- Design
- Watercourse
- Existing footpath
- Proposed footpath
- Existing on-road cycleway
- Existing shared path
- Proposed shared path
- Proposed on-road cycleway
- Proposed shared path underpass
- Traffic light controlled pedestrian crossing
- Existing traffic lights to be removed
- Proposed traffic lights

Sheet layout

Paper Size A4

0 35 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-4b

Proposed and existing pedestrian and cyclist facilities

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR020_PedestrianFacilities_DDP_0.mxd

Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Construction footprint/ Design / Cycleways, 2016; LPI: DTDB, 2012.

6.4 Noise and vibration

6.4.1 Summary

An assessment of potential noise and vibration impacts was included in Chapter 9 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 3 – Noise and Vibration Assessment* (GHD 2016b) was prepared for the project and included in Appendix G of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-7.

The review also identified the following issues with the noise and vibration assessment:

- A number of residences located in and near Atherton Close, Bond Close and Slade Close in the suburbs of Rankin Park and New Lambton Heights had been incorrectly excluded from the sensitive receivers identified in the EIS
- Excavation (including rock breaking) for the widening of an existing hard rock cutting on the western side of Lookout Road was not included in the construction noise and vibration assessment. This activity may be carried out as part of the early work for the project.

As a result, the potential operational and construction noise and vibration impacts have been reassessed in Section 6.4.2. The updated noise and vibration assessment (GHD 2018b) is provided in Appendix D and all key changes are summarised in the following section. Where the potential impacts are consistent with those identified in the EIS, these are not summarised here but are included in the updated noise and vibration assessment.

In addition to considering the design refinements and issues raised in submissions, the construction and operational noise models have been refined and as a result, this has also led to changes in the potential impacts.

Table 6-7 Noise and vibration assessment review

EIS consideration	Further assessment required?	Yes/No
Construction impacts:		
• Construction noise	Due to the design refinements and in response to submissions the construction noise assessment has been updated.	Yes
• Sleep disturbance	Due to the design refinements the construction noise assessment has been updated.	Yes
• Construction compounds	Due to the construction compound refinements (Section 5.4.4) the assessment of potential impacts from compound operations has been updated.	Yes
• Construction traffic	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction vibration	Due to the design refinements and in response to submissions the construction vibration assessment has been updated.	Yes

EIS consideration	Further assessment required?	Yes/No
• Construction blasting	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Operation impacts:		
• Operational noise	Due to the design refinements and in response to submissions the operational noise assessment has been updated.	Yes
• Maximum noise levels/sleep disturbance	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Heavy vehicle engine (compression) braking	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Traffic noise increase on existing roads	Due to the refined design for the hospital interchange (Section 5.4.1) there would be a minor redistribution of traffic as described in Section 6.3. As a result, the potential for traffic noise increase on existing roads has been updated.	Yes
• Operational vibration	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Operational management options	Due to the design refinements the operational noise management options have been reviewed.	Yes

6.4.2 Assessment

Existing environment

Receivers

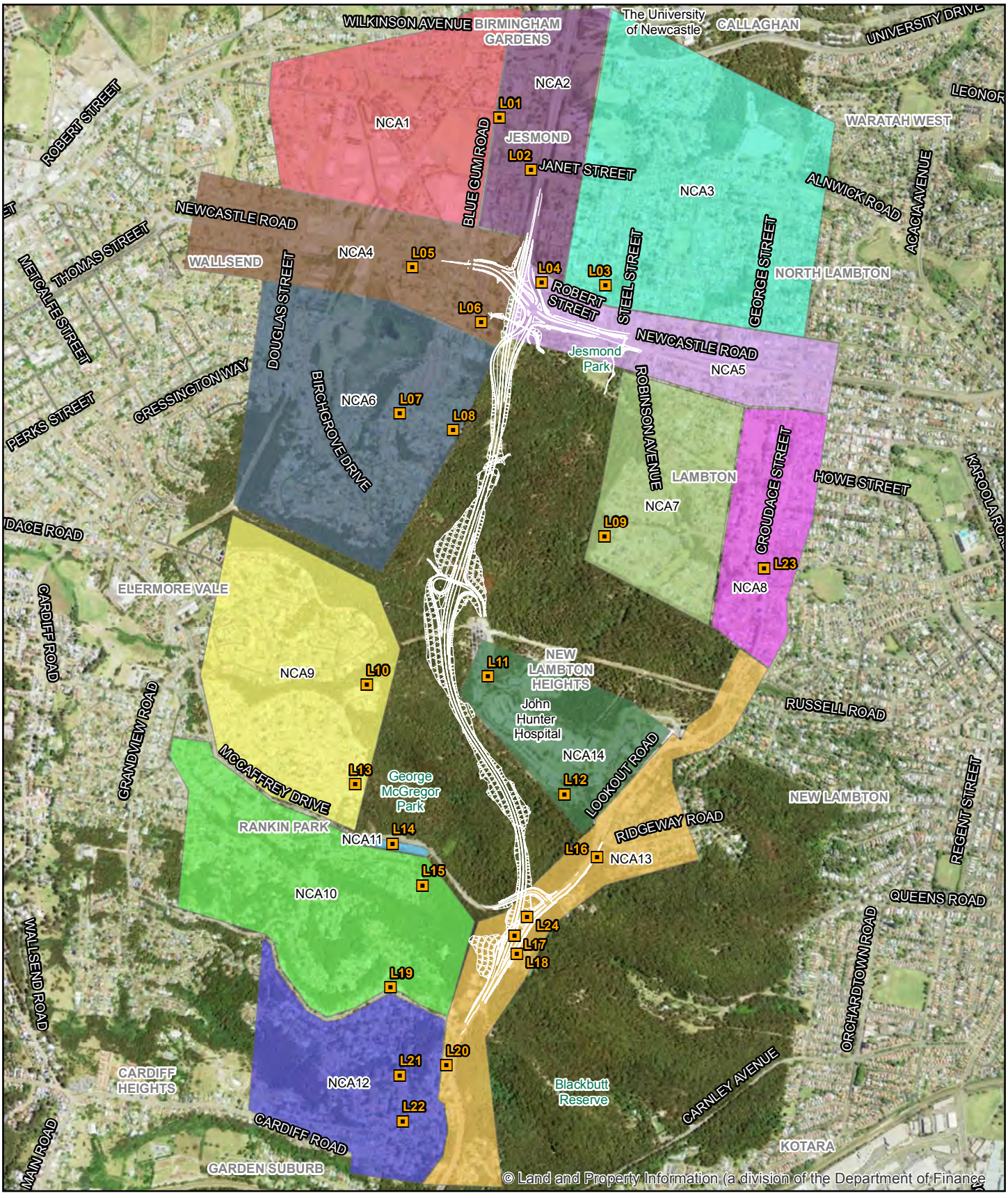
Following exhibition of the EIS and receipt of submissions, it was identified a number of residences had been incorrectly excluded from the sensitive receivers identified in the EIS.

The additional sensitive receivers are generally located in and near Atherton Close, Bond Close and Slade Close in the suburbs of Rankin Park and New Lambton Heights. These receivers were located in noise catchment area (NCA) 10. A total of 64 additional sensitive residential receivers have been identified and have now been assigned receiver numbers within NCA10. There are no additional sensitive non-residential receivers or commercial/industrial receivers.

The noise catchments areas for the project are shown in Figure 6-5. All receivers (including the additional receivers in NCA10) are mapped in the updated noise and vibration assessment (Appendix D).

In the noise and vibration assessment carried out for the EIS, a home music business located within a residential premises on Lookout Road, was assessed as both a residential and commercial receiver. However, following exhibition of the EIS, Roads and Maritime has carried out further investigations and identified the home music business cannot be classified as a commercial receiver as commercial businesses are prohibited in the land zoning under the *Newcastle Local Environment Plan 2012*. As such, it is now classified as a home occupation and is not considered further as a commercial receiver. The building is still considered a residential receiver and has been assessed as such.

As a result of the changes described above the noise assessment has considered potential impacts to a total of 3100 sensitive receivers across 14 noise catchment areas.



LEGEND

Design

Noise logger location

Noise cacthment areas

NCA1 NCA2 NCA3 NCA4 NCA5 NCA6 NCA7 NCA8 NCA9 NCA10 NCA11 NCA12 NCA13 NCA14

Paper Size A4

0 65 130 260 390 520 650

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-5
Noise catchment areas

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR021_NoiseCatchments_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Design / cycleways/ footpaths, 2016; LPI: DTDB, 2012.

Potential impacts

Construction overview

A range of construction activities were assessed in the construction noise and vibration assessment for the EIS. Following exhibition of the EIS, receipt of submissions and further review of constructability issues for the project, the following additional construction activities have been included in the updated noise and vibration assessment (Appendix D):

- Excavation (including rock breaking) for the widening of an existing hard rock cutting on the western side of Lookout Road. This activity may be carried out as part of the early work for the project
- Additional and adjusted construction compounds (Section 5.4.4).

Construction noise – predicted construction noise levels

The updated noise and vibration assessment (Appendix D) contains detailed tables and figures showing construction noise levels and exceedances in each noise catchment area. A summary of the potential worst case number of exceedances is provided in Table 6-8. In Table 6-8 the change as a result of the updated assessment is indicated in brackets.

Overall the findings of the updated construction noise assessment are consistent with those in the EIS. The main findings are:

- In relation to the noise catchment areas:
  - All noise catchments areas located immediately next to the construction footprint are affected by construction noise levels with exceedances of the noise management levels
  - NCA4 and NCA5 (located on Newcastle Road) and NCA13 (located on Lookout Road) are the most impacted based on predicted noise levels
  - NCA3 (located north of Newcastle Road) and NCA6 (located west of the project) are the most impacted based on number of receivers which would experience noise levels above the noise management level
  - NCA14 (John Hunter Hospital precinct) would experience high levels of external construction noise which may exceed the internal noise criteria in some buildings
  - Sensitive residential and non-residential receivers nearest to construction activities in NCA2, NCA4, NCA5, NCA6, NCA13 and NCA14 would experience noise levels above the highly affected noise management level
  - Commercial receivers next to the construction footprint located in NCA1 and NCA4 have the potential to be impacted by construction noise above the noise management level
- In relation to construction activities:
  - Activities which encompass the entire project area, such as vegetation clearing and bulk earthworks are likely to affect the most receivers
  - Activities such as bulk earthworks, general compound operations, major compound operations and bridge construction have the potential to impact nearby receivers for longer periods of time
  - Most construction activities near NCA14 (John Hunter Hospital precinct) have the potential to result in high levels of external construction noise which may exceed the internal noise criteria
- In relation to working hours:
  - The refined approach to the morning extended working hours would result in less construction noise impacts to sensitive receivers
  - Construction activities carried out during standard construction hours are predicted to exceed the noise management level in all NCAs next to the construction footprint
  - Construction activities carried out during the proposed extended construction hours adopted for the project are predicted to exceed the noise management level in all NCAs except NCA8
  - Construction activities during out of hours (outside proposed extended construction hours) are predicted to exceed the noise management level in all NCAs

- Construction activities during standard construction hours have the potential to exceed the noise management level at sensitive non-residential receivers including educational, child care and hospital facilities. Construction noise management levels are applicable as an internal level only when the facilities are in use
- Construction activities during standard construction hours have the potential to exceed the noise management level at formal and informal recreational areas including bushland areas, parks and sporting facilities when these areas are in use
- Construction activities during proposed extended construction hours are not anticipated to generate noise impacts at childcare facilities or schools as the construction management levels apply only when the facility is in use. Impacts may still occur at community centres, places of worship, health facilities and recreational areas where these receiver locations are in use during the extended construction hours.

The installation of directional signage as described in Section 5.5.7 could result in minor construction noise during installation however, this is not expected to be significant and would be of short duration.

The noise and vibration mitigation measures detailed in Section 9.5 of the EIS will be implemented to minimise the identified potential impacts.

In relation to potential construction noise impacts to facilities in NCA14 (John Hunter Hospital precinct), Roads and Maritime has carried out ongoing consultation with NSW Health Infrastructure and Hunter New England Local Health District during all stages of development of the project. This has included potential impacts during construction. Further consultation will be carried out during detailed design and construction to minimise and manage potential adverse impacts associated with construction noise on the operations of the John Hunter Hospital precinct.

Table 6-8 Number of construction noise exceedances (worst case)

NCA	Receiver type	Number of exceedances – standard construction hours	Number of exceedances – proposed extended construction hours	Number of exceedances –out of hours
NCA1	Residential	107 (+69)	196 (-1)	196 (-1)
	Non-residential	2 (no change)	2 (no change)	2 (no change)
	Commercial/ industrial	1 (no change)	1 (no change)	1 (no change)
NCA2	Residential	213 (+34)	308 (+18)	310 (+2)
	Non-residential	11 (+2)	11 (+2)	11 (+2)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA3	Residential	594 (+28)	600 (+7)	600 (+6)
	Non-residential	4 (+2)	4 (+2)	4 (+2)
	Commercial/ industrial	24 (+24)	24 (+24)	24 (+24)
NCA4	Residential	207 (+23)	256 (+9)	260 (+3)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	21 (no change)	21 (no change)	21 (no change)
NCA5	Residential	118 (+25)	187 (+50)	231 (+9)
	Non-residential	2 (no change)	2 (no change)	2 (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA6	Residential	335 (+6)	335 (+4)	335 (+4)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)

NCA	Receiver type	Number of exceedances – standard construction hours	Number of exceedances – proposed extended construction hours	Number of exceedances –out of hours
NCA7	Residential	175 (+3)	175 (+2)	175 (+2)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA8	Residential	Nil (no change)	2 (+2)	105 (+1)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA9	Residential	215 (no change)	215 (no change)	215 (no change)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA10	Residential	154 (+61)	158 (+65)	158 (+65)
	Non-residential	1 (+1)	1 (+1)	1 (+1)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA11	Residential	9 (+5)	17 (no change)	17 (no change)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
NCA12	Residential	193 (+14)	207 (+7)	207 (+1)
	Non-residential	3 (+1)	3 (+1)	3 (+1)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)

NCA	Receiver type	Number of exceedances – standard construction hours	Number of exceedances – proposed extended construction hours	Number of exceedances –out of hours
NCA13	Residential	51 (+33)	139 (+56)	153 (+2)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (-1)	Nil (-1)	Nil (-1)
NCA14	Residential	3 (+1)	3 (+1)	3 (+1)
	Non-residential	18 (+4)	18 (+4)	18 (+4)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)

Construction noise – sleep disturbance

In the EIS, the updated construction noise assessment identified there was the potential for sleep disturbance impacts in all NCAs except NCA8, NCA9 and NCA11, if construction activities occur during the night-time period. The updated construction noise assessment has identified there is potential for sleep disturbance impacts, if construction activities occur during the night-time period, as follows:

- For general construction activities, in all NCAs except NCA8
- During rock breaking on Lookout Road, in NCA10, NCA12 and NCA13
- For the additional construction compounds D and E, in NCA5 and compound F in NCA13.

The noise and vibration mitigation measures detailed in Section 9.5 of the EIS will be implemented to minimise the identified potential impacts.

Construction noise – construction compounds

Consistent with the EIS, the updated construction noise assessment has identified noise impacts are predicted for sensitive residential, sensitive non-residential and commercial/industrial receivers due to the operation of construction compounds. A summary of the potential worst case number of exceedances is provided in Table 6-9. In Table 6-9 the change as a result of the updated assessment is indicated in brackets.

The environmental management measures detailed in Section 9.5 of the EIS will be implemented where feasible and reasonable to minimise potential impacts associated with compound operations.

Table 6-9 Number of construction noise exceedances (worst case) - compounds

Construction scenario	Receiver type	Number of exceedances – standard construction hours	Number of exceedances – proposed extended construction hours	Number of exceedances –out of hours
Compound A operations	Residential	220 (+142)	469 (+110)	778 (+476)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
Compound B operations	Residential	295 (+141)	814 (+304)	1622 (+1156)
	Non-residential	2 (no change)	2 (no change)	2 (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
Compound C operations	Residential	342 (+156)	968 (+333)	1845 (+1251)
	Non-residential	Nil (no change)	Nil (no change)	Nil (no change)
	Commercial/ industrial	8 (+3)	8 (+3)	8 (+3)
Major compound A operations	Residential	986 (+360)	1563 (+258)	2900 (+408)
	Non-residential	14 (no change)	14 (no change)	14 (no change)
	Commercial/ industrial	Nil (no change)	Nil (no change)	Nil (no change)
Compound D operations	Residential	255	789	1250
	Non-residential	1	1	1
	Commercial/ industrial	Nil	Nil	Nil

Construction scenario	Receiver type	Number of exceedances – standard construction hours	Number of exceedances – proposed extended construction hours	Number of exceedances –out of hours
Compound E operations	Residential	268	781	1258
	Non-residential	2	2	2
	Commercial/ industrial	Nil	Nil	Nil
Compound F operations	Residential	27	280	636
	Non-residential	Nil	Nil	Nil
	Commercial/ industrial	Nil	Nil	Nil

Construction vibration

Consistent with the EIS, the updated construction vibration assessment has identified there is the potential for structural damage to buildings located within 18 metres of certain vibration intensive construction activities and for residents to feel vibration within about 140 metres of these activities.

For the additional sensitive receivers located in NCA10, they would experience vibration levels above the human comfort level however, the predicted levels would not exceed the structural damage criteria.

The noise and vibration mitigation measures detailed in Section 9.5 of the EIS will be implemented to minimise the identified potential impacts.

In relation to the additional rock breaking activity on Lookout Road, nearby sensitive receivers would experience vibration levels above the human comfort level. There are two sensitive residential receivers located near the northern extent of the proposed work in NCA13. Subject to the type and size of equipment used during construction, predicted vibration levels would exceed the structural damage criteria at the sensitive residential receiver located closest to Lookout Road. In the EIS, this receiver was already identified as being within an area where construction vibration levels could exceed the structural damage criteria and as such, the specific construction vibration measures detailed in Section 9.5 of the EIS will be implemented.

Operational noise – predicted noise levels

Consistent with the EIS, the key findings of the updated operational noise assessment include:

- Receivers near existing major roads such as Newcastle Road, Lookout Road and Croudace Street are subject to existing high levels of traffic noise
- A total 49 sensitive receivers (50 in the EIS) qualify for consideration for mitigation as a result of the project as detailed in Table 6-10
- The project is predicted to exceed the project specific noise criteria at the following sensitive non-residential receivers (when in use):
  - Jesmond Park Uniting Church (NCA5) by up to 22 dB (13 dB in the EIS)
  - St Margaret's Anglican Church (NCA5) by up to 24 dB (23 dB in the EIS)
  - Buildings in the John Hunter Hospital precinct (NCA14) (Hunter Medical Research Institute, Yallarwah Place, John Hunter Hospital short stay unit, Forensic Medicine, John Hunter Hospital main building and Byrne House) by up to 20 dB (19 dB in the EIS).
- About 1154 sensitive receivers (1300 in the EIS) in the study area would experience either no change, or lower road traffic noise levels in 2030 with construction of the project, when compared to the no build scenario. This is due to the use of a low noise pavement and reduced traffic volumes along some roads.
- In general, surrounding formal recreational areas would experience either no appreciable change (less than 1.1 dB(A) increase) (1.2 dB(A) in the EIS), or lower road traffic noise levels in 2030 with construction of the project, when compared to the no build scenario. This is due to the use of a low noise pavement and reduced traffic volumes along some existing roads. Recreational areas located on the existing route of Lookout Road (north of the southern interchange), Croudace Street and Newcastle Road would experience the greatest benefits.

Table 6-10 Summary of sensitive receivers requiring consideration for noise mitigation

NCA	EIS number of receivers which qualify for consideration for noise mitigation	Updated number of receivers which qualify for consideration for noise mitigation
NCA2	3	3
NCA4	9	9
NCA5	13	11
NCA6	11	10
NCA13	5	5
NCA14	9	11
Total	50	49

Operational noise – traffic noise increase on existing roads

Due to the refined design for the hospital interchange (Section 5.4.1) there would be a minor redistribution of traffic on surrounding roads as described in Section 6.3. As a result, the potential for traffic noise increase on existing roads has been reassessed in the updated noise and vibration assessment (Appendix D).

Consistent with the EIS, the updated assessment indicates noise levels on existing local roads are not expected to significantly increase as a result of the project with any predicted increase expected to be less than 0.5 dB.

Operational management options

While the number of receivers which qualify for consideration for noise mitigation has changed slightly, the overall preliminary mitigation scenario is still valid. As a result the preliminary noise mitigation scenario now includes:

- Low noise road pavements consisting of stone mastic asphalt for all new pavement areas where feasible
- Construction of Noise Barrier 3 (3 metres high and 437 metres long)
- Construction of Noise Barrier 4 (3.5 metres high and 760 metres long)
- At-property treatments for 35 sensitive receivers located:
  - Along the existing Jesmond to Shortland section of the Newcastle Inner City Bypass, to the east and west of the project
  - Along Newcastle Road to the east and west of the project
  - In the John Hunter Hospital precinct
  - On Lookout Road near the southern interchange.

The noise assessment and preliminary mitigation scenario (including barrier heights and locations) will be re-evaluated at the detailed design stage and is subject to change. This may result in more or less receivers qualifying for consideration of noise mitigation. This will take into account any changes to the design and where required, feedback from consultation with affected residents. Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

6.4.3 Additional environmental management measures

No additional environmental management measures are required.

6.5 Landscape character and visual impact

6.5.1 Summary

An assessment of potential landscape character and visual impacts was included in Chapter 10 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Urban design and landscape character and visual impact assessment* (Ki Studio 2016) was prepared for the project and included in Appendix H of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-11.

As a result, the potential landscape character and visual impacts have been reassessed in Section 6.5.2. An updated assessment (Ki Studio October 2018) is provided in Appendix E and all key changes are summarised in the following section. Where the potential impacts are consistent with those identified in the EIS, these are not summarised here but are included in the updated assessment report.

Table 6-11 Landscape character and visual impact review

EIS consideration	Further assessment required?	Yes/No
Construction impacts	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Operation impacts:		
• Landscape character	Due to the proposed grade separation of the Jesmond Park shared path (Section 5.4.2) the landscape character impact assessment for Zone L – Jesmond Park has been updated. The proposed design refinements would not result in any additional impacts to other landscape character zones considered in the EIS.	Yes
• Visual impact	Due to the proposed grade separation of the Jesmond Park shared path (Section 5.4.2), the visual impacts for viewpoint 8 (viewpoint 7 in the EIS), viewpoint 13 (viewpoint 12 in the EIS) and viewpoint 16 (viewpoint 15 in the EIS) have been updated. An additional viewpoint (viewpoint 2) has also been assessed. The proposed design refinements would not result in any additional impacts to other viewpoints considered in the EIS.	Yes

6.5.2 Assessment

Landscape character

The updated assessment (Ki Studio 2018) identifies changes to the landscape character of Zone L – Jesmond Park. The grade separation of the Jesmond Park shared path (Section 5.4.2) would create a more urbanised landscape character for users of the shared use path. This proposed design refinement occurs at the perimeter of the zone and does not alter the overall landscape character impact rating of moderate in this zone. There would be no change to the landscape character impact ratings as a result of the refined design for the hospital interchange.

Visual impact

As discussed in Section 10.4.2 of the EIS, based on the visual catchment of the study area there are only a small number of areas with direct views of the project.

The visual impact assessment carried out for the EIS has been updated. Due to the addition of a new viewpoint (viewpoint 2) at the southern end of the project, all viewpoint numbers as presented in the EIS have changed as noted within this section.

Due to the proposed grade separation of the Jesmond Park shared path (Section 5.4.2), the elements and magnitude of three viewpoints have been amended as follows:

- Viewpoint 8 (viewpoint 7 in the EIS) – viewer: pedestrians and cyclists using the Jesmond Park shared path
- Viewpoint 13 (viewpoint 12 in the EIS) – viewer: pedestrians and cyclists using the existing shared path bridge over the existing Jesmond to Shortland section of the Newcastle Inner City Bypass north of Newcastle Road
- Viewpoint 16 (viewpoint 15 in the EIS) – viewer: residences located immediately to the north-east of the northern interchange.

All of these viewpoints now include views of the bridge (Bridge 8) providing a key built form feature. Of these three viewpoint changes, only Viewpoint 16 has a slightly increased visual impact of high (moderate to high in the EIS). This is due to the dominance of built form elements, changing the visual character of the northern interchange.

Figure 6-6 and Figure 6-7 shows views towards the project from viewpoints 8 and 16. For each viewpoint existing photos (without project) and indicative photomontages (with project) are shown.

Due to these minor changes, the predicted impacts for these viewpoints are consistent with those identified in the EIS.

There would be no change to the visual impact ratings as a result of the refined design for the hospital interchange.

The installation of directional signage as described in Section 5.5.7 could result in minor visual impacts however, given they would be located adjacent to existing roads this is not expected to be significant.

An additional viewpoint (viewpoint 2) has also now been assessed as described in Table 6-12. The assessment has identified that until the proposed landscaping becomes established the visual impact would be moderate to high during the day and high at night. When the vegetation has become established and matured, the impact would reduce to moderate during the day and moderate to high at night.

Figure 6-8 shows the view towards the project from viewpoint 2. For this viewpoint an existing photo (without project) and indicative photomontage (with project) is shown.

During construction the proposed new construction compound F, would be visible for nearby residents, in particular those located on Lookout Road. The compound is located within the footprint of the new road infrastructure and would not be used for the full duration of main work construction although other construction support activities may be ongoing at this location. While the compound would be visible to nearby residents, it is located in an area where intensive construction activities would occur and as a result no additional significant visual impacts are expected. However, in the event that the compound is used at night there could be impacts associated with construction vehicle movements and lighting. Potential impacts would be managed in accordance with the construction environmental management plan.

Table 6-12 Visual impact from viewpoint 2

Description of the setting	Viewer type	Sensitivity rating	Project elements visible	Impact (with mature landscaping)
Isolated residences looking north to the current bushland setting in the suburb of New Lambton Heights	Residents	High	Northbound Lookout Road flyover visible in the mid-distance. At night street lighting would also be visible.	Moderate (day) Moderate to high (night)

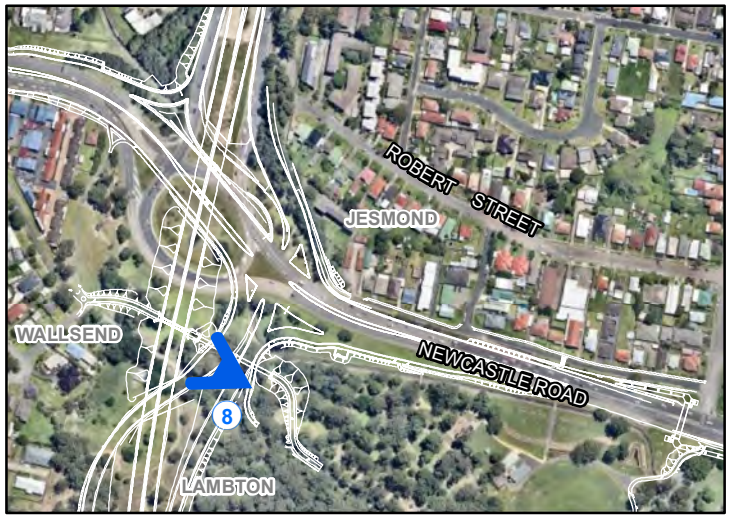
6.5.3 Additional environmental management measures

No additional environmental management measures are required as a result of the additional assessment.

In response to submissions, additional environmental management measures have been identified and are included in Chapter 7.

Viewpoint 8 - without project

Viewpoint 8 - with project



Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

Design

Viewpoint

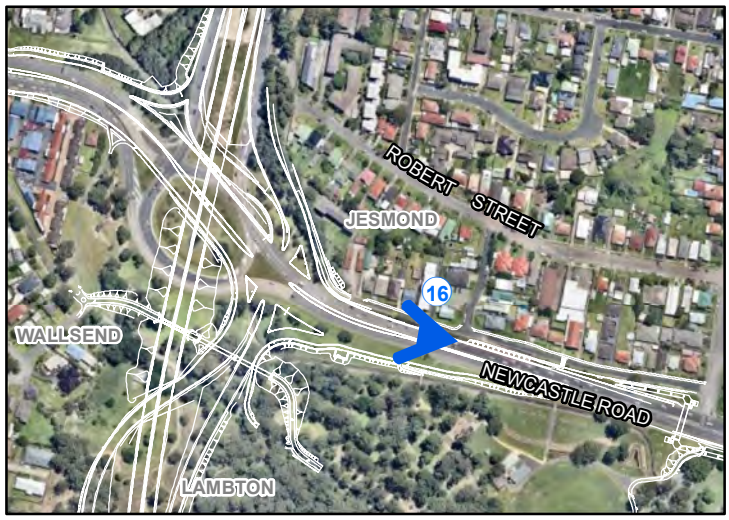
Rankin Park to Jesmond

Figure 6-6
Project photomontages – viewpoint 8

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR020_ProjectPhoto_Vp8.mxd
Data source: Aurecon: Photo montages 2016.

Viewpoint 16 - without project

Viewpoint 16 - with project



Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

Design

Viewpoint

Rankin Park to Jesmond

Figure 6-7
Project photomontages – viewpoint 16

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR021_ProjectPhoto_Vp16.mxd
Data source: Aurecon: Photo montages 2016.

Viewpoint 2 - without project

Viewpoint 2 - with project (without fully established vegetation)

Paper Size A4

0 25 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

Design

Viewpoint

Rankin Park to Jesmond

Figure 6-8
Project photomontages – viewpoint 2

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR022_ProjectPhoto_Vp2.mxd
Data source: Aurecon: Photo montages 2016.

6.6 Socio-economic, land use and property

6.6.1 Summary

An assessment of potential socio-economic, land use and property impacts was included in Chapter 11 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 5 – Socio-economic assessment* (GHD 2016c) was prepared for the project and included in Appendix I of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-13.

As a result, the potential socio-economic, land use and property impacts have been reassessed in Section 6.6.2. The potential change in impacts as a result of the design refinements are relatively minor. As such, this technical paper has not been updated.

Table 6-13 Socio-economic, land use and property review

EIS consideration	Further assessment required?	Yes/No
Land use and property:		
• Construction – property acquisition and transfer of ownership	Due to design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road, there has been a slight adjustment to the proposed road corridor (Section 5.5.4). As such, the property acquisition requirements for the project have been updated.	Yes
• Construction – mineral resources	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction – utilities	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction – construction lease areas	Due to refinements to the construction footprint (Section 5.5.8), potential construction lease areas have been updated.	Yes
• Operation	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Socio-economic assessment:		
• Employment opportunities	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

EIS consideration	Further assessment required?	Yes/No
• Local businesses	The potential impacts on local businesses are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
	The potential impacts to the home occupation activity on Lookout Road have been reviewed.	Yes
• Access and connectivity	The potential impacts for local and regional connectivity and private property access are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
	Due to the refined design for the hospital interchange (Section 5.4.1), the potential impacts have been updated.	Yes
	Due to the design refinements for pedestrians and cyclists (Section 5.4.2), the potential impacts have been updated.	Yes
• Community values – amenity, lifestyle and community cohesion	Due to the design refinements the potential impacts have been reviewed.	Yes
• Social infrastructure	Due to the refined design for the hospital interchange (Section 5.4.1) and slight adjustment to the proposed road corridor (Section 5.5.4), the potential impacts have been updated.	Yes

6.6.2 Assessment

Land use and property

Construction – property acquisition and transfer of ownership

The project would require acquisition of property as detailed in Section 5.3.21 of the EIS. Most of the land which would be impacted by the project is designated as a road corridor for the project and is either already owned by Roads and Maritime, or by other government agencies. A number of other properties have also been acquired by Roads and Maritime during planning for the project.

As discussed in Section 5.5.4, due to design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road, there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road. The changed arrangements for the shared path connection has been developed in consultation with Newcastle City Council in order to minimise potential impacts to Jesmond Park.

As a result there would be a slight increase in the area of acquisition from about 57.7 hectares to about 57.8 hectares. The additional area would impact Jesmond Park which is owned by Newcastle City Council as detailed in Table 5-6 and shown in Figure 5-13. The total area of acquisition from Jesmond Park would now be about 0.3 hectares or 3.6 per cent of the affected lot (compared with 0.25 hectares (three per cent) in the EIS). All other direct property impacts detailed in Section 5.3.21 of the EIS have not changed.

The extent of property acquisition would be confirmed during detailed design. Land acquisition will be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime 2014b) and the *Land Acquisition (Just Terms Compensation) Act 1991*.

Due to this minor change, the predicted impacts are consistent with those identified in the EIS.

Construction – potential construction lease areas

Construction of the project would require temporary leasing of land (or other temporary arrangements) for ancillary facilities and construction work (Section 5.4.5 of the EIS).

As a result of refinements to the construction footprint (Section 5.5.8), potential construction lease areas have been adjusted as detailed in Table 5-7 and shown in Figure 5-15. The refinements to the construction footprint are required for construction of the shared path bridge (Bridge 7) over Newcastle Road and associated shared path connections and the grade separation (Bridge 8) of the Jesmond Park shared path (Section 5.4.2).

All other potential construction lease areas detailed in Section 5.4.5 of the EIS have not changed.

The project would now require potential leasing of about 2.86 hectares compared with 2.73 hectares in the EIS. The additional areas would temporarily impact land owned by Newcastle City Council. The extent of potential construction lease areas would be confirmed during detailed design in consultation with Newcastle City Council.

Due to this minor change, the predicted impacts are consistent with those identified in the EIS.

Socio-economic assessment

Local businesses and home occupation

The potential impacts during construction and operation to local businesses are consistent with those described in the EIS.

The potential impacts to the home occupation activity in a private residence on Lookout Road were considered in the EIS include:

- Access (pedestrian and vehicular) during construction (Sections 8.3.1, 8.3.2 and 11.3.2 of the EIS)
- Parking changes during operation (Sections 8.3.2 and 11.3.2 of the EIS)
- Construction noise and vibration (Section 9.4.1 of the EIS)
- Operational noise (Sections 9.4.2 and 9.4.3 of the EIS)
- Socio-economic impacts (Section 11.3.2 of the EIS).

Key potential impacts identified in the EIS are:

- Changes to property access during construction
- Loss of informal on-street parking during construction and operation
- Increased noise levels during construction and operation.

The potential impacts associated with the design refinements are consistent with those identified in the EIS. Roads and Maritime has identified there are potential impacts to the home occupation activity, which along with any other sensitive receiver located near the project, will be managed in accordance with the measures detailed throughout the EIS. Specific measures that will be implemented for all sensitive receivers including the home occupation activity will include:

- Further consultation during detailed design
- Further consultation during pre-construction including during development of the construction environmental management plan, construction noise and vibration management plan and construction traffic management plan
- Notifications and further consultation during construction
- Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario (to be confirmed during detailed design) before, or as soon as possible during construction, to assist with mitigation of construction noise levels.

As discussed in Section 4.7.7, Roads and Maritime has committed to specific measures to assist with access to any properties affected by construction activities, including the home occupation activity during construction as part of a construction traffic management plan.

It is considered that with the implementation of these management and mitigation measures, impacts can be adequately managed so as to not cause economic impact to the home occupation activity.

Access and connectivity – John Hunter Hospital precinct

The potential impacts during construction are consistent with those described in the EIS.

During operation, the addition of south-facing ramps at the hospital interchange (Section 5.4.1) would improve accessibility to the hospital precinct.

Access and connectivity – pedestrian and cyclist access

As discussed in Section 8.3.1 of the EIS, during construction, there would be disruptions to pedestrian activity on paths and cyclist activity on shared paths and on-road cycleways, particularly those near Jesmond Park, Newcastle Road, and along Lookout Road and McCaffrey Drive. The measures detailed in Section 6.3.2 will be implemented in order to minimise the impacts to users of the Jesmond Park shared path during construction.

Where possible the duration of closure of existing paths would be limited and alternative safe access would be provided at all times.

As such, the potential impacts during construction are consistent with those described in the EIS.

During operation, the project (as described in the EIS) included provisions for pedestrian and cyclist connectivity in the local area (Section 5.3.14 of the EIS). The proposed design refinements (Section 5.4.2) would further enhance options for walking and cycling during operation.

Overall, the project, including the proposed design refinements, would result in improved access and connectivity for pedestrians and cyclists.

Community values – amenity and lifestyle

As discussed in Section 11.3.2 of the EIS, construction and operation of the project would result in changes to local amenity due to changes in noise levels, air quality and visual amenity. Updated assessments for noise and vibration, air quality and visual amenity (Sections 6.4, 6.5 and 6.11 respectively) have been carried out for this report and while there

are minor changes in the predicted impacts in some cases, overall the impacts are consistent with those identified in the EIS. Key changes include:

- Increased noise levels during construction
- Minor changes in predicted operational noise levels and a refinement of the preliminary noise mitigation scenario
- Minor changes in visual impacts for viewers located near the proposed grade separation of the Jesmond Park shared path.

The environmental management measures detailed in Chapter 7 will be implemented to minimise potential amenity and lifestyle impacts.

Community values – changes to movement and access

The potential impacts during construction for broader community movement and access are consistent with those described in the EIS. During construction, there would be disruptions for pedestrian and cyclist as discussed in the preceding section, however these would also be consistent with those described in the EIS.

The proposed design refinements (Section 5.4.2) would further enhance options for walking and cycling during operation. Overall, the project, including the proposed design refinements, would result in improved access and connectivity for pedestrians and cyclists. During operation, the addition of south-facing ramps at the hospital interchange (Section 5.4.1) would improve accessibility to the hospital precinct.

Community values – sense of community and participation

The potential impacts during construction and operation are consistent with those described in the EIS.

Social infrastructure

The potential impacts to the John Hunter Hospital precinct, The University of Newcastle, emergency services and recreational facilities during construction are consistent with those described in the EIS.

The potential impacts to The University of Newcastle during construction are consistent with those described in the EIS.

During operation, the addition of south-facing ramps at the hospital interchange (Section 5.4.1) would improve accessibility to the John Hunter Hospital precinct for the public, staff and emergency services.

During operation, there would be a minor change in the potential impacts to Jesmond Park. As discussed in Section 5.5.4, due to design refinements associated with the shared path connections to the bridge (Bridge 7) over Newcastle Road, there has been a slight adjustment to the proposed road corridor on the southern side of Newcastle Road. The changed arrangements for the shared path connection has been developed in consultation with Newcastle City Council in order to minimise potential impacts to Jesmond Park.

As a result there would be a slight increase in the area of acquisition from Jesmond Park to about 0.3 hectares or 3.6 per cent of the affected lot (compared with 0.25 hectares (three per cent) in the EIS). Due to this minor change, the predicted impacts are consistent with those identified in the EIS.

6.6.3 Additional environmental management measures

No additional environmental management measures are required as a result of the additional assessment.

In response to submissions, additional environmental management measures have been identified and are included in Chapter 7.

6.7 Flooding and drainage

6.7.1 Summary

An assessment of potential impacts to flooding and drainage was included in Chapter 12 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 6 – Flooding and Drainage Assessment* (Aurecon 2016b) was prepared for the project and included in Appendix J of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-14.

As a result, the potential flooding and drainage impacts have been reassessed in Section 6.7.2. A supplementary flooding and drainage assessment (Aurecon 2018b) is provided in Appendix F and all key changes are summarised in the following section.

Table 6-14 Flooding and drainage assessment review

EIS consideration	Further assessment required?	Yes/No
Construction impacts:		
• Flooding – work in flood affected areas	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Flooding – site compounds and stockpile site locations	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Flooding – work in existing watercourses	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Flooding – work in existing drainage lines	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Flooding – vegetation clearing and bulk earthworks	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Operation impacts:		
• Flooding	Due to the proposed grade separation of the Jesmond Park shared path (Section 5.4.2) at the northern interchange, the flood modelling carried out for the project has been updated.	Yes

EIS consideration	Further assessment required?	Yes/No
• Hydraulic analysis of bridges and realignment of watercourse 2	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Drainage	While the proposed drainage infrastructure (Section 5.5.2) has been refined (to reflect other design refinements), the potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Watercourse hydraulics	Due to the design refinements, the hydrological modelling carried out for the project has been updated.	Yes

6.7.2 Assessment

Operation

Flooding

As discussed in Section 12.3.2 of the EIS, without the implementation of flood mitigation measures at the northern interchange, the project would further increase existing flooding which occurs within the Dark Creek catchment.

Due to the grade separation of the Jesmond Park shared path (Section 5.4.2), the proposed flood mitigation measures have been refined as described in Section 5.5.2. Consistent with the EIS, this would provide the project (including the northern interchange) a flood immunity for the 100 year annual recurrence interval (ARI) event, compared to the existing less than 5 year ARI event flood immunity of Newcastle Road.

Updated flood modelling has been carried out and is provided in Appendix F. The key findings of the updated assessment (relative to existing flood levels) include:

- An increase in both flood extents and depths in Jesmond Park, in particular:
  - An increase of up to 0.62 metres at the western end of the park for the 100 year ARI event (decreased from 0.64 metres in the EIS)
  - An increase of up to 0.37 metres at the eastern end of the park for the 20 year ARI event (no increase in the EIS)
- The project would not worsen downstream (near Blue Gum Road) flooding conditions
- There would be a minor increase of up to 0.02 metres in the 5 year ARI event (decreased from 0.04 metres in the EIS) in flooding of the garden area of a block of residential units to the north-east of the northern interchange. For all other modelled events there would be a decrease in flood levels which is consistent with the EIS.

Consistent with the EIS, overall the project would improve existing flooding conditions for Newcastle Road, the northern interchange and for most events, areas immediately to the north-east of the northern interchange and maintain existing conditions for areas downstream of the northern interchange. This is due to the flood mitigation work which temporarily retains floodwaters within Jesmond Park. Consistent with the EIS, the duration of inundation within Jesmond Park is not expected to increase significantly and no additional buildings or structures are expected to be impacted. As most of the impacted area is already affected by flooding, the project is not expected to cause impacts to users of the park.

Watercourse hydraulics

Hydraulic modelling for the watercourse sub-catchments (Figure 6-9) within which the project is located was carried out to identify existing peak flows, flow velocities and water depths for a range of average recurrence interval (ARI) events, including the probable maximum flood (PMF). In addition to considering the design refinements, the updated modelling has been refined to provide greater definition between sealed surfaces (eg road surfaces) and vegetated areas (eg rehabilitated batters and vegetated swales) for both the existing (no project) and with project scenarios.

The detailed modelling results are provided in the supplementary flooding and drainage assessment (Appendix F) and are summarised in Table 6-15, Table 6-16 and Table 6-17. The results indicate the following:

- Increased peak flows are predicted across all sub-catchments (with the exception of the PMF event in sub-catchment B) and are mostly affected by the increase in impervious surfaces in each sub-catchment:
  - Excluding the PMF event, the increases are relatively low, being up to 1.2 cubic metres per second compared with 1.1 cubic metres per second in the EIS
  - In the PMF event in sub-catchment G the predicted increase is 3.1 cubic metres per second (about 5 per cent) which is consistent with the EIS
- Increased flow velocities are predicted across all sub-catchments with the exception of the PMF event in sub-catchment B and 10 year ARI event in sub-catchment G, where minor decreases are predicted. The predicted increases are relatively minor, being up to 0.09 metres per second compared with 0.1 metres per second in the EIS
- Increased water levels are predicted for most sub-catchments but are relatively minor, being up to six centimetres (no change from the EIS).

These results are consistent with the EIS and as such, no additional impacts are expected. As discussed in the EIS and updated in this report, the project includes a range of measures to manage stormwater including the roadside drainage system, vegetated swales and operational water quality treatment structures. Scour protection and energy dissipators will be provided where the drainage system discharges to the surrounding ephemeral watercourses. These measures have been developed in accordance with relevant guidelines and are typical treatments commonly applied to ephemeral watercourses.

Consistent with the EIS, all increases (in peak flows, velocities and levels) are relatively minor and are not expected to result in any significant impacts to the downstream ephemeral watercourses in relation to long term bed and bank stability or occurrence of overtopping flows which would result in property or environmental damage. Roads and Maritime identified in the EIS there are existing erosional processes occurring in some of the ephemeral watercourses located in the bushland area. While minor, the predicted increases would likely increase the rate of these existing processes however the geomorphological assessment carried out as part of the EIS identified this would only continue short term until either bedrock is reached or the gully heads reach the project drainage outlets. Further it is important to note these processes would continue even if the project was not constructed.

The proposed control measures are consistent with the surrounding road network and balanced with reducing the scale of the project in the urban bushland setting. Substantial hard engineering structures within the ephemeral watercourses downstream of the project would be required to implement any potential additional controls to achieve higher compliance with guideline values/targets which are typically not met under existing conditions. Additional environmental impacts (eg vegetation clearing and in-stream construction work) are considered to be disproportionate and unnecessary.

6.7.3 Additional environmental management measures

No additional environmental management measures are required.

Table 6-15 Predicted watercourse hydraulics – peak flows (cubic metres per second)

Sub-catchment	Scenario	10 year ARI event	50 year ARI event	100 year ARI event	PMF
A	With project (change from existing)	10.1 (+11%)	14.2 (+8.4%)	16.3 (+7.2%)	88.2 (+1.5%)
	Change from EIS [1]	+0.3 (+2.1%)	+0.4 (+2.2%)	+0.4 (+1.2%)	+0.4 (+0.5%)
B	With project (change from existing)	3.3 (+6.5%)	4.6 (+4.5%)	5.3 (+3.9%)	29.3 (-6.7%)
	Change from EIS [1]	+0.1 (-0.2%)	+0.1 (+2.3%)	no change	-0.10 (no change)
C (includes sub-catchments A and B)	With project (change from existing)	15.9 (+7.4%)	22.4 (+5.7%)	25.7 (+4.9%)	139.7 (+0.8%)
	Change from EIS [1]	+0.4 (+0.5%)	+0.4 (+0.9%)	+0.4 (+0.4%)	+1.5 (+1.2%)
D	With project (change from existing)	2 (+5.3%)	2.9 (+7.4%)	3.3 (+6.5%)	17.9 (+1.7%)
	Change from EIS [1]	-0.3 (+0.7%)	-0.5 (+1.2%)	-0.6 (+1%)	+2.5 (+2.3%)
E	With project (change from existing)	2.4 (+20%)	3.5 (+20.7%)	4 (+17.6%)	22.1 (+10%)
	Change from EIS [1]	+0.1 (+5%)	+0.1 (+3.4%)	+0.1 (-0.5%)	-1.3 (-2.5%)
F	With project (change from existing)	2.5 (no change)	3.7 (+2.8%)	4.2 (+2.4%)	24 (+1.3%)
	Change from EIS [1]	no change	+0.1 (+2.8%)	+0.1 (+2.4%)	-1.4 (-0.7%)
G (includes sub-catchments E and F)	With project (change from existing)	6.2 (+6.9%)	9.1 (+5.8%)	10.6 (+7.1%)	61.4 (+5.3%)
	Change from EIS [1]	+0.1 (-0.1%)	+0.1 (-0.1%)	+0.2 (-0.1%)	-1.5 (+0.1%)

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated

Table 6-16 Predicted watercourse hydraulics – flow velocities (metres per second)

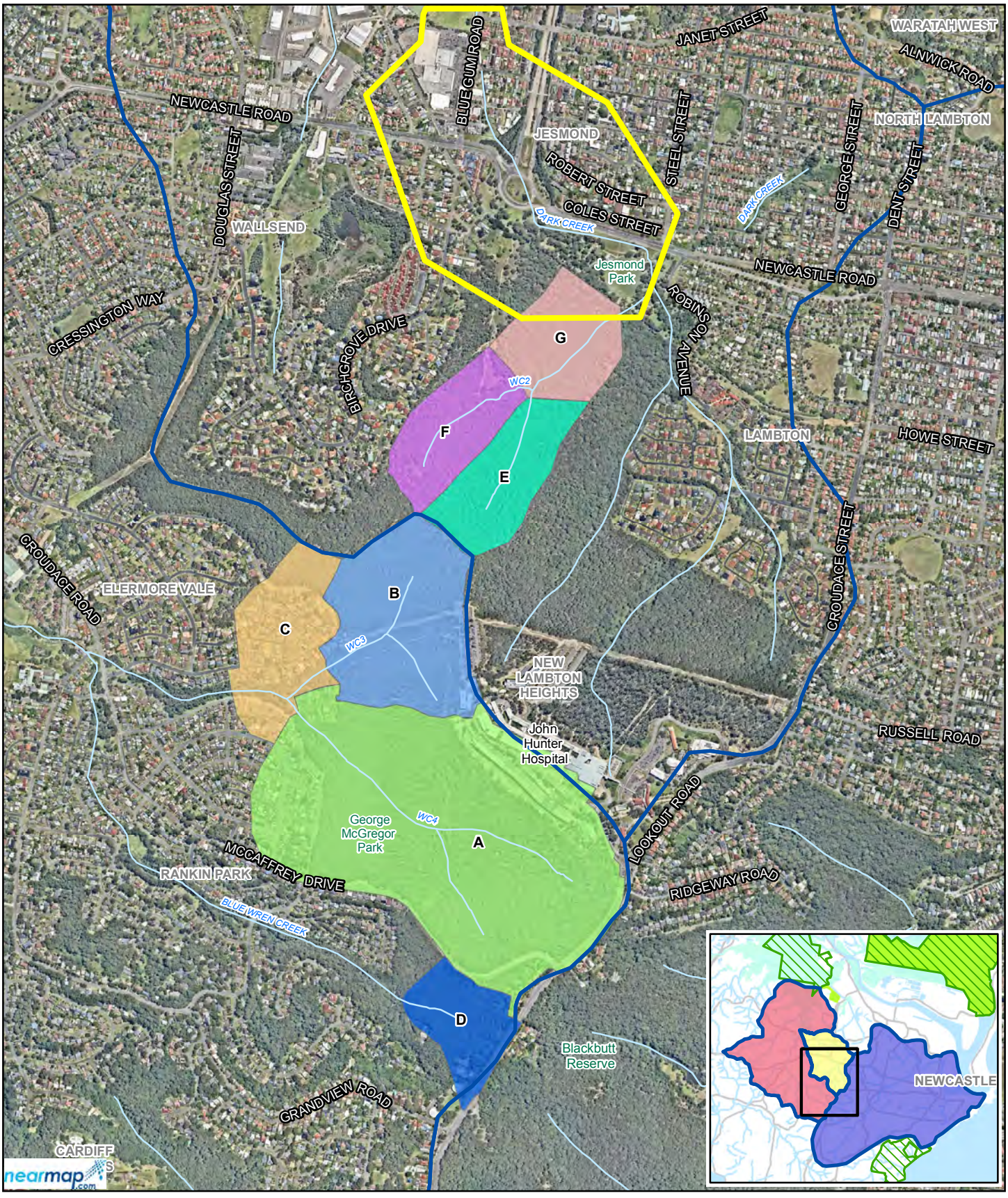
Sub-catchment	Scenario	10 year ARI event	50 year ARI event	100 year ARI event	PMF
A	With project (change from existing)	1.37 (+0.06)	1.52 (+0.04)	1.59 (+0.04)	1.99 (+0.02)
	Change from EIS [1]	-1.23 (-0.04)	-1.38 (+0.04)	-1.51 (-0.06)	-3.61 (+0.02)
B	With project (change from existing)	1.59 (+0.03)	1.75 (+0.02)	1.82 (+0.02)	1.4 (-0.1)
	Change from EIS [1]	-0.31 (-0.07)	-0.35 (+0.02)	-0.38 (+0.02)	-2.2 (-0.1)
C (includes sub-catchments A and B)	With project (change from existing)	0.96 (+0.01)	1.04 (+0.02)	1.06 (no change)	1.77 (no change)
	Change from EIS [1]	+0.26 (+0.01)	+0.34 (+0.02)	+0.26 (no change)	+0.67 (no change)
D	With project (change from existing)	0.85 (+0.02)	0.96 (+0.02)	1.01 (+0.02)	1.84 (+0.01)
	Change from EIS [1]	-0.05 (+0.02)	-0.04 (+0.02)	-0.09 (+0.02)	+0.14 (+0.01)
E	With project (change from existing)	1.43 (+0.06)	1.59 (+0.08)	1.65 (+0.08)	2.57 (+0.06)
	Change from EIS [1]	+0.03 (+0.06)	-0.01 (-0.02)	+0.05 (+0.08)	-0.03 (-0.04)
F	With project (change from existing)	1.43 (no change)	1.57 (no change)	1.63 (+0.01)	2.35 (+0.01)
	Change from EIS [1]	+0.03 (no change)	-0.03 (no change)	+0.03 (+0.01)	-0.05 (+0.01)
G (includes sub-catchments E and F)	With project (change from existing)	2.7 (-0.25)	2.95 (+0.04)	3.03 (+0.03)	3.53 (+0.09)
	Change from EIS [1]	+2.5 (-0.25)	+2.75 (+0.04)	+2.83 (+0.03)	+2.83 (+0.09)

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated

Table 6-17 Predicted watercourse hydraulics – water levels (AHD (metres))

Sub-catchment	Scenario	10 year ARI event	50 year ARI event	100 year ARI event	PMF
A	With project (change from existing)	28.83 (+0.05)	29.02 (+0.05)	29.1 (+0.04)	30.71 (+0.01)
	Change from EIS [1]	-0.31 (no change)	-0.30 (+0.01)	-0.30 (no change)	-0.05 (no change)
B	With project (change from existing)	29.53 (+0.01)	29.59 (+0.01)	29.62 (+0.01)	30.66 (no change)
	Change from EIS [1]	no change (-0.01)	no change	no change	+0.01 (+0.02)
C (includes sub-catchments A and B)	With project (change from existing)	26.65 (+0.06)	26.96 (+0.05)	27.11 (+0.06)	28.81 (+0.01)
	Change from EIS [1]	+0.02 (no change)	+0.01 (no change)	+0.02 (+0.01)	+0.01 (+0.01)
D	With project (change from existing)	60.45 (+0.01)	60.52 (+0.02)	60.55 (+0.02)	61.12 (+0.01)
	Change from EIS [1]	-0.03 (-0.01)	-0.03 (+0.01)	-0.04 (no change)	+0.07 (+0.01)
E	With project (change from existing)	19.89 (+0.03)	19.95 (+0.03)	19.97 (+0.03)	20.53 (+0.04)
	Change from EIS [1]	+0.01 (+0.01)	+0.01 (+0.01)	no change	-0.03 (-0.02)
F	With project (change from existing)	19.38 (no change)	19.45 (no change)	19.48 (+0.01)	20.04 (+0.01)
	Change from EIS [1]	no change	no change	+0.01 (+0.01)	-0.02 (+0.01)
G (includes sub-catchments E and F)	With project (change from existing)	12.54 (+0.06)	12.69 (+0.02)	12.77 (+0.04)	14.49 (+0.03)
	Change from EIS [1]	-1.05 (+0.02)	-1.15 (-0.02)	-1.18 (-0.01)	-1.50 (no change)

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated



LEGEND

- Design
- Watercourse
- Catchment boundary

Catchments

- Dark Creek
- Ironbark Creek
- Throsby, Styx and Cottage Creeks
- Sub-catchment A
- Sub-catchment B
- Sub-catchment C
- Sub-catchment D
- Sub-catchment E
- Sub-catchment F
- Sub-catchment G
- Hunter Estuary Wetlands - Ramsar
- State Environmental Planning Policy no. 14 - Coastal Wetlands
- Hunter Wetlands National Park
- Flood model extent

Paper Size A4

0 62.5 125 250 375 500

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-9

Flood model and hydraulic analysis extents

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Data source: Geoscienece Australia: National Park, 2006; DSEWPaC: Ramsar Wetland, 2008, CANRI: SEPP14, 2008; Nearmap: Aerial Imagery, 20160331; Aurecon: Design / Catchments, 2016; LPI: DTDB, 2012.

6.8 Soils, contamination and water quality

6.8.1 Summary

An assessment of potential soils, contamination and water quality impacts was included in Chapter 13 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 7 – Water Quality and Watercourse Assessment* (GHD 2016d) was prepared for the project and included in Appendix K of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-18.

As a result, the potential soils, contamination and water quality impacts have been reassessed in Section 6.8.2. A supplementary water quality and watercourse assessment (GHD 2018c) is provided in Appendix G and all key changes are summarised in the following section.

Table 6-18 Soils, contamination and water quality assessment review

EIS consideration	Further assessment required?	Yes/No
Geology, topography and soils:		
• Construction – geology and topography	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction – watercourse geomorphology	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Operation – geology and topography	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Operation – watercourse geomorphology	Due to the design refinements, the potential watercourse geomorphology impacts have been reviewed.	Yes
Contamination:		
• Construction	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Operation	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Water quality:		
• Construction	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

EIS consideration	Further assessment required?	Yes/No
• Operation – road runoff	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Operation – water quality modelling	Due to the design refinements, the operational water quality modelling has been updated.	Yes
• Operation – spill events	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Operation – groundwater	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Soil and water management:		
• Construction – erosion and sedimentation	Due to other design refinements, the proposed construction phase sedimentation basins have been adjusted (Section 5.5.11).	Yes
• Construction – materials handling	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction – tannins	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction – mine remediation (grouting)	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Construction – contamination	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
• Operation	Due to other design refinements, the proposed operational phase water quality treatment structures have been adjusted (Section 5.4.3).	Yes

6.8.2 Assessment

Geology, topography and soils – operation – watercourse geomorphology

As discussed in Section 5.5.3, due to other design refinements there has been adjustment of the required cut and fill volumes. This would require a minor widening (about five metres (four per cent)) of the fill in the upper reaches of Blue Wren Creek (watercourse 5). This minor widening would not result in any noticeable additional impacts to this watercourse.

Updated hydraulic modelling (Section 6.7.2) carried out for the project (including the design refinements) indicates the predicted changes in peak flows, flow velocities and water depths

are consistent with the EIS and as such, no additional impacts are expected. Refer to Section 6.7.2 for further discussion regarding potential impacts associated with existing erosional processes located in the ephemeral watercourses downstream of the project.

Water quality – operation – water quality modelling

MUSIC (model for urban stormwater improvement conceptualisation) modelling was carried out to estimate the impact of the project (including the design refinements) on pollutant (total suspended solids (TSS), total phosphorous (TP), total nitrogen (TN) and gross pollutants) concentrations in both the local catchment (ephemeral creeks immediately surrounding the project that are tributaries of Dark Creek and Ironbark Creek) and the downstream sensitive receiving environment (wider catchment including SEPP 14 and Ramsar wetlands) (Figure 6-10).

In addition to considering the design refinements, the modelling has been refined to provide greater definition between sealed surfaces (eg road surfaces) and vegetated areas (eg rehabilitated batters and vegetated swales) for both the project and the broader catchment.

The MUSIC modelling was carried out for the project (including the design refinements) under the following scenarios:

- Existing conditions (no project scenario)
- Project without treatment
- Project with treatment (proposed water quality treatment structures (Section 5.4.3).

The MUSIC modelling results were compared with the following:

- *NSW Water Quality and River Flow Objectives* (OEH 2006), which define agreed environmental values and long-term goals for NSW's surface waters. The values defined for the Hunter River for protection of aquatic ecosystems have been adopted for the assessment and are consistent with the framework for assessing water quality provided by *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ 2000)
- Newcastle City Council *Development Control Plan 2012* (Newcastle City Council 2012) supplements the *Newcastle Local Environmental Plan 2012* and provides additional information which should be taken into account when preparing a development application under Part 4 of the EP&A Act. It should be noted the project does not require a Part 4 consent and therefore the requirements of the *Development Control Plan 2012* do not apply. However, the relevant water treatment targets requirements have been considered in this assessment
- EIS design MUSIC modelling.

The detailed modelling results are provided in the supplementary water quality and watercourse assessment (Appendix G) and summarised in the following sections.

MUSIC modelling – local catchment

The modelling predicted average pollutant concentrations (Table 6-19 and Table 6-20) and annual pollutant loads (Table 6-21 and Table 6-22) in the Dark Creek and Ironbark Creek local catchments near the project and indicates:

- Under existing conditions (no project scenario), average TP concentration exceeds the ANZECC/ARMCANZ (2000) default trigger value while average TSS and TN are just below the default trigger values
- The project (without treatment), would result in an increase in modelled average pollutant concentrations
- The project (with treatment), would achieve substantial reductions in modelled average pollutant concentrations (compared to the without treatment scenario) and would achieve the adopted ANZECC/ARMCANZ (2000) default trigger values for TSS in Dark Creek and TSS and TP in Ironbark Creek

- The project (with treatment), would achieve the Newcastle City Council targets for annual pollutant loads in the Ironbark Creek and Dark Creek catchments
- Relative to the EIS design, the project (with treatment), would achieve further substantial reductions in pollutants entering Dark Creek and Ironbark Creek.

Table 6-19 Modelled average pollutant concentrations in local catchment (Dark Creek)

Parameter	ANZECC default trigger value	Existing conditions [1]	EIS conditions (with treatment)	Operational conditions (without treatment)	Operational conditions (with treatment)
Flow (m^3/s)	n/a	0.0013	0.006	0.0026	0.002
TSS (mg/L)	6	5.74	54.8	65.9	5.34
TP (mg/L)	0.025	0.029	0.18	0.154	0.04
TN (mg/L)	0.35	0.287	1.25	1.22	0.66
Gross pollutants (kg/day)	n/a	0	11.7	5.54	0

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated

Table 6-20 Modelled average pollutant concentrations in local catchment (Ironbark Creek)

Parameter	ANZECC default trigger value	Existing conditions [1]	EIS conditions (with treatment)	Operational conditions (without treatment)	Operational conditions (with treatment)
Flow (m^3/s)	n/a	0.0017	0.011	0.0031	0.0025
TSS (mg/L)	6	5.81	41.0	65.9	2.3
TP (mg/L)	0.025	0.029	0.133	0.167	0.022
TN (mg/L)	0.35	0.289	1.08	1.29	0.53
Gross pollutants (kg/day)	n/a	0	14.7	5.91	0

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated

Table 6-21 Modelled annual pollutant loads in local catchment (Dark Creek)

Parameter	Newcastle City Council water quality target	Operational conditions (without treatment)	Operational conditions (with treatment)	Achieved percentage reduction
TSS (kg/year)	85%	19,200	2120	89%
TP (kg/year)	65%	35.4	8.9	75%
TN (kg/year)	45%	178	97	46%

Parameter	Newcastle City Council water quality target	Operational conditions (without treatment)	Operational conditions (with treatment)	Achieved percentage reduction
Gross pollutants (kg/year)	90%	2030	1	100%

Table 6-22 Modelled annual pollutant loads in local catchment (Ironbark Creek)

Parameter	Newcastle City Council water quality target	Operational conditions (without treatment)	Operational conditions (with treatment)	Achieved percentage reduction
TSS (kg/year)	85%	21,600	1010	95%
TP (kg/year)	65%	42.2	5.71	86%
TN (kg/year)	45%	211	88.2	58%
Gross pollutants (kg/year)	90%	2160	1.71	100%

Dark Creek is a heavily modified environment and following the reduction of contaminants by the water quality treatment structures (Section 5.4.3) and proposed environmental management measures (Section 7) and the mixing with water sources in the surrounding residential/commercial catchment, it is considered the impact to the Dark Creek would not present an appreciable reduction in water quality. Water quality treatment by the project is modelled to reduce average pollutant concentrations by up to 92 per cent and annual pollutant loads by up to 89 per cent compared to the without treatment scenario. There would also be substantial reductions in gross pollutants. As Dark Creek presents limited habitat for aquatic flora or fauna, it is considered the changes to water quality are unlikely to result in a significant impact to the local environment.

Ironbark Creek presents a less modified environment in comparison to Dark Creek. The condition of the waterway presents more opportunity for natural attenuation of nutrients and solids sourced from the project and surrounding land uses without resulting in a significant loss to water quality. Water quality treatment by the project is modelled to reduce average pollutant concentrations by up to 92 per cent and annual pollutant loads by up to 95 per cent compared to the without treatment scenario. There would also be substantial reductions in gross pollutants and as such, it is considered that the changes to water quality are unlikely to result in a significant impact to the local environment.

The proposed operational water quality treatment structures are designed to capture the ‘first flush’ flows, which typically include higher concentrations of pollutants. In addition, the modelling does not include any water quality attenuation which would be provided by the typically ephemeral natural watercourse reaches immediately downstream of the project.

As such, the model provides an 'upper estimate' of the potential increases to pollutants reporting to the local watercourses as a result of the project. As water from the local watercourses is interspersed with the water sourced from the surrounding catchment within its perennial flows, it is considered potential water quality impacts such as sedimentation, eutrophication and changes in available light or oxygen would be negligible. It is anticipated any locally occurring aquatic flora and fauna have habituated to this urban water quality and modified condition and as a result it is unlikely to result in a significant impact to the environment or any potentially occurring flora or fauna.

As discussed in the EIS and updated in this report, the project includes a range of measures to manage stormwater including the maintained roadside drainage system, vegetated swales and operational water quality treatment structures. Scour protection and energy dissipators will be provided where the drainage system discharges to the surrounding ephemeral watercourses. These measures have been developed in accordance with relevant guidelines and are typical treatments commonly applied to ephemeral watercourses.

Consistent with the EIS, with implementation of these controls, there would be a substantial reduction in the pollutants reporting to the surrounding environment, and in the case of TSS and TP would be no worse than existing conditions. The assessment shows that consistent with NSW Government policy, the operational controls proposed as part of the project, would assist in working towards achievement of the environmental values of the downstream receiving waterways. The proposed control measures are consistent with the surrounding road network and balanced with reducing the scale of the project in the urban bushland setting. Substantial hard engineering structures within the ephemeral watercourses downstream of the project would be required to implement any potential additional controls to achieve higher compliance with guideline values/targets which are typically not met under existing conditions. Additional environmental impacts (eg vegetation clearing and in-stream construction work) are considered to be disproportionate and unnecessary.

MUSIC modelling – sensitive receiving environment (wider catchment)

The modelling predicted average pollutant concentrations in the downstream sensitive receiving environment (wider catchment including SEPP 14 and Ramsar wetlands) (Table 6-23 and Table 6-24) and indicates:

- Under existing conditions (no project scenario), average pollutant concentrations exceed the ANZECC/ARMCANZ (2000) default trigger values
- The project (without treatment), would result in a minor increase in modelled average pollutant concentrations
- The project (with treatment), would achieve reductions in modelled average pollutant concentrations (compared to the without treatment scenario) and while it would not achieve the ANZECC/ARMCANZ (2000) default trigger values it would be slightly better than/no worse than existing conditions
- Relative to the EIS design, the project (with treatment), would achieve further substantial reductions in pollutants entering the downstream sensitive receiving environment.

Much of Ironbark Creek (which is the main watercourse draining to the downstream SEPP 14 and Ramsar wetlands) downstream of the project passes through residential, commercial and industrial areas, and has been concrete lined and highly modified. The catchment area of the SEPP 14 and Ramsar wetlands is therefore highly developed, with estimated impervious areas of up to 57 per cent. The highly developed nature of the Ironbark Creek catchment results in flows into the wetlands which have relatively high pollutant concentrations. The project is estimated to result in a negligible increase in the impervious area of the SEPP 14 and Ramsar wetland catchments (about 0.7 per cent and 0.4 per cent respectively).

In summary, the modelling indicates the proposed water quality treatment measures (Section 5.4.3) assist in mitigating the TSS, TP, TN and gross pollutants reporting to the SEPP 14 and Ramsar wetlands. The assessment shows that consistent with NSW Government

policy, the operational controls proposed as part of the project, would assist in working towards achievement of the environmental values of the downstream receiving waterways. In particular, in the sensitive receiving environment (SEPP 14 and Ramsar wetlands), with the project, water quality reporting to the SEPP 14 and Ramsar wetlands, in terms of TSS, TP and TN, would be no worse than existing conditions because of the proposed water quality treatment structures. It also highlights the impacts from the project would not result in a change to water quality in the sensitive receiving environment and is therefore considered to be consistent with *Significant impact guidelines 1.1: Matters of National Environmental Significance* (DotE 2013).

In addition, and as per the modelling for the local catchment, the modelling does not include any water quality attenuation which would be provided by the ephemeral natural watercourse reaches immediately downstream of the project. As such, the model provides an 'upper estimate' of the potential increases to pollutant concentrations reporting to the wetlands as a result of the project.

Table 6-23 Average modelled pollutant concentrations in wider catchment (SEPP 14 wetland)

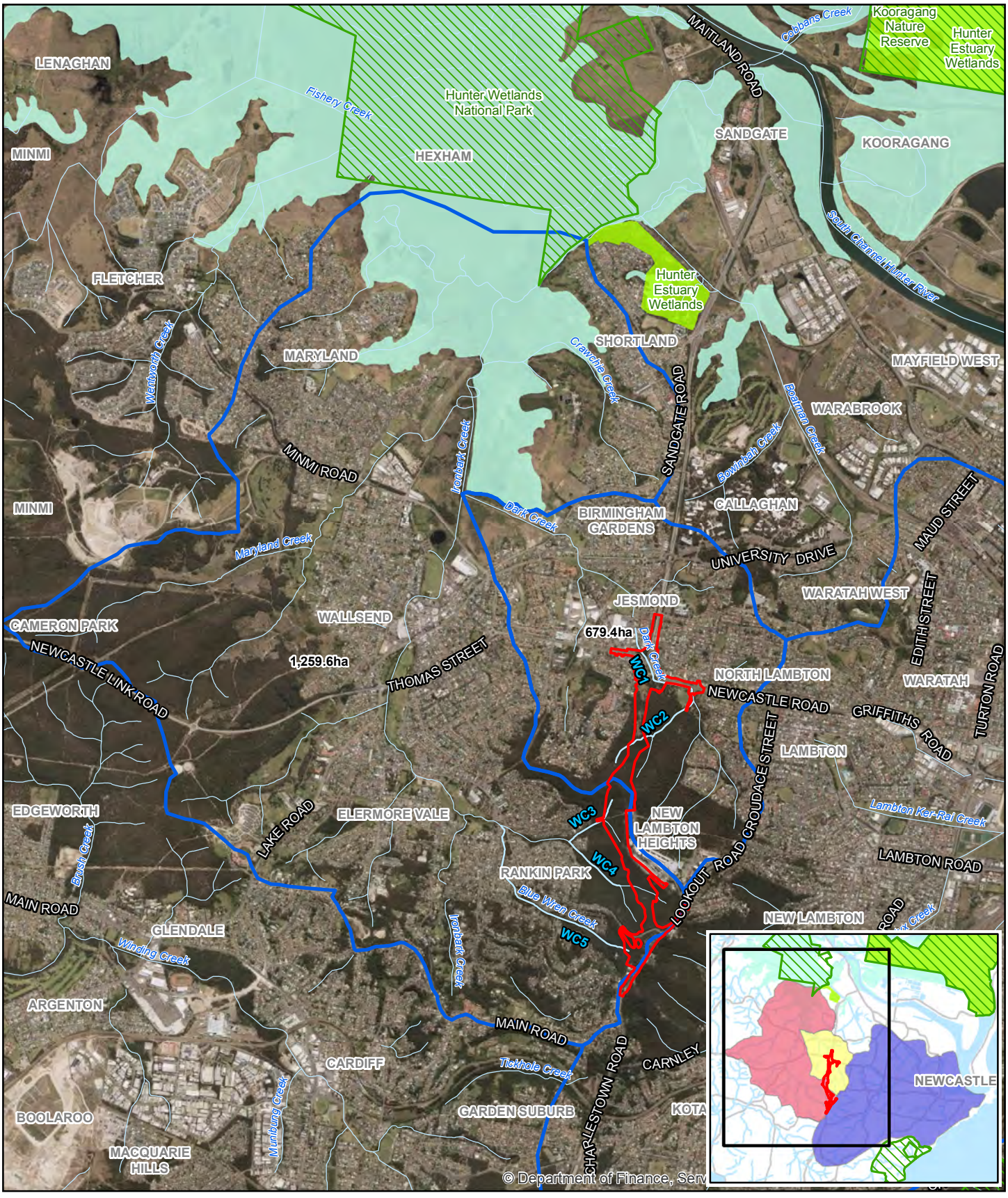
Parameter	ANZECC default trigger value	Existing conditions [1]	EIS conditions (with treatment)	Operational conditions (without treatment)	Operational conditions (with treatment)
Flow (m^3/s)	n/a	0.320	0.368	0.323	0.321
TSS (mg/L)	6.0	46.9	54.4	49.5	46.5
TP (mg/L)	0.03	0.171	0.186	0.176	0.166
TN (mg/L)	0.30	1.41	1.53	1.49	1.40
Gross pollutants (kg/day)	n/a	751	856	762	751

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated

Table 6-24 Average modelled pollutant concentrations in wider catchment (Ramsar wetland)

Parameter	ANZECC default trigger value	Existing conditions [1]	EIS conditions (with treatment)	Operational conditions (without treatment)	Operational conditions (with treatment)
Flow (m^3/s)	n/a	0.492	0.567	0.495	0.494
TSS (mg/L)	6.0	46.1	52.7	48.0	45.8
TP (mg/L)	0.03	0.172	0.185	0.176	0.168
TN (mg/L)	0.30	1.42	1.52	1.48	1.41
Gross pollutants (kg/day)	n/a	1070	1210	1080	1070

1. Due to a refinement in the model the existing conditions reported in the EIS have been updated



LEGEND

- Construction footprint
- Hunter Estuary Wetlands - Ramsar
- State Environmental Planning Policy no. 14 - Coastal Wetlands
- Hunter Wetlands National Park
- Watercourse
- Catchment boundary

Catchments

- Dark Creek
- Ironbark Creek
- Throsby, Styx and Cottage Creeks

Paper Size A4

0 360 720 1,080 1,440

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-10
Surface water catchments

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR024_SWCatchments_0.mxd
Data source: Geoscienece Australia: Natioanl Park, 2006; DSEWPaC: Ramsar Wetland, 2008, CANRI: SEPP14, 2008; Aurecon: Construction footprint, 2016; PB: Catchments, 2015; LPI: Aerial imagery, 2015. LPI: DCDB\DTDB, 2012.

Soil and water management – construction – erosion and sedimentation

As discussed in Section 13.5.1 of the EIS, construction activities have the potential to generate sediment-laden runoff which, without proper erosion and sediment controls, could pollute the downstream environment. In order to minimise the potential impacts to the downstream environment, erosion and sediment controls would be implemented during construction in accordance with a soil and water management plan, incorporating an erosion and sediment control plan (ESCP).

During construction, the erosion and sediment controls would include sedimentation basins and associated dirty water catch drains and management of off-site stormwater through and/or around the site via clean water diversion drains. Localised sediment controls, such as sediment fencing and filter strips, would be implemented where runoff from a construction area cannot be reasonably directed towards a sedimentation basin. These locations are likely to include in-stream work such as the construction of watercourse crossings and culverts.

The construction erosion and sediment controls, including sedimentation basins, will be planned, designed and constructed in accordance with the *Managing Urban Stormwater, Soils and Construction, Volume 1 4th Edition, March 2004* (Blue Book) (Landcom 2004) and *Managing Urban Stormwater, Volume 2D – Main road construction* (DECC 2008).

In the EIS design, during construction, about 16 sedimentation basins (with a total catchment area of about 36.2 hectares) were proposed to capture sediment laden runoff from construction areas. As described in Section 5.5.11, due to design refinements, during construction there will be still be about 16 sedimentation basins but some would be in new locations (with a total catchment area of about 37.5 hectares) to capture sediment laden runoff from construction areas. The preliminary proposed sedimentation basins are shown in Figure 5-8 and the revised catchment areas and volumes are provided in Table 6-25.

As such, the refined construction phase soil and water management system is consistent with that proposed in the EIS and would minimise the potential impacts to the downstream environment.

Table 6-25 Preliminary proposed construction sedimentation basins

Basin	Catchment area (ha)	Volume (cubic metres)
B7500N	2.3	432
B7600	2.0	348
B8000N	1.7	385
EWB8000S	0.9	204
B8100S	1.9	564
B8150N	1.5	341
B8250N	1.6	363
B8400N	1.8	471
B8700S	6.6	1330
B8800N	5.6	1466
B9300S	2.9	759

Basin	Catchment area (ha)	Volume (cubic metres)
B9600S	4.3	1126
EWB9700S	0.6	178
B10000N	2.5	567
B10100S	0.8	161
B10150S	0.5	101

Soil and water management – operation

As discussed in Section 13.5.2 of the EIS, it was proposed to retain and modify five of the construction sedimentation basins as operational water quality treatment structures to assist with ongoing water quality control during operation of the project.

As described in Section 5.4.3, it is now proposed to retain and modify eight of the construction sedimentation basins as operational water quality treatment structures (Table 6-26 and Figure 5-1). Vegetated swales are also proposed to be constructed along batters. Vegetated swales are proposed where batter grades are suitable (between one and five per cent) and would provide pre-treatment before water entering the operational water quality treatment structures. This pre-treatment would improve the effectiveness of the operational water quality treatment structures.

The proposed treatment measures would receive first flush flows from the road drainage system before discharge to the nearby ephemeral watercourses and would be designed in accordance with the criteria detailed in Section 13.5.2 of the EIS and the supplementary water quality and watercourse assessment (Appendix G).

The refined operational water quality treatment structures would now have a total catchment area of about 29.3 hectares, compared with 24.8 hectares in the EIS design, with all operational areas (excluding existing roads) now treated. As discussed in the preceding sections, these would further assist to reduce potential pollutants from entering the downstream sensitive receiving environments, creek lines and bushland areas immediately surrounding the project, to provide ongoing water quality improvement.

Table 6-26 Proposed operational water quality treatment structures

Treatment structure	Operational catchment area (ha)
B7500N	4.1
B8000N	2.4
B8150N	0.9
B8250N	2.6
B8400N	1.0
B8700S	1.4
B8800N	3.9

Treatment structure	Operational catchment area (ha)
B9600S	1.8
Vegetated swales (not draining to another structure)	11.2

6.8.3 Additional environmental management measures

No additional environmental management measures are required.

6.9 Groundwater

6.9.1 Summary

An assessment of potential groundwater impacts was included in Chapter 14 of the EIS. A technical report, *Newcastle Inner City Bypass – Rankin Park to Jesmond Technical Paper 8 – Groundwater Assessment* (GHD 2016a) was prepared for the project and included in Appendix L of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-27.

As a result, the potential groundwater impacts have been reassessed in Section 6.9.2. The potential change in impacts as a result of the design refinements are relatively minor. As such, this technical paper has not been updated.

Table 6-27 Groundwater assessment review

EIS consideration	Further assessment required?	Yes/No
Groundwater inflow and drawdown	Due to other design refinements, there has been adjustment of the required cut and fill volumes (Section 5.5.3) and as such, the potential groundwater inflow and drawdown impacts have been reviewed.	Yes
Groundwater quality impacts	Due to other design refinements, there has been adjustment of the required cut and fill volumes (Section 5.5.3) and as such, the potential groundwater quality impacts have been reviewed.	Yes
Impacts on groundwater dependent ecosystems	Due to other design refinements, there has been adjustment of the required cut and fill volumes (Section 5.5.3) and as such, the potential groundwater quality impacts have been reviewed.	Yes
Recharge and flow paths	Due to other design refinements, there has been adjustment of the required cut and fill volumes (Section 5.5.3) and as such, the potential groundwater quality impacts have been reviewed.	Yes
Cumulative impacts	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

EIS consideration	Further assessment required?	Yes/No
Assessment against the *NSW Aquifer Interference Policy* (DTI 2012)	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

6.9.2 Assessment

Groundwater inflow and drawdown

In the EIS design, groundwater inflows were predicted in cuts 1 to 4, all of which would intercept the perched groundwater system. Cut 4 has increased from 588,000 cubic metres to 603,000 cubic metres (an increase of 15,000 cubic metres (about 2.6 per cent)). This increase is not expected to significantly change the predicted volume of groundwater inflow into cut 4 or the area of drawdown and is consistent with the assessment carried out in the EIS. As such, no further modelling has been carried out.

Groundwater quality impacts

Consistent with the EIS design, cuttings for the project would intercept the perched groundwater system, which contains isolated minor elevated levels of some analytes. The minor adjustments to cut 4 would not result in any additional groundwater quality impacts other than those identified in the EIS. As such, no further assessment is required.

Impacts on groundwater dependent ecosystems

The project (including the design refinements) would not result in any additional clearing or drawdown impacts to groundwater dependent ecosystems. Consistent with the EIS design, groundwater seepage captured in the cuttings would be returned to the watercourses which support the surrounding intermittent groundwater dependent ecosystems and as such, no additional impacts are expected.

Recharge and flow paths

The perched groundwater system currently naturally seeps into the ephemeral creeks within the bushland area. The construction of fill and hardstand areas could result in a minor localised change to where perched groundwater seeps in these areas.

Relative to the EIS design, fills 1 and 3 have increased and fill 6 has decreased, with an overall increase in fill being about 114,000 cubic metres. These represent minor increases and decreases in the extent of the fills and are not expected to result in noticeable changes to recharge or seepage patterns beyond those described in the EIS. Groundwater seepage would occur at or near the base of the new fill and groundwater inflows would be directed to the existing watercourses via the operational drainage system.

Therefore, consistent with the EIS, it is not expected this change to perched groundwater flow pathways would impact on watercourses or intermittent groundwater dependent ecosystems since the watercourses which currently support these groundwater dependent ecosystems would continue to receive the same seepage and surface flows from the perched aquifer.

6.9.3 Additional environmental management measures

No additional environmental management measures are required.

6.10 Aboriginal heritage

6.10.1 Summary

An assessment of potential impacts to Aboriginal heritage was included in Chapter 15 of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-28. In their submission, OEH identified concerns with the adequacy of the assessment in relation to potential impacts to places of Aboriginal cultural significance, Aboriginal objects and potential archaeological deposits as detailed in Section 3.14.

As a result, the potential Aboriginal heritage impacts have been reassessed in Section 6.10.2. An Aboriginal Cultural Heritage Assessment Report (Kelleher Nightingale Consulting 2018) is provided in Appendix H and summarised in the following section.

Table 6-28 Aboriginal heritage assessment review

EIS consideration	Further assessment required?	Yes/No
Impact avoidance	Following completion of additional Aboriginal heritage investigations the potential for impact avoidance has been updated.	Yes
Impacts on Aboriginal heritage objects and places	Following completion of additional Aboriginal heritage investigations the potential for impact on Aboriginal heritage objects and places has been updated.	Yes
Impacts on Aboriginal heritage cultural places	Following completion of additional Aboriginal heritage investigations the potential for impact on Aboriginal heritage cultural places has been updated.	Yes

6.10.2 Assessment

Assessment methodology

Overview

Following exhibition of the EIS the following additional Aboriginal heritage investigations have been carried out:

- *Newcastle Inner City Bypass – Rankin Park to Jesmond NSW, Aboriginal Archaeological Survey Report - Stage 2 PACHCI* (Kelleher Nightingale Consulting 2017) prepared in accordance with stage 2 of the Roads and Maritime *Procedure for Aboriginal cultural heritage consultation and investigation* (PACHCI) (Roads and Maritime Services 2011a)
- *Newcastle Inner City Bypass – Rankin Park to Jesmond NSW, Aboriginal Cultural Heritage Assessment Report* (Kelleher Nightingale Consulting 2018) prepared in accordance with stage 3 of PACHCI.

The assessments were prepared in accordance with the SEARs and the following guidelines:

- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010a)
- *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC 2005a)

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010b).

Stage 2 survey

The stage 2 survey (Kelleher Nightingale Consulting 2017) included:

- A search of the Aboriginal Heritage Information Management System (AHIMS) and other heritage registers and lists
- Review of previous archaeological investigations relevant to the project including those carried out for the EIS and earlier stages of the project
- Review of the landscape context within which the project is located
- Development of a predictive model
- Field survey with representatives from the Awabakal Local Aboriginal Land Council and Awabakal and Guringai People Native Title Claimants on the 15 February 2017 and 6 March 2017.

Stage 3 test excavations

The stage 3 test excavations (Kelleher Nightingale Consulting 2018) involved archaeological test excavation of sites identified in the stage 2 survey as requiring further investigation. The primary aim of the test excavation was to determine if intact archaeological deposits were present and to assess the nature and extent of these deposits. The test excavations were carried out with representatives of registered Aboriginal parties in August 2017.

Aboriginal cultural heritage consultation

The stage 2 field survey was carried out with representatives from the Awabakal Local Aboriginal Land Council and the Awabakal and Guringai People Native Title Claimants. Comments from Awabakal Local Aboriginal Land Council on the draft stage 2 survey report were received and incorporated into the final report.

Before the start of the stage 3 test excavations, Roads and Maritime consulted with the Aboriginal community in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW 2010b). A total of 17 Aboriginal parties registered to be involved in the project. Roads and Maritime formed an Aboriginal focus group with formal meetings held in June and October 2017.

Representatives of the registered Aboriginal parties participated in the stage 3 test excavations. All registered Aboriginal parties were provided with the draft stage 3 test excavation report for review, with comments included in the final report (*Newcastle Inner City Bypass – Rankin Park to Jesmond NSW, Aboriginal Cultural Heritage Assessment Report* (Kelleher Nightingale Consulting 2018)).

Existing environment

Physical context

The project is located within a landscape with varying levels of natural and human disturbance. The construction of roads, utilities and structures in addition to historic mining, clearance of native vegetation, landscaping and natural process such as erosion had disturbed both subsurface deposits and removed old growth trees.

The local topography is dominated by a ridgeline along which Lookout Road is located which forms the boundary between the catchments of Ironbark Creek and Dark Creek to the north and west and Styx Creek to the east. The southern part of the project is located on steep slopes which gradually reduce and extend through to the central part of the project. The northern portion of the project consists of lower slopes.

Cultural context

The project area and surrounding region are known to have been important to and extensively used by past Aboriginal people. The project is located within the territory of the Awabakal people.

While it is believed the majority of Aboriginal activity near the project would have focused on the Hunter River, freshwater sources, swamps and coastal areas, the Newcastle region remains important to local Aboriginal people, who have maintained their traditional ties to the area through the sharing of knowledge and lore between generations.

The consultation has identified the local area has cultural heritage value (social value) to the local Aboriginal community in general however, no specific places of cultural heritage value were identified.

Aboriginal heritage objects and places

Before the current stage 2 and 3 assessments being carried out for the projects there were no AHIMS registered sites located within the project area. Two sites (axe grinding grooves and associated artefact scatter) were identified about 375 metres to the south-east of the project in Blackbutt Reserve as shown in Figure 6-11.

The stage 2 survey identified four artefact scatters (RP2J AFT 1 to RP2J AFT 4) and two potential archaeological deposits (PADs) (RP2J PAD 1 and RP2J PAD 2) as summarised in Table 6-29 and shown in Figure 6-11. The remainder of the area displayed low archaeological potential due to combinations of topography, geology, erosion, fluvial activity or disturbance from land use practices.

Test excavations of the identified sites within the construction footprint as part of the stage 3 test excavations confirmed four locations of Aboriginal archaeological value containing Aboriginal objects as summarised in Table 6-29. As part of the stage 3 test excavations RP2J PAD 1 and RP2J PAD 2 were subsequently renamed RP2J IF 1 and RP2J IF 2 respectively.

An assessment of significance was also carried out for the identified sites in accordance with the *Australia ICOMOS Burra Charter, 1999* (Australia ICOMOS 1999). The assessment considered the social/cultural, historic, scientific and aesthetic significance of Aboriginal heritage values for each site. The concluding statement of significance is provided in Table 6-29.

Table 6-29 Identified Aboriginal sites

Site	Description and statement of significance
RP2J AFT 1	This artefact scatter is located on an upper south-west facing slope near the head of an unnamed ephemeral creek. The stage 2 survey identified a low density surface artefact scatter comprised of one silcrete flake and two greywacke flakes. This site was not subject to stage 3 test excavation as it is located outside the construction footprint. This site was assessed as having low archaeological potential and significance due to a high level of disturbance and imported gravels.

Site	Description and statement of significance
RP2J AFT 2	This artefact scatter is located on the crest of a west running ridge. The stage 2 survey identified a low density surface artefact scatter comprised of one tuff/mudstone flake fragment and one silcrete flake. This site was not subject to stage 3 test excavation as it is located outside the construction footprint. This site was assessed as having low archaeological potential and significance due to a high level of disturbance and imported gravel/brick fill.
RP2J AFT 3	This artefact scatter is located on an elevated flat area overlooking the junction of two unnamed ephemeral creeks. The stage 2 survey identified a surface artefact scatter comprised of one tuff/mudstone flake and two pieces of a tuff/mudstone flake. The stage 3 test excavation identified a total of 13 artefacts and confirmed an intact archaeological deposit was present. Based on the intactness, representativeness and research potential, this site was assessed as displaying moderate archaeological significance. The cultural significance of the site, as part of the holistic and interconnected landscape was assessed as displaying high cultural significance by Aboriginal stakeholders.
RP2J AFT 4	This artefact scatter is located on a crest and north facing slope of a ridge spur overlooking the junction of Dark Creek and its ephemeral tributaries. The stage 2 survey identified a surface artefact scatter comprised of one silcrete flake fragment and six silcrete and tuff/mudstone flakes and flake fragments. The stage 3 test excavation identified one artefact and the site was heavily disturbed by filling and other activities. As such, it was concluded the source of the artefacts discovered in the stage 2 survey were part of a disturbed archaeological deposit. Based on the intactness, representativeness and research potential, this site was determined to have low archaeological significance. The cultural significance of the site, as part of the holistic and interconnected landscape was assessed as displaying high cultural significance by Aboriginal stakeholders.
RP2J IF 1 (formerly RP2J PAD 1)	This isolated artefact is located on the crest of localised highpoint on a north-west ridgeline. It was initially identified as a potential archaeological deposit (RP2J PAD 1) during the stage 2 survey. The stage 3 test excavation only identified one artefact and concluded while subsurface deposits exist at the site, the low density of artefacts recovered and observed soil profile indicated a low potential for further archaeological information. Based on the intactness, representativeness and research potential, this site was determined to have low archaeological significance. The cultural significance of the site, as part of the holistic and interconnected landscape was assessed as displaying high cultural significance by Aboriginal stakeholders.

Site	Description and statement of significance
RP2J IF 2 (formerly RP2J PAD 2)	This isolated artefact is located on the crest of localised highpoint on a north-west ridgeline. It was initially identified as a potential archaeological deposit (RP2J PAD 2) during the stage 2 survey. The stage 3 test excavation only identified one artefact and concluded while subsurface deposits exist at the site, the low density of artefacts recovered and observed soil profile indicated a low potential for further archaeological information. Based on the intactness, representativeness and research potential, this site was determined to have low archaeological significance. The cultural significance of the site, as part of the holistic and interconnected landscape was assessed as displaying high cultural significance by Aboriginal stakeholders.

Potential impacts

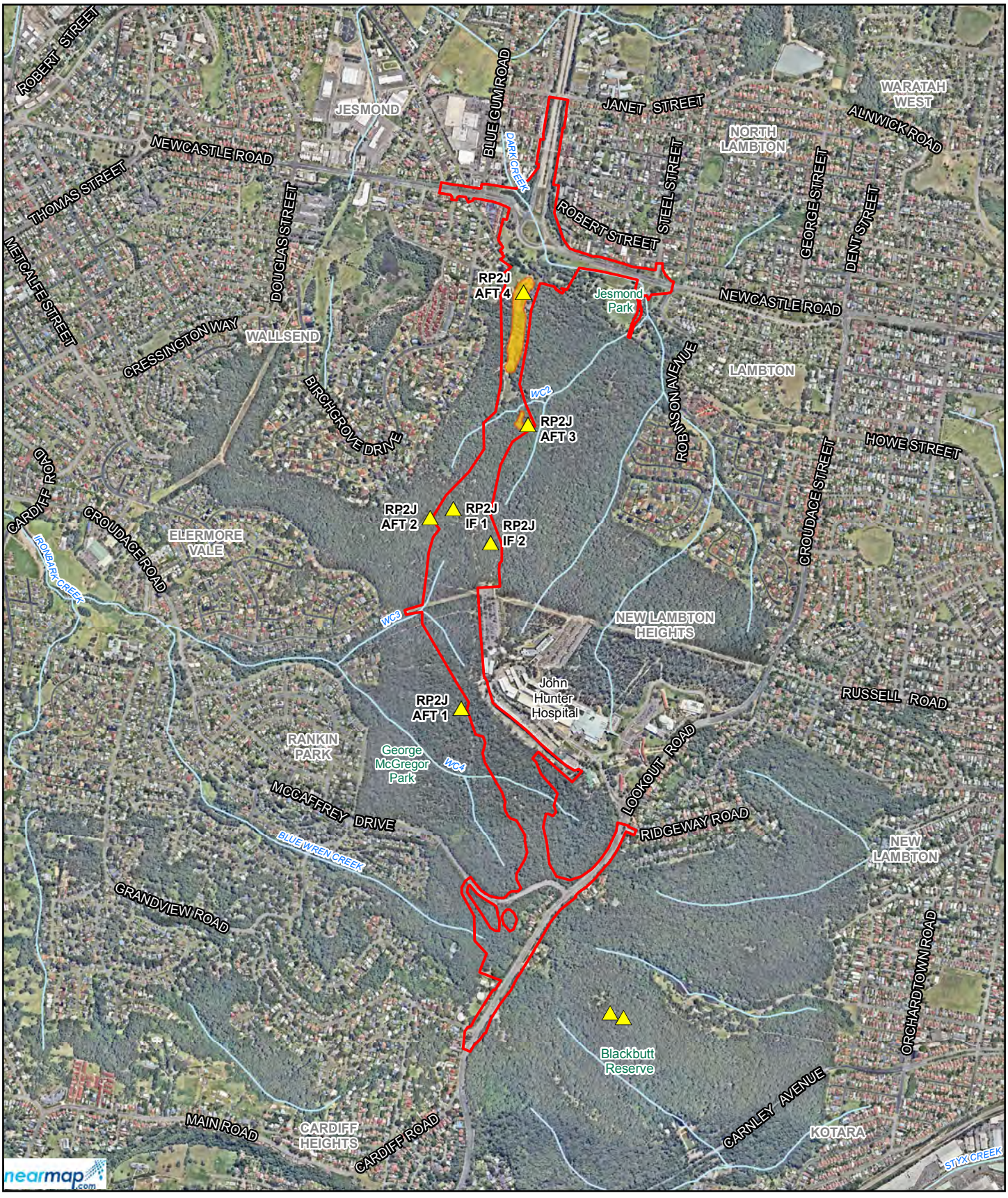
Impact avoidance

The construction footprint has been minimised as far as practical in order to avoid and minimise impacts to the environment and community while achieving the project objectives for delivery of the fifth stage of the Newcastle Inner City Bypass. Two of the identified sites (RP2J AFT 1 and RP2J AFT 2) are located outside the construction footprint and impacts would be avoided. The remaining four sites (RP2J AFT 3, RP2J AFT 4, RP2J IF 1 and RP2J IF 2) are located within the construction footprint and direct impact to these sites cannot be avoided.

Impacts on Aboriginal heritage objects, places and cultural values

Four of the identified sites (RP2J AFT 3, RP2J AFT 4, RP2J IF 1 and RP2J IF 2) are located within the construction footprint for the project and as a result, would be directly impacted. Site RP2J AFT 3 was assessed as having moderate archaeological significance, while the remaining three sites were assessed as having low archaeological significance. All of these sites have been assessed as having high cultural significance by Aboriginal stakeholders.

The scientific value of the sites is directly related to the physical information (eg artefacts) contained within the sites which can be mitigated with a collection and/or salvage program. While, the cultural significance of the sites to the Aboriginal community cannot be offset, it can be mitigated through a collection and/or salvage program including the collection and safekeeping of salvaged artefacts in a protected conservation area (or as consulted with the Aboriginal community). This approach has been discussed with and recommended by the Aboriginal community.



LEGEND

- Aboriginal heritage site
- Aboriginal heritage area
- Watercourse
- Construction footprint

Paper Size A4

0 70 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

Rankin Park to Jesmond

Figure 6-11
Indentified Aboriginal sites

G:\22\17656\GIS\Maps\Deliverables\SubmissionsReport\2217656_CH06_SR025_AboriginalHeritage_0.mxd
Data source: Nearmap: Aerial Imagery, 20160331; Aurecon: Study areat, 2016; AHIMS: Aboriginal Heritage Data, 2014; LPI: DTDB, 2012.

6.10.3 Additional environmental management measures

Additional mitigation measures for the construction and operation of the project are detailed in Table 6-30.

Table 6-30 Additional environmental management measures for Aboriginal heritage impacts

Impact	Environmental management measure	Responsibility	Timing
Avoidance of impacts to known Aboriginal heritage sites	During detailed design, Roads and Maritime will avoid impacts to sites RP2J AFT 1 and RP2J AFT 2. In the event impacts are unavoidable further consultation with Awabakal Local Aboriginal Land Council will be carried out.	Roads and Maritime	Detailed design
Impacts to Aboriginal heritage sites	An Aboriginal heritage management plan will be prepared to manage potential direct project impacts to Aboriginal heritage. The plan will include management recommendations contained in the *Newcastle Inner City Bypass – Rankin Park to Jesmond NSW, Aboriginal Cultural Heritage Assessment Report* (Kelleher Nightingale Consulting 2018). The plan will include: • As part of the site induction, all workers will be advised of their obligations in relation to heritage under the *National Parks and Wildlife Act 1974* • Procedures for management of unexpected finds.	Construction contractor	Pre-construction
Impact to known Aboriginal heritage site (RP2J AFT 3)	Roads and Maritime will carry out sub-surface archaeological salvage of site RP2J AFT 3 before construction starts in the affected area. The salvage will be carried out in accordance with the methodology contained in the *Aboriginal Cultural Heritage Assessment Report* (Kelleher Nightingale Consulting 2018) and in consultation with the Aboriginal community.	Roads and Maritime	Pre-construction

Impact	Environmental management measure	Responsibility	Timing
Impact to known Aboriginal heritage sites (RP2J AFT 3, RP2J AFT 4, RP2J IF 1 and RP2J IF 2)	Roads and Maritime will carry out surface archaeological collection of the identified sites in the construction footprint before construction starts in the affected area. The collection will be carried out in accordance with the methodology contained in the *Aboriginal Cultural Heritage Assessment Report* (Kelleher Nightingale Consulting 2018) and in consultation with the Aboriginal community.	Roads and Maritime	Pre-construction

6.11 Air quality

6.11.1 Summary

An assessment of potential impacts to air quality was included in Chapter 17 of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-31.

As a result, the potential air quality impacts have been reassessed in Section 6.11.2.

Table 6-31 Air quality assessment review

EIS consideration	Further assessment required?	Yes/No
Construction air emissions	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No
Operational air emissions	Due to the refined design for the hospital interchange (Section 5.4.1) there would be a minor redistribution in traffic on nearby roads as discussed in Section 6.3. As a result the potential operational air quality impacts have been reviewed.	Yes

6.11.2 Assessment

Operational air emissions

The EIS (Section 17.3.2) included predictions of air pollutant concentrations from roads using the Roads and Maritime *Tool for Roadside Air Quality* (TRAQ) software. TRAQ is consistent with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (Approved Methods) (DEC 2005b) and provides a 'first-pass' screening assessment for carbon monoxide (CO), oxides of nitrogen (NO_x) and particulate matter less than 10 microns (PM_{10}).

When compared to the criteria specified in the Approved Methods, the modelling carried out for the EIS indicated air pollutant levels from the project (at distances greater than 10 metres from the road edge) are below the criteria and there would be reductions for roads along the existing route if the project is constructed.

Due to the refined design for the hospital interchange (Section 5.4.1) there would be a minor redistribution of traffic as described in Section 6.3.

These changes are relatively minor and would not result in noticeable changes to the modelling carried out for the EIS and as such, no further modelling has been carried out.

Consistent with the EIS, there is likely to be an overall reduction in the total volume of air pollutants emitted into the regional airshed, due to the improved traffic conditions of the project compared to the existing road network without the project.

Due to these minor changes, the predicted impacts are consistent with those identified in the EIS.

6.11.3 Additional environmental management measures

No additional environmental management measures are required.

6.12 Resource use and waste management

6.12.1 Summary

An assessment of potential resource use and waste management impacts was included in Chapter 18 of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-32.

As a result, the potential resource use and waste management impacts have been reviewed in Section 6.12.2.

Table 6-32 Resource use and waste management assessment review

EIS consideration	Further assessment required?	Yes/No
Resource use	The proposed design refinements include minor adjustments to the materials required to construct the project (Section 5.5.12) and as such, the resource use requirements have been updated.	Yes
	There are no expected changes to potential impacts associated with operation of the project beyond those identified in the EIS and as such, these are not considered in this report.	No

EIS consideration	Further assessment required?	Yes/No
Waste generation	The proposed design refinements include minor adjustments to the volume of earthworks (Sections 5.5.3 and 5.5.10). As such, the potential waste generation has been updated. All other waste streams are consistent with those assessed in the EIS and are not considered in this report.	Yes
	There are no expected changes to potential impacts associated with operation of the project beyond those identified in the EIS and as such, these are not considered in this report.	No

6.12.2 Assessment

Construction – resource use

As discussed in Section 18.4.1 of the EIS, construction of the project would require a range of materials to be transported to and within the construction footprint and compound/stockpile areas. Due to the proposed design refinements there has been minor adjustments to the estimated usage of concrete, asphalt and water during construction of the project (Section 5.5.12) as follows:

- Construction of the project would require about 13,000 cubic metres of concrete (12,000 cubic metres in the EIS)
- Construction of the project would require about 57,000 tonnes of asphalt (55,000 tonnes in the EIS)
- Construction of the project would require about 40 mega litres of water (non-potable and potable) (39 mega litres in the EIS)

Consistent with the EIS, these construction materials would be sourced from local suppliers or on-site batching plants (for concrete and asphalt) and the local Hunter Water Corporation potable water network.

Due to these minor changes, the predicted impacts are consistent with those identified in the EIS.

Construction – waste generation

As discussed in Section 18.4.2 of the EIS, construction of the project would generate a number of waste streams, which if incorrectly managed could result in potential impacts to land and water.

As a result of the proposed design refinements there would be changes in the earthwork (cut and fill) volumes required to construct the project (Sections 5.5.3 and 5.5.10). This would indicatively generate about 82,000 cubic metres of surplus material from cuts (177,000 cubic metres in the EIS), of which about 40,700 cubic metres (no change from the EIS) of surplus material which is unsuitable for use in fill, may have to be disposed off-site.

As discussed in Section 5.5.10, there is potential that as the detailed design is developed grade lines will be adjusted to further balance the cut and fill requirements. Where a surplus of cut materials still occurs this material could be used in a number of ways through the project, such as to flatten batters or to provide visual screening.

Due to these minor changes, the predicted impacts are consistent with those identified in the EIS.

6.12.3 Additional environmental management measures

No additional environmental management measures are required.

6.13 Greenhouse gas and climate change

6.13.1 Summary

An assessment of potential greenhouse gas and climate change impacts was included in Chapter 20 of the EIS.

A review of the issues considered in the EIS was carried out to identify where additional assessment was required as a result of the proposed design refinements and submissions as detailed in Table 6-33.

As a result, the potential greenhouse gas and climate change impacts have been reviewed in Section 6.13.2.

Table 6-33 Greenhouse gas and climate change assessment review

EIS consideration	Further assessment required?	Yes/No
Greenhouse gas emissions	The proposed design refinements include minor adjustments to the volume of earthworks (Sections 5.5.3 and 5.5.10) and the materials required to construct the project (Section 5.5.12). These have the potential to impact on greenhouse gas emissions and these have been reviewed.	Yes
Climate change	The potential impacts are consistent with the impacts outlined in the EIS and as such, no further assessment is required.	No

6.13.2 Assessment

The EIS (Section 20.3.1) included predictions of greenhouse gas generation during construction and operation of the project using the VicRoads *Greenhouse Gas Assessment Calculator for Road Projects* Version 0.1.111215 (Carbon Gauge). Carbon Gauge is consistent with greenhouse gas reporting principles and guidelines and considers scope 1, 2 and 3 emissions for carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, hydro fluorocarbons and perfluorocarbons. The resulting aggregated emissions are referred to in terms of tonnes of carbon-dioxide equivalent emissions (tCO_2-e).

The assessment identified the combined estimated scope 1 and scope 3 greenhouse gas emissions for the construction of the project are about 50,000 tCO_2-e and for the operation and maintenance of the project are about 250 tCO_2-e per annum.

The proposed design refinements are unlikely to result in any noticeable changes to the predicted construction or operation greenhouse gas emissions and as such, no further modelling has been carried out.

Consistent with the EIS, the predicted greenhouse gas emissions from the construction and operation of the project would likely to be offset by a reduction in fuel consumption and greenhouse gas emissions from vehicles using the project compared with the existing route. This is primarily because of increased vehicle efficiency along the bypass. Vehicle emissions from the project are estimated to provide a saving of about 10,000 tCO2-e per annum as compared to vehicles using the existing route.

Due to these minor changes, the predicted impacts are consistent with those identified in the EIS.

6.13.3 Additional environmental management measures

No additional environmental management measures are required.

7 Revised environmental management measures

The EIS for the project identified a range of environmental outcomes and management measures which would be required to avoid or reduce the environmental impacts.

After consideration of the issues raised in the submissions, the environmental management measures for the project (Chapter 22 of the EIS) have been revised. Should the project be approved, the environmental management measures in Table 7-1 will guide the subsequent phases of the project. Additional and/or modified environmental management measures to those presented in the EIS are in *blue italics*. Deleted measures, or parts of measures, appear as ~~strikethrough text~~.

Table 7-1 Summary of revised environmental management measures

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Biodiversity				
General	BD01	A flora and fauna management plan will be prepared as part of the Construction Environmental Management Plan (CEMP) for the project. The flora and fauna management plan will be prepared and implemented in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA *2011a* ~~2011b~~).	Construction contractor	Pre-construction
	BD02	All workers will be provided with an environmental induction before starting work on-site. This would include information on the ecological values of the site and study area and measures to be implemented to protect biodiversity.	Construction contractor	Construction
Clearing of native vegetation	BD03	The Biodiversity Offsets Strategy will be finalised, in accordance with the *NSW Biodiversity Offsets Policy for Major Projects* (OEH 2014b) as part of detailed design and required offsets secured.	Roads and Maritime	Pre-construction/ construction
Impacts to threatened flora and fauna species	BD04	Vegetation clearing will be carried out in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 4: Clearing of vegetation and removal of bushrock)* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
	BD05	Pre-clearance surveys will be carried out in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 1: Pre-clearing process)* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	BD06	Any unexpected threatened species finds will be dealt with in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
	BD07	Exclusion zones will be identified and demarcated in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 2: Exclusion zones)* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
Impacts to native vegetation	BD08	Clearing of native vegetation and mature trees, particularly hollow-bearing trees, will be avoided and minimised where possible around watercourses, in Jesmond Park, near proposed fauna crossing structures and those identified as known or likely to be used for breeding and roosting by Powerful Owl (*Ninox strenua*). ~~This is to assist with rehabilitation and habitat connectivity.~~	Roads and Maritime and Construction contractor	Detailed design and construction
	BD09	Roads and Maritime will investigate opportunities to retain trees in construction compound A to provide an arboreal crossing for Squirrel Gliders and other arboreal fauna between vegetation to the east and west of the alignment.	Roads and Maritime	Detailed design
	BD10	The location of trees to be retained in the construction footprint would be confirmed during detailed design and incorporated in the flora and fauna management plan, landscape plan and re-vegetation management plan.	Roads and Maritime *and Construction contractor*	Detailed design *and pre-construction*

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	BD11	Native vegetation will be re-established in accordance with a re-vegetation management plan prepared in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Guide 3: Re-establishment of native vegetation) (RTA *2011a* ~~2011b~~). The re-vegetation management plan will use suitable species from the indigenous vegetation communities present at the site to replace habitat for threatened species including Grey-headed Flying-fox.	Construction contractor	Construction
Potential for spread of exotic species, or spread of pathogens	BD12	Protocols for preventing or minimising the spread of noxious and environmental weeds will be developed and implemented in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 6: Weed Management)* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
	BD13	Protocols for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be developed and implemented in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 7: Pathogen Management)* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
Impacts to fauna and fauna habitat	BD14	Fauna handling will be conducted in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 9: Fauna handling)* (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
	BD15	Habitat will be replaced or re-instated in accordance with Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 5: Reuse of woody debris and bushrock* and *Guide 8: Nest boxes)* (RTA *2011a* ~~2011b~~).	Construction Contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	BD16	Clearing of hollow-bearing trees will be carried out during periods which avoid breeding and hibernation seasons for threatened hollow-dependant fauna species (particularly the Powerful Owl (*Ninox strenua*) and Squirrel Glider (*Petaurus norfolcensis*)) where practicable.	Construction Contractor	Construction
	BD17	All permanent lighting will be designed to minimise light spill to surrounding habitat as far as practicable.	Roads and Maritime	Detailed design
	BD18	Down-lights and motion sensor lighting will be used where possible during construction in order to reduce light spill to surrounding habitat.	Construction contractor	Construction
Fragmentation of identified biodiversity links and habitat corridors	BD19	The fauna connectivity strategy will be finalised during detailed design to minimise impacts to fauna movement, in particular the Squirrel Glider.	Roads and Maritime	Detailed design
	BD20	Connectivity measures will be implemented in accordance with the Wildlife Connectivity Guidelines for Road Projects (Roads and Maritime, in preparation).	Construction contractor	Construction
Aquatic habitat impacts	BD21	Aquatic habitat will be protected in accordance with Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (Guide 10: Aquatic habitats and riparian zones)* (RTA *2011a* ~~2011b~~), standard precautions and mitigation measures of the *Policy and guidelines for fish habitat conservation and management Update 2013* (Department of Primary Industries 2013) and with reference to DPI Water *Guidelines for Controlled Activities on Waterfront Land*.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	BD22	The realignment of the northern branch of watercourse 2 will be designed to behave in a similar hydrologic and geomorphic manner as existing conditions and encourage native revegetation.	Roads and Maritime	Detailed design
	BD23	Native vegetation will be re-established around the realignment of the northern branch of watercourse 2 in accordance with a re-vegetation management plan prepared in accordance with the Roads and Maritime *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (Guide 3: Re-establishment of native vegetation) (RTA *2011a* ~~2011b~~).	Construction contractor	Construction
~~Groundwater dependent ecosystems~~	~~BD24~~	~~Minimise potential impacts to groundwater dependent ecosystems by implementation of management measures in accordance with the groundwater assessment (Chapter 14 of the EIS).~~	~~Construction contractor~~	~~Construction~~
Impacts to native vegetation	*BD24*	*Roads and Maritime will carry out further consultation with Newcastle City Council during detailed design regarding construction compounds D and E which are located in Jesmond Park to consider management measures required to minimise potential impacts to the area.*	*Roads and Maritime*	*Detailed design*
Traffic and transport				
Construction traffic impacts	TT01	Roads and Maritime will carry out further consultation with NSW Health Infrastructure, Hunter New England Local Health District and Ronald McDonald House during detailed design to minimise potential impacts associated with use of the hospital road network for construction access.	Roads and Maritime	Detailed design
Property access impacts	TT02	During detailed design, Roads and Maritime will carry out consultation with affected landowners about changes to property access.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Fire trail impact	TT03	Consultation with relevant fire authorities will be carried out during the detailed design phase regarding the construction of additional fire trails.	Roads and Maritime	Detailed design
Public transport impacts	TT04	Roads and Maritime will carry out consultation with bus service providers during detailed design to manage potential impacts to bus operations and identify need for temporary and/or permanent relocation of bus stops.	Roads and Maritime	Detailed design
Parking impacts	TT05	Roads and Maritime will carry out consultation with Newcastle City Council to determine if replacement disabled parking spaces are required in the dedicated carpark in Jesmond Park.	Roads and Maritime	Detailed design
Impacts on access in the bushland area	TT06	During detailed design, Roads and Maritime will investigate the feasibility of an additional pedestrian access point across the proposed road corridor in the bushland area in consultation with nearby landowners, in order to provide improved connectivity between the John Hunter Hospital precinct and residential areas to the west.	Roads and Maritime	Detailed design
Construction traffic impacts	TT07	A construction traffic management plan (CTMP), including a vehicle movement plan, will be prepared in accordance with: • Roads and Maritime *QA Specification G10* (Roads and Maritime *2015c* ~~2015d~~) • Roads and Maritime's *Traffic Control at Work Sites* (Roads and Traffic Authority 2010) • Relevant Australian Standards such as *Australian Standard (AS) 1742 – Manual of Uniform Traffic Control Devices* (Standards Australia *2014a* ~~2014~~).	Construction contractor	Pre-construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	TT08	The *CTMP* ~~plan~~ will be developed in consultation with, as relevant, Newcastle City Council, NSW Health Infrastructure, Hunter New England Local Health District and emergency service providers. The plan will specify all requirements related to construction traffic and transport including: • Details of heavy haulage routes • Traffic control plans for work area including access to the site. This will include details of site specific traffic control measures (including signage) to manage traffic movements • Road safety audit requirements • Requirements for condition surveys of roads before the start of construction • Parking arrangements for construction staff • Access arrangements at construction sites detailing vehicle access movements • Notification requirements for changes to the existing road network • Notification requirements for changes to property access, bus stops and pedestrian/cyclist facilities.	Construction contractor	Pre-construction
	TT09	The contractor would ~~be required to~~ obtain any ~~required~~ licences and permits, such as a road occupancy licence, which would be required for any work or traffic controls in a public road.	Construction contractor	Pre-construction *and construction*

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Property access impacts	*TT10*	*In order to minimise access impacts, in consultation with residents the construction contractor will:* • *Provide vehicle access as far as practical/safe to enable residents, visitors and patrons to park inside the affected property* • *Where vehicle access is not available, pedestrian access would be provided where practical/safe* • *Where pedestrian access is unavailable for safety reasons, pedestrians can be escorted through the construction site by pre-arrangement with the construction contractor.*	*Construction contractor*	*Construction*
Jesmond Park shared path impacts	*TT11*	*In order to minimise the impacts to users of the Jesmond Park shared path during construction Roads and Maritime will:* • *Construct the new shared path bridge (Bridge 7) over Newcastle Road and associated connections as early work* • *Provide pedestrian and cyclist access across the construction footprint on the southern side of Newcastle Road for limited periods of time where safe and practical to do so* • *Construct the new overpass bridge (Bridge 8) and underpass arrangement for the Jesmond Park shared path as soon as practicable.*	*Construction contractor*	*Construction*
Noise and vibration				
Operational noise impacts	NV01	Roads and Maritime will review and update the operational noise model during detailed design to determine the final mitigation scenario. Where required this will include consultation with affected sensitive receivers.	Roads and Maritime	Detailed design
	NV02	Roads and Maritime will investigate opportunities for implementation of the final mitigation scenario prior to, or as soon as possible during construction, to assist with mitigation of construction noise levels.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	NV03	Roads and Maritime will carry out further review of the sensitive non-residential receivers, including those in the John Hunter Hospital precinct, where it has been identified that the internal criteria may be exceeded. This review, including assessment of building materials and monitoring (if required), will determine the transmission loss through the relevant building facades and identify if mitigation is required.	Roads and Maritime	Detailed design
	NV04	Roads and Maritime will investigate opportunities to further refine grades where possible and assess the need for installation of signage to limit use of compression brakes by heavy vehicles.	Roads and Maritime	Detailed design
Vibration impacts (sensitive equipment)	NV05	Consultation with NSW Health and Hunter New England Local Health District will be carried out to identify the specific construction vibration limits for all sensitive equipment and facilities in the hospital precinct. Appropriate buffer distances will then be established.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Construction noise and vibration management	NV06	A construction noise and vibration management plan (CNVMP) will be prepared as part of the construction environmental management plan (CEMP). The plan will include, but not be limited to: • A map indicating the locations of receivers • A risk assessment to determine potential risk for activities likely to affect receivers (for activities carried out during standard construction hours, during the proposed extended construction hours and outside of the proposed extended construction hours) • Management measures to avoid noise and vibration impacts during construction activities including identification of appropriate work practices and equipment selection and use • A process for community notifications regarding construction activities • A process for scheduling of high noise and/or vibration generating activities during less sensitive noise periods as far as is possible • A process for implementation of respite periods, where required, in accordance with *Interim Construction Noise Guideline* (DECC 2009) for noise and vibration generating activities with impulsive, tonal or low frequency characteristics • A process for assessing the performance of the implemented management measures • A process for documenting and resolving issues and complaints • A program of noise and vibration monitoring for sensitive receivers • A process for updating the plan when activities affecting construction noise and vibration change. Identify in inductions and where required toolbox talks where noise and vibration management is required.	Construction contractor	Pre-construction and construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	NV07	An out of hours work procedure (for work outside the proposed extended construction hours) will be developed and would include the following: • Contact the local community potentially affected by the proposed work and inform them by letter of the proposed work, location, type of work, days and dates of work and hours involved. The contact will be made before the start of work • A suitable advertisement will be placed in local papers including a reference to night-time noise impacts • A 24-hour community liaison phone number and permanent site contact will be provided so that complaints can be received and addressed in a timely manner • Measures to investigate and respond to any valid noise complaints.	Construction contractor	Pre-construction and construction
Construction vibration impacts	NV08	Building condition surveys will be conducted at receivers (as required) within 18 metres of proposed vibration generating activities (buildings and other structures).	Construction contractor	Pre-construction
	NV09	Notification of the proposed construction activities by letterbox drop will be carried out for all occupied buildings within 18 metres of vibration generating activities.	Construction contractor	Pre-construction and construction
	NV10	Where construction work will be located within 18 metres of any buildings vibration monitoring will be carried out at the beginning of the given construction activity. Where measurements indicate building damage criteria are exceeded, vibration generating activities are to immediately halt and alternative low-vibration work practices will be investigated and implemented.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	NV11	A documented review will be carried out to determine if alternative methods can be implemented, where construction activity involving vibration intensive plant occurs: • Within 18 metres of buildings • Within the sensitive equipment buffer distances • Or if any monitoring indicates levels are excessive.	Construction contractor	Pre-construction and construction
Construction vibration impacts - John Hunter Hospital precinct	NV12	Construction buffer distances and potential additional mitigation measures identified during detailed design will be implemented in relation to sensitive equipment, standard buildings and heritage buildings in the John Hunter Hospital precinct.	Construction contractor	Construction
Construction noise impacts	NV13	Where practical, equipment will be selected to minimise noise emissions. Equipment will be fitted with appropriate silencers and be in good working order. Machines found to produce excessive noise compared to normal industry expectations will be removed from the site or stood down until repairs or modifications can be made.	Construction contractor	Construction
	NV14	Where reasonable and feasible, measures will be taken to shield sensitive receivers from noise such as: • The layout of the construction compound so that primary noise sources are at a maximum distance from residences, with solid structures (sheds, containers, etc.) placed between residences and noise sources (and as close to the noise sources as is practical). • Enclosures to shield fixed noise sources such as pumps, compressors, fans, screens (where practicable). • Taking advantage of site topography when situating plant.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Construction noise and vibration complaints handling	NV15	In the event of a valid noise complaint, monitoring will be carried out and reported as soon as possible. If exceedances are detected, the situation will be reviewed to attempt to identify reduce the impact to acceptable levels, where practicable.	Construction contractor	Construction
Blasting overpressure and ground vibration impacts	NV16	If blasting is to be carried out, a detailed blasting assessment will be carried out in consultation with NSW Health Infrastructure and Hunter New England Local Health District. The assessment will be prepared with reference to the human comfort, sensitive equipment and structural damage criteria for all receivers including residential receivers and receivers located in the John Hunter Hospital precinct. The assessment will be carried out by a suitably qualified and experienced blast consultant/contractor and determine the allowable blast sizes based on-site specific conditions and may include carrying out test blasts (or equivalent method). The assessment will identify all relevant requirements to be incorporated into a blasting management plan for the construction phase to ensure the relevant criteria can be met.	Roads and Maritime/ Construction contractor	Detailed design, pre-construction and construction
Operational noise impacts	NV17	To confirm the findings of the operational noise assessment a post-construction noise monitoring program (including simultaneous traffic counts) will be carried out within 12 months of project opening once traffic flows have stabilised. Monitoring locations will be selected along the project at/near the monitoring locations carried out in this assessment. A review of L_{Amax} events including heavy vehicle engine (compression) braking will be included in the post-construction noise assessment.	Roads and Maritime	Operation

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Landscape character and visual impact				
Landscape and visual impacts	LC01	The concept urban design and landscape plans will be finalised during detailed design and be consistent with the urban design objectives and principles. The plans will be developed in accordance with: • *Beyond the Pavement* (Roads and Maritime 2014a) • *Bridge Aesthetics* (Roads and Maritime 2012a) • *Landscape Guideline* (Roads and Traffic Authority *2008* ~~2008b~~) • *Noise Wall Design Guideline* (Roads and Maritime *2016b* ~~2016d~~). The landscape plan will be consistent with the re-vegetation management plan (~~Chapter 7~~ *management measure BD11*) and will use suitable species from the indigenous vegetation communities present at the site to replace habitat for threatened species including Grey-headed Flying-fox. The landscape plan will include vegetation screening for highly impacted viewpoints where possible.	Roads and Maritime	Detailed design
Impacts on access in the bushland area	LC02	During detailed design, Roads and Maritime will investigate the feasibility of an additional pedestrian access point across the proposed road corridor in the bushland area in consultation with nearby landowners, in order to provide improved connectivity between the John Hunter Hospital precinct and residential areas to the west.	Roads and Maritime	Detailed design
Water sensitive urban design	LC03	Temporary and permanent drainage infrastructure would be designed to incorporate water sensitive urban design principles where possible such as replacing concrete lined longitudinal catch drains with vegetated swales and the operational water quality control measures.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Visual impacts	*LC04*	*Roads and Maritime will review feasible and reasonable measures to address privacy concerns for residents located immediately near the southbound off-ramp at the northern interchange in consultation with the affected property owners.*	*Roads and Maritime*	*Detailed design*
Construction visual impacts	~~LC04~~ *LC05*	Disturbed areas would be progressively revegetated during the construction period.	Construction contractor	Construction
	~~LC05~~ *LC06*	Construction lighting will be located to minimise potential impacts to surrounding residents.	Construction contractor	Construction
Monitoring of landscaping and rehabilitation	~~LC06~~ *LC07*	Landscape and rehabilitation work will be monitored and remedial measures implemented where required until vegetation has stabilised.	Roads and Maritime	Operation
Socio-economic, land use and property				
Community consultation	SL01	The draft Community Consultation Framework will be finalised during detailed design and will be implemented during construction to provide timely and transparent information about changes to access, traffic conditions, details of the construction program and general construction progress during the construction phase.	Roads and Maritime	Detailed design and construction
Property acquisition	SL02	Property acquisition will be carried out in accordance with the *Land Acquisition Information Guide* (Roads and Maritime 2014b) and the *Land Acquisition (Just Terms Compensation) Act 1991.*	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Residual public land	SL03	Areas of potentially residual public land would be confirmed during the detailed design phase and where there is residual Roads and Maritime land not required for the project or other future road requirements, consultation with Newcastle City Council and other government agencies will be carried out to identify possible land swaps or transfers.	Roads and Maritime	Detailed design
Fire trail impact	SL04	Consultation with relevant fire authorities will be carried out during the detailed design phase regarding the construction of additional fire trails.	Roads and Maritime	Detailed design
Impacts to Disc Golf course at Jesmond Park	SL05	Roads and Maritime will carry out consultation with the Newcastle Disc Golf club and the Newcastle City Council regarding potential relocation of the impacted Disc Golf course holes.	Roads and Maritime	Detailed design
Impacts on local businesses	SL06	Roads and Maritime will consult with local businesses that would be affected by the project.	Roads and Maritime	Detailed design
Impacts on access in the bushland area	SL07	During detailed design, Roads and Maritime will investigate the feasibility of an additional pedestrian access point across the proposed road corridor in the bushland area in consultation with nearby landowners, in order to provide improved connectivity between the John Hunter Hospital precinct and residential areas to the west.	Roads and Maritime	Detailed design
	SL08	During detailed design, Roads and Maritime will carry out consultation with Newcastle City Council about the feasibility of modifying the Bicentennial walking trail, if required.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Impact to utilities	SL09	Roads and Maritime will co-ordinate work with respective utility providers before any changes to the utility services infrastructure. ~~Where services will be disrupted the affected residents will be consulted before work being carried out.~~	Roads and Maritime	Detailed design ~~and construction~~
Impact to residences	*SL10*	*During detailed design, Roads and Maritime will review the northern interchange layout including opportunities to move the intersection (including the southbound off-ramp) to the south-west further away from residential properties and to refine the layout of the northbound off-ramp further away from residential properties.*	*Roads and Maritime*	*Detailed design*
Impact to utilities	*SL11*	*Where services will be disrupted the affected residents will be consulted before work being carried out.*	*Construction contractor*	*Construction*
Private property access	~~SL10~~ *SL12*	The construction contractor will consult with affected property owners/residents to minimise disruption to access. Where access to property would be disrupted for an extended period, alternative access will be provided. Pedestrian and emergency vehicle access to properties will be maintained at all times.	Construction contractor	Construction
Pedestrian and cyclist access	~~SL11~~ *SL13*	Pedestrian and cyclist access on existing formal paths will be maintained where possible. Where closure of a formal path is required alternative access and appropriate signage will be provided.	Construction contractor	Construction
Emergency services access	~~SL12~~ *SL14*	During construction emergency vehicle access to the bushland areas surrounding the project will be provided at all times.	Construction contractor	Construction
Flooding and drainage				

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Flooding and stormwater impacts	FD01	The proposed flood mitigation measures and changes to watercourses would be further refined during detailed design to minimise potential impacts.	Roads and Maritime	Detailed design
Flooding impacts	FD02	Roads and Maritime will consult with affected property owners likely to be affected by a change in flood levels including providing details of the predicted actual changes in flood levels in relation to each individual property.	Roads and Maritime	Detailed design
	FD03	Roads and Maritime will consult with the owners of the block of residential units to the north-east of the northern interchange where flood mitigation work will be carried out.	Roads and Maritime	Detailed design
	FD04	Construction staging plans will be refined during detailed design to ensure flood mitigation structures are constructed in a way that minimises flood risk.	Roads and Maritime	Detailed design
Realignment of watercourse 2 (WC2)	FD05	Further refinement of the design for the realignment of WC2 will be investigated during detailed design to ensure it is designed to behave in a similar hydrologic and geomorphic manner as existing conditions as far as is practicable.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Flooding impacts during construction	FD06	The construction environmental management plan will include a flood risk management plan that details the processes for flood preparedness, materials management, weather monitoring, site management and flood incident management. The plan will be developed in accordance with: • *Managing Urban Stormwater, Soils and Construction, Volume 1 4th Edition, March 2004* (Landcom 2004) and *Managing Urban Stormwater, Volume 2D – Main road construction* (DECC 2008) • Roads and Maritime *Erosion and Sedimentation Management Procedure* (Roads and Traffic Authority 2009) • Roads and Maritime *Technical Guideline, Temporary Stormwater Drainage for Road Construction* (Roads and Maritime Services 2011b) • Roads and Maritime *Stockpile Site Management Guideline* (Roads and Maritime Services 2011c).	Construction contractor	Pre-construction
Drainage impacts during construction	FD07	Activities that may affect existing drainage systems will be carried out so that existing hydraulic capacity of these systems is maintained where possible.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Soils, contamination and water quality				
Watercourse erosion	SW01	Roads and Maritime will investigate the following during detailed design: • Watercourse 2 (northern branch) – additional stabilisation measures near the bridge to minimise the risk of the existing gully head located about 200 metres downstream of the bridge from undermining the bridge or creek realignment work • Watercourse 2 (southern branch) – additional stabilisation measures near the culvert outlet to minimise the risk of undermining of the outlet structure by the existing gully head (currently located about 100 metres downstream) • Watercourse 3 and 4 - stabilised flow paths, including scour protection measures, to convey the cross drainage outlet flows to existing drainage lines on the western side of the project • Watercourse 4 – measures such as energy dissipaters to minimise erosion risk in the gully system below the multi-storey hospital carpark • Watercourse 4 – measures to minimise erosion and scour risk downstream of the project associated with concentrated flows from drainage outlets.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Impacts to water quality and soil erosion	SW02	A soil and water management plan will be prepared in accordance with: • Roads and Maritime *Code of Practice for Water Management, Road Development and Management* (RTA 1999) • Roads and Maritime *Erosion and Sedimentation Management Procedure* (RTA 2009) • *Managing Urban Stormwater, Soils and Construction, Volume 1 4th Edition, March 2004* (Landcom 2004) and *Managing Urban Stormwater, Volume 2D – Main road construction* (DECC 2008) • Roads and Maritime *Technical Guideline, Temporary Stormwater Drainage for Road Construction* (Roads and Maritime 2011b) • Roads and Maritime *Stockpile Site Management Guideline* (Roads and Maritime 2011c) • Roads and Maritime *Technical Guideline, Environmental Management of Construction Site Dewatering* (RTA *2011b* ~~2011c~~) • *Management of Tannins from Vegetation Mulch* (Roads and Maritime 2012b) • *Guideline for Batter Surface Stabilisation using vegetation* (Roads and Maritime *2015e* ~~2015f~~).	Construction contractor	Pre-construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Impacts to water quality and soil erosion	SW03	The soil and water management plan will address the following: • Identify areas of high risk based on soil erodibility • Management strategies to be used to minimise surface water impacts, including identification of water treatment measures, discharge points and erosion and sediment control measures • Minimising stormwater (volume and velocity) from running onto downstream work by appropriate staging of the work and, where necessary, utilising erosion control measures • Maximising diversion of clean water around or through disturbed portions of the site • Sedimentation basin construction and management • Measures to monitor and manage spoil, fill and materials • Protection of waterways • Management of tannins that may be generated from stockpiled vegetation • Monitoring of discharge waters • Measures for the management of tannins from stockpiled vegetative materials • Management of stockpiles.	Construction contractor	Pre-construction
Contaminated soil	SW04	Further soil testing would be carried out to delineate the extent of areas of contamination and classify the soils against the relevant criteria for reuse on-site or for disposal off-site.	Construction contractor	Pre-construction and construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Contaminated soil	SW05	A contaminated soil management plan will be prepared in accordance with the *Contaminated Land Management Act 1997,* Roads and Maritime *Guideline for the Management of Contaminated Land* (Roads and Maritime *2013a* ~~2013c~~), Roads and Maritime *Environmental Incident Classification and Reporting Procedure*, (Roads and Maritime *2016c* ~~2016c~~) and EPA Guidelines on contaminated land management. The contaminated soil management plan will include: • Contaminated land legislation and guidelines including any relevant licences and approvals to be obtained • Identification of locations of known or potential contamination • Identification of rehabilitation requirements, classification, transport and disposal requirements of any contaminated soil • Measures to manage excavation, segregation, stockpiling, validation and disposal requirements for potentially contaminated materials • Measures to ensure the contaminated soil is managed so that it does not pose a risk to water quality. Measures to be implemented include ensuring contaminated soils are deep buried and blended where further testing confirms on-site reuse is acceptable, or off-site disposal to a licensed facility where required • Contaminated management measures including unexpected finds procedures for unanticipated discovery of contaminated material or other source of contamination during construction.	Construction contractor	Pre-construction and construction
Soil erosion	SW06	The project will be constructed in accordance with the soil and water management plan.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Accidental spills during construction	SW07	An emergency spill response procedure will be prepared to minimise the impact of spills including details on the requirements for managing, cleaning up and reporting.	Construction contractor	Construction
	SW08	Spill kits and adequate quantities of suitable material to counteract spillage would be kept readily available.	Construction contractor	Construction
	SW09	The refuelling of plant and maintenance of machinery will be carried out in designated refuelling areas. Refuelling would be attended at all times.	Construction contractor	Construction
	SW10	Vehicle wash-downs and/or concrete truck washouts will be located in a designated bunded area or located off-site.	Construction contractor	Construction
	SW11	Machinery will be checked daily to ensure that there are no oil, fuel, or other liquid leaks.	Construction contractor	Construction
Contamination	SW12	In the event that indicators of contamination are encountered during construction of the project (such as odours or visually contaminated materials), work in the area will cease until advice on the need for remediation or other action is obtained from the Roads and Maritime project manager.	Construction contractor	Construction
Water quality impacts	SW13	A soil conservation specialist will be engaged during construction to advise on the planning and implementation of erosion and sedimentation controls.	Construction contractor	Construction
	SW14	Sediment laden water will be directed through the construction phase water management system. All construction sedimentation basins and associated temporary drainage shall be designed and constructed as detailed in this report to manage flows generated by the 80th percentile five day rainfall event.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	SW15	Water quality monitoring will be carried out at key discharge points from the construction phase water management system. The monitoring requirements will be defined in the soil and water management plan and will include collection of samples for analysis from sedimentation basin discharge points and visual monitoring of other points of release of construction waters.	Construction contractor	Construction
Building demolition impacts	SW16	During demolition the following controls will be implemented: • Scheduling of work to avoid strong winds and rainfall • Mandatory coverage of trucks carrying *waste and* debris • Temporary barriers or dust screens, as appropriate, to suppress the effect of dust movement to uncontrolled sites • Dust suppression such as wetting measures • *Appropriate control* ~~Fencing~~ of temporary stockpiles on hardstands.	Construction contractor	Construction
Water quality impacts	~~SW18~~ *SW17*	~~Roads and Maritime will implement~~ *Construct* the operational water quality controls detailed in this report (subject to further refinement during detailed design) ~~to provide ongoing water quality improvements during operation of the project~~.	~~Roads and Maritime~~ *Construction contractor*	~~Operation~~ *Construction*
Revegetation	~~SW17~~ *SW18*	Proposed re-vegetation of cleared areas will be carried out with consideration of minimising erosion and in accordance with the *Guideline for Batter Surface Stabilisation using vegetation* (Roads and Maritime *2015e* ~~2015f~~).	Construction contractor	Post construction
Water quality impacts	SW19	Where practical stormwater, including road runoff and intercepted groundwater, will be directed towards operational water quality treatment structures that will assist in the removal of pollutants from discharge water.	Roads and Maritime	Operations

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Water quality impacts	SW20	As part of an operational environmental management plan visual inspection of stormwater management system, including the operational water quality treatment structures, will be carried out for a minimum period of 12 months to ensure the stormwater management system is operating as designed.	Roads and Maritime	Operation
Groundwater				
Groundwater inflow	GW01	During detailed design the cuttings will be designed to minimise the volume of groundwater inflow as far as is practicable.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Groundwater monitoring	GW02	A groundwater monitoring program will be prepared and implemented. The program will include: • Installation of monitoring bores (to replace those that would be removed during construction) • New monitoring bores will be installed both in and outside the predicted zones of perched groundwater drawdown to confirm the conceptual model. New bore(s) will be established in the proposed mine remediation area to confirm the depth to groundwater and groundwater quality • New monitoring bores will be installed near where mine remediation work is proposed to confirm the groundwater depth • Establishment of project specific water quality objectives • Bores will initially be monitored monthly for 12 months to collect baseline data. Monitoring will start as soon as possible and before the start of construction and will continue until completion, which may be after start of construction. The frequency of monitoring will then be reviewed to determine the appropriate regime • Bores will be monitored for standing water level and water quality (including pH, total dissolved solids, dissolved metals, nutrients and total recoverable hydrocarbons (silica gel clean-up) • A program of reporting of the monitoring results so that any unforeseen impacts are identified and responded to in a timely manner • The monitoring program will continue until 12 months after completion of construction with an annual review of groundwater data unless results permit an earlier end date.	Roads and Maritime	Detailed design, pre-construction, construction and operation-

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Groundwater discharge	GW03	During detailed design Roads and Maritime will review the monthly groundwater monitoring data to confirm the proposed construction and operational water management controls are appropriate and the project specific water quality objectives can be achieved.	Roads and Maritime	Detailed design
Groundwater dewatering	GW04	A construction groundwater and dewatering management plan will be prepared to manage groundwater inflows during construction.	Construction contractor	Pre-construction and construction
Groundwater quality	GW05	Coal seams exposed by cuttings will be sealed with shotcrete or over-excavated and backfilled with an inert material.	Construction contractor	Construction
Groundwater discharge	GW06	During construction, all groundwater seepage in the cuttings will be handled in the construction phase surface water management system.	Construction contractor	Construction
Groundwater management	GW07	An operational groundwater management plan will be prepared if groundwater monitoring results indicate there are likely to be post-construction groundwater quality discharge exceedances of the project specific water quality objectives.	Roads and Maritime	Operation
Aboriginal heritage				
Avoidance of impacts to known Aboriginal heritage sites	*AH01*	*During detailed design, Roads and Maritime will avoid impacts to sites RP2J AFT 1 and RP2J AFT 2. In the event impacts are unavoidable further consultation with Awabakal Local Aboriginal Land Council will be carried out.*	*Roads and Maritime*	*Detailed design*

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Impacts to Aboriginal heritage sites	*AH02*	*An Aboriginal heritage management plan will be prepared to manage potential direct project impacts to Aboriginal heritage. The plan will include management recommendations contained in the Newcastle Inner City Bypass – Rankin Park to Jesmond NSW, Aboriginal Cultural Heritage Assessment Report (Kelleher Nightingale Consulting 2018). The plan will include:* • *As part of the site induction, all workers will be advised of their obligations in relation to heritage under the National Parks and Wildlife Act 1974* • *Procedures for management of unexpected finds.*	*Construction contractor*	*Pre-construction*
Impact to known Aboriginal heritage site (RP2J AFT 3)	*AH03*	*Roads and Maritime will carry out sub-surface archaeological salvage of site RP2J AFT 3 before construction starts in the affected area. The salvage will be carried out in accordance with the methodology contained in the Aboriginal Cultural Heritage Assessment Report (Kelleher Nightingale Consulting 2018) and in consultation with the Aboriginal community.*	*Roads and Maritime*	*Pre-construction*
Impact to known Aboriginal heritage sites (RP2J AFT 3, RP2J AFT 4, RP2J IF 1 and RP2J IF 2)	*AH04*	*Roads and Maritime will carry out surface archaeological collection of the identified sites in the construction footprint before construction starts in the affected area. The collection will be carried out in accordance with the methodology contained in the Aboriginal Cultural Heritage Assessment Report (Kelleher Nightingale Consulting 2018) and in consultation with the Aboriginal community.*	*Roads and Maritime*	*Pre-construction*
~~Inadvertent impacts on heritage objects or places~~	~~AH01~~	~~As part of the site induction, all workers will be advised of their obligations in relation to heritage under the *National Parks and Wildlife Act 1974* and the guidelines to follow if unanticipated heritage objects, places or PADs are located during construction.~~	~~Construction contractor~~	~~Construction~~

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
~~Aboriginal heritage objects or places encountered during work~~	~~AH02~~	~~If any potential Aboriginal objects (including skeletal remains) and/or places are discovered (or suspected) during the course of the project, all work near the find must cease and the steps outlined in the Roads and Maritime *Standard Management Procedure, Unexpected Heritage Items* (Roads and Maritime 2015g) must be followed.~~	~~Construction contractor~~	~~Construction~~
Non-Aboriginal heritage				
Construction impact on potential heritage item	HH01	Roads and Maritime will consult with DP&E, OEH Heritage Division and the Heritage Council of New South Wales to finalise the salvage program for the Hollywood shanty town site and associated impacted portion of the tramway. The salvage program will include sub-surface archaeological investigations as part of a salvage program, archival recording of any discovered items, further historical research and documentation of the history of the site. The final salvage program will be implemented in accordance with the approved salvage program.	Roads and Maritime	Pre-construction
Potential finds during construction	HH02	Contractors will be given awareness training on non-Aboriginal heritage before carrying out any construction work to ensure understanding of potential heritage items and the procedure in the event of discovery of non-Aboriginal heritage materials, features or deposits, or the discovery of skeletal remains.	Construction Contractor	Pre-construction and construction
Potential finds during construction	HH03	In the event that either non-Aboriginal heritage items or skeletal remains are identified in the course of construction, the procedure detailed in Roads and Maritime *Standard Management Procedure, Unexpected Heritage Items* (Roads and Maritime *2015f* ~~2015g~~) will be followed.	Construction Contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Air quality				
General air quality impacts	AQ01	The Construction Environmental Management Plan will include measures for the management of air emissions including: • Air quality management objectives • Potential sources and impacts of air emissions • Sensitive receivers • Hours of work • Mitigation measures to minimise air quality impacts to sensitive receivers and the environment • Consideration of high winds in dry weather • Suitable buffer zone separation distance from temporary fixed plant to off-site sensitive receivers (eg at least 100 metres for batching plants where possible) • A monitoring program to assess compliance with identified objectives • Contingency plans to be implemented in the event of non-compliances and/or complaints about air quality.	Construction contractor	Pre-construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	AQ02	The following mitigation measures will be used on-site and included as part of the Construction Environmental Management Plan: • Areas of exposed surfaces are to be minimised through construction site planning and programming • Locating stockpiled material as far as possible from sensitive receivers • All stockpiles will be designed, established, operated and decommissioned in accordance with Roads and Maritime *Stockpile Site Management Guideline* (Roads and Maritime, 2011c) • Dust suppression measures, such as the use of water carts or soil binders, will be used on any unsealed surfaces and other exposed areas • Sealed roads at access points will be watered-down regularly to minimise the re-suspension of dust on sealed roads • Imposing work vehicle speed limits and designating specific routes for haulage and access • Construction activities which would generate dust would be avoided or modified during high wind periods where possible • All trucks will be covered when transporting materials to and from the site • All construction equipment will be maintained and operated in accordance with manufacturer specifications.	Construction contractor	Construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Resource use and waste management				
Construction waste	RW01	A resource and waste management plan will be prepared to identify the hierarchy for sourcing and the use of resources and waste management. The plan will adopt the resource management hierarchy principles of the *Waste Avoidance and Resource Recovery Act 2001*, Roads and Maritime Services waste management procedures and Environmental Management System. The plan will include, but not be limited to: • Identification of the waste stream that will be generated during construction • A waste register detailing types of waste collected, amounts, date, time, transportation method and details of disposal • A resource management strategy detailing beneficial reuse options for surplus and/or unsuitable material • A strategy to minimise waste in packaging • Consideration of procurement strategies to minimise unnecessary consumption of materials.	Construction Contractor	Pre-construction and construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Surplus excavation material	RW02	Surplus material that is not able to be used on-site as part of the project would be reused or disposed of in the following order of priority: • Transfer to other nearby Roads and Maritime projects for immediate use • Transfer to an approved Roads and Maritime temporary stockpile site for future use during projects or routine maintenance • Transfer to a Roads and Maritime approved site for reuse on concurrent private/local government project (with appropriate approvals as required) • Disposal at an approved materials recycling or licensed waste disposal facility • As otherwise provided for by the relevant ~~waste~~ legislation *and regulation*.	Construction Contractor	Construction
Existing waste	RW03	Pre-existing waste will be dealt with in accordance with the POEO Act and *Waste Classification Guidelines Part 1: Classifying Waste* (EPA *2014* ~~2014a~~) and either recycled or disposed of at an appropriately licensed facility at the start of construction.	Construction Contractor	Construction
Operational waste	RW04	All operational waste will be managed in accordance with the Roads and Maritime waste management procedures and Environmental Management System.	Roads and Maritime	Operation

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Hazards and risk				
Bushfire risk	HR01	The construction environmental management plan will include a bushfire management plan in accordance with the *Planning for Bush Fire Protection 2006 (Rural Fire Service 2006).* Measures to be implemented to manage bushfire risk include: • Consultation requirements for community notifications in the event of a bushfire • Maintaining equipment in good working order • Ensuring plant and equipment are fitted with appropriate spark arrestors, where practicable • Ensuring site workers are informed of the site rules including designated smoking areas and putting rubbish in designated bins • Obtaining hot work permits and implementing total fire bans as required • Implementing adequate storage and handling requirements for potentially flammable substances in accordance with the relevant guidelines.	Construction contractor	Pre-construction
Consultation with emergency services	HR02	Consultation with emergency services, including the Rural Fire Service and Fire and Rescue NSW to: • Ensure access is maintained during and after construction • To identify hazard reduction burns in the locality of the project.	Construction contractor	Pre-construction and construction
Mine subsidence risk	HR03	Roads and Maritime will obtain approval from *Subsidence Advisory NSW* ~~the Mine Subsidence Board~~ for the project.	Roads and Maritime	Detailed design
	HR04	The risk of mine subsidence will be further investigated during detailed design in consultation with *Subsidence Advisory NSW* ~~the Mine Subsidence Board~~, and the final design of bridges and other structures confirmed.	Roads and Maritime	Detailed design

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
Mine remediation – grouting	HR05	A mine remediation management plan will be prepared to manage potential risks associated with grouting operations. The plan will be prepared with reference to groundwater monitoring data ~~(Chapter 14 of the EIS~~ to determine the risk of grouting impacting on groundwater. The plan will detail measures to manage the risk of escape of grout, including into surface watercourses or groundwater, through natural fractures including: • Consultation • Monitoring • Emergency spill response procedure.	Construction contractor	Construction
Coal seam gas generation	HR06	A coal seam gas management plan will be prepared and implemented to manage risks during construction. The plan will detail the requirements for monitoring before and during construction where excavation would intersect with areas of known coal seam gas or coal seams. It will also include response procedures, including notifying emergency services if required, to ensure the safety of workers and the public.	*Construction contractor* ~~Roads and Maritime~~	Pre-construction and construction
Greenhouse gas and climate change				
Climate change	GH01	The detailed design of the project will take into consideration the potential effect of climate change, including designing drainage to accommodate increased rainfall and severe weather events.	Roads and Maritime	Detailed design
Greenhouse gas emissions	GH02	Vegetation removal will be minimised where practicable.	Construction contractor	Pre-construction
	GH03	The use of alternative fuels and power sources for construction plant and equipment will be investigated and implemented, where appropriate.	Construction contractor	Pre-construction

Environmental issue/impact	ID	Environmental management measures	Responsibility	Timing
	GH04	Recycled materials will be incorporated in the design of pavement and structures where possible.	Construction contractor	Pre-construction
	GH05	The energy efficiency and related carbon emissions will be considered in the selection of vehicle and plant equipment.	Construction contractor	Pre-construction
Cumulative impacts				
Cumulative impacts	CU01	The construction contractor will review environmental impacts before the start of construction and every six months during construction. Any new impacts identified will be addressed appropriately to reduce cumulative effects and reported as part of the construction environmental management plan.	Construction contractor	Construction

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Appendix A

Newspaper advertisement

Appendix B

Biodiversity assessment report

Appendix C

Supplementary traffic and transport assessment

Appendix D

Noise and vibration assessment

Appendix E

Urban design, landscape character and visual impact assessment

Appendix F

Supplementary flooding and drainage assessment

Appendix G

Supplementary water quality and watercourse assessment

Appendix H

Aboriginal heritage assessment

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Customer feedback
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