



M12 Motorway - Central Section Detailed Design

Division 5.2 and EPBC Act Approval
Consistency assessment report

Design and boundary changes between
Cecil Park and east of Badgerys Creek

Transport for NSW | October 2021

Revision	Date	Prepared by	Reviewed by
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Glossary of terms and abbreviations

Term	Meaning
AEP	Annual exceedance probability: the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage.
Afflux	Flood level afflux refers to the increase in flood level due to the proposed design when compared with the existing condition
AHD	Australian height datum
Approval documents	<p>The set of documents that comprise the Division 5.2 Approval:</p> <ul style="list-style-type: none"> • Roads and Maritime Services (2019, October) <i>M12 Motorway, Environmental impact statement</i> (the EIS) • Transport for NSW (2020, October) <i>M12 Motorway, submissions report</i> (the EIS submissions report) • Transport for NSW (2020, October) <i>M12 Motorway, Amendment Report</i> (the amendment report) • Transport for NSW (2020, December) <i>M12 Motorway, Amendment Report submissions report</i> (the AR submissions report) • Transport for NSW (2021, 8 March) <i>The M12 Motorway Amendment Report Submissions Report – Amendment</i>. <p>The documents that comprise the EPBC referral:</p> <ul style="list-style-type: none"> • Submission #3486 – The M12 Motorway Project between the M7 Motorway, Cecil Hills and The Northern Road, Luddenham, NSW • Notification of referral decision and designated proponent - controlled action; date of decision 19 October 2018; ID: 2018-8286.
AR	Amendment report
AR submissions report	Submissions report for the amendment report
AHIMS	Aboriginal Heritage Information Management System
BC Act	<i>Biodiversity Conservation Act 2016</i> (NSW)
CEEC	Critically endangered ecological community
CEMP	Construction environment management plan
CoA	Condition of approval
DAWE	Department of Agriculture, Water and the Environment Former Department of Environment and Energy (DoEE)
DECCW	Department of Environment, Climate Change and Water Now Department of Agriculture, Water and the Environment (DAWE)

Term	Meaning
DGA	Dense graded asphalt
DoEE	Department of the Environment and Energy Now Department of Agriculture, Water and the Environment (DAWE)
DPC (Heritage)	Department of Premier and Cabinet (Heritage) Formerly Office of Environment and Heritage (OEH)
EESG	Environment, Energy and Science Group of the Department of Planning, Industry and Environment Formerly NSW Office of Environment and Heritage
EIS	Environmental impact statement
EPA	Environmental Protection Agency
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth).
EPBC referral	A proponent must refer a proposed action to the Australian Government Minister for the Environment (the Minister) for assessment, if it has, will have, or is likely to have a significant impact on the world heritage values of a declared World Heritage property, or is likely to have a significant impact on the National Heritage values of a National Heritage place.
Exclusion zones	Exclusion zones are areas of environmental importance (eg threatened vegetation or heritage items) that need to be protected. These exclusion zones are defined as no-go areas and are to be protected for the duration of construction in that particular footprint area.
LEP	Local environment plan
NTU	Nephelometric Turbidity Units
Operational footprint	Generally includes the M12 Motorway and additional areas required for operation and maintenance of the project.
PCT	Plant community type
POEO Act	<i>Protection of the Environment Operations Act 1997</i> (NSW)
REMM	Revised environmental management measures
Roads and Maritime	Roads and Maritime Services; now known as Transport for NSW
SEARs	Secretary's environmental assessment requirements
SEPP	State environmental planning policy

Term	Meaning
Submissions report	Submissions report for the EIS
Study area	The term study area is used to describe the locations investigated. The study area varies based on the specific areas of interest targeted for each environmental issue (eg ecology, heritage, noise, visual amenity etc). The study area relevant to particular environmental issues is shown on figures where relevant.
TECs	Threatened ecological communities
Transport	Transport for NSW
The project	M12 Motorway
TSC Act	<i>Threatened Species Conservation Act 1995</i> (NSW) (repealed) but relevant for this assessment due to being saved under the BC Transitional arrangements.
WSPT	Western Sydney Parkland Trust

1. Introduction

1.1 Background

Transport for NSW (Transport) completed an environmental impact statement of the M12 Motorway (the Project EIS) in October 2019. The EIS identified a range of environmental, social and planning issues associated with the construction and operation of the M12 Motorway and proposed measures to mitigate and manage those potential impacts.

The EIS was publicly exhibited in October and November 2019. Following public exhibition, submissions from community members, special interest and business groups and government authorities were received and addressed by Transport in the EIS submissions report, which was published in October 2020.

An amendment report was prepared in accordance with clause 192(3) of the Environmental Planning and Assessment Regulation 2000 (NSW) (EP&A Regulation) to amend the project following further design development since exhibition of the EIS. The amendment report was exhibited for 14 days in October and November 2020. Submissions from community members, special interest and business group and government authorities were received and addressed in the amendment report submissions report (AR submissions report) published in December 2020. Further refinements and clarifications as a result of the development of the detailed design were also addressed in the AR submissions report.

The Minister for Planning and Public Spaces approved the M12 Motorway under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 23 April 2021. The approval incorporated the Minister's conditions of approval.

For the purposes of this consistency assessment, the Approval issued by the NSW Minister for Planning and Public Spaces for the M12 Motorway referred to as the Division 5.2 Approval.

The M12 Motorway was referred to the Australian Government Minister for the Environment and Energy under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) due to significant impact on Matters of National Environmental Significance (MNES), comprising impacts to listed threatened species and communities and was subject to assessment via the Bilateral agreement.

The Australian Government Minister's approval was received on 3 June 2021 subject to a number of conditions being met. For the purposes of this consistency assessment, the approval issued by the Australian Government Minister for the Environment and Energy for the M12 Motorway is referred to as the EPBC Approval.

The project must be carried out in accordance with the Division 5.2 Approval and the following documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement* (the EIS)
- Transport for NSW (2020, October) *M12 Motorway, submissions report* (the EIS submissions report)
- Transport for NSW (2020, October) *M12 Motorway, Amendment Report* (the amendment report)
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report submissions report* (the AR submissions report)
- Transport for NSW (2021, 8 March) *The M12 Motorway Amendment Report Submissions Report – Amendment*.

The EPBC referral is detailed in the following documents and supporting attachments:

- Submission #3486 – The M12 Motorway Project between the M7 Motorway, Cecil Hills and The Northern Road, Luddenham, NSW

- Notification of referral decision and designated proponent - controlled action; date of decision 19 October 2018; ID: 2018-8286.

1.2 Purpose of consistency assessment

The purpose of this consistency assessment is to:

- Describe the proposed changes to the project that have been developed during detailed design relative to the Division 5.2 Approval and the EPBC Approval
- Assess changes to the environmental impacts associated with the detailed design of the project relative to the Division 5.2 Approval and the EPBC Approval
- Determine if the detailed design is consistent with the Division 5.2 Approval or whether further approval is required either for a modification application or a new project
- Determine if the detailed design is consistent with the EPBC Approval. Or whether a variation to the conditions of approval or a new referral is required.

1.3 Project description

The M12 Motorway will start about 30 kilometres west of the Sydney central business district, at its connection with the M7 Motorway at Cecil Hills and end at The Northern Road at Luddenham. This consistency assessment covers the central section (the project) of the M12 Motorway shown within the red area marked in Figure 1-1.



Figure 1-1: M12 central section extents

The central section starts at its western extent just north of the Suez Kemps Creek Resource Recovery Park through to around one kilometre west of the M7 Motorway. The central section traverses through the following suburbs, from west to east:

- Badgerys Creek
- Kemps Creek
- Mount Vernon
- Cecil Hills
- Cecil Park.

Existing roads which are crossed or close to the project include Elizabeth Drive, Clifton Avenue, Salisbury Avenue, Devonshire Road, Range Road, Mamre Road, Duff Road.

The central section is located within greenfield areas of the South West Growth Area and within the Western Sydney Aerotropolis (formerly known as the Western Sydney Priority Growth Area). The Western Sydney Employment Area is located around six kilometres north-north-east of the project.

2. Proposed change

2.1 Description of proposed change

The project (SSI-9364) has been approved under Division 5.2 of the EP&A Act. It is also a controlled action under the EPBC Act and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID: 2018/8286).

The project as described in the Division 5.2 Approval and the EPBC Approval is detailed in Chapter 5 of the EIS, amended in Chapter 3 and 4 of the amendment report and Chapter 5 of the AR submissions report. The project as described in the EPBC Approval (ID: 2018-8286) referral document is detailed in Chapter 1 of the referral document #3486.

The principle changes to the approved project in the detailed design of the M12 central section are listed below and an overview is shown in Figure 2-1:

- Main M12 carriageway – amendments include minor changes to the vertical and horizontal alignment and refinement to drainage and utility infrastructure; changes to the locations of emergency crossovers, bays and signage to reduce the space between them and improve motorway safety.
- South Creek Bridge (BR06) - the length of the bridge has been reduced to 12 x 33 metres spans with an overall bridge length of 396 metres. The refined bridge structure includes a design where bridge piers are positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 9 of the eastbound carriageway and Pier 10 of the westbound carriageway have been positioned at the edge of the creek and not within the low flow portion.
- Clifton Avenue – the vertical alignment of the bridge (BR07) and intersection has been lowered. The intersection design has been refined with additional drainage, reduced length of associated access road and provision of an emergency access point and maintenance track to the motorway carriageway.
- Kemps Creek Bridge (BR08) - The length of the bridge has been reduced to 5 x 30 metres spans, with an overall bridge length of 150 metres. The refined bridge structure includes a design where bridge piers are positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 3 on both carriageways is located within the creek, although the piers are positioned towards the creek bank and not within the low flow portion.
- Elizabeth Drive – minor changes to the alignment of Elizabeth Drive to avoid the location of the piers of the M12 Elizabeth Drive over bridge (BR09) and accommodate the installation of safety barriers. This also results in the relocation of eastbound bus stop (Stop ID 217193). The bus stop is to be moved by 200 metres west of its current position.
- Range Road Bridge (BR10) – the bridge structure has been reduced from a three span to a single span and no longer includes a maintenance track. This would result in additional earthworks and no longer provides spill through abutment, associated earthworks and maintenance track.
- Water Tower Access Road and bridge (BR11) – The road and bridge have been moved around 25 metres to the east to increase the distance between the bridge and the neighbouring TransGrid 330kV exclusion zone. This bridge and road have been widened to include lanes 0.5 metres wider, a 3.0 metre wide shared path and shoulders. This has widened the overall bridge and access road from 6.0 metres to around 16 metres.
- Changes to permanent land acquisition to accommodate minor changes to design such as extended drainage infrastructure and changes to reflect the updated deposited plans lodged with NSW Land Registry Services showing land boundary and subdivision information.

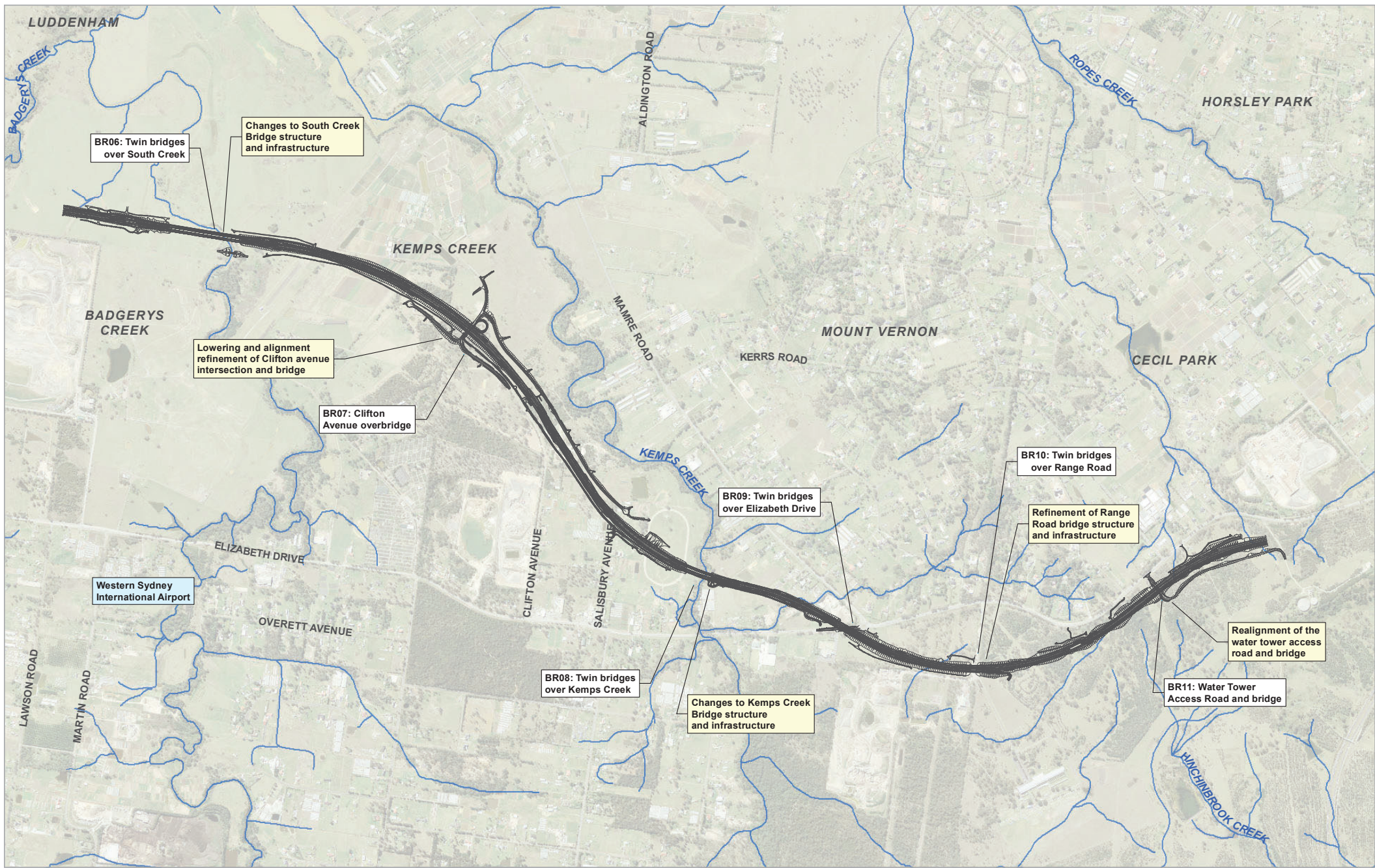
During construction the following changes are proposed:

- Construction compound AF14 identified in the AR submissions report has been removed as it is not available for use
- Minor changes to the construction footprint to accommodate construction of drainage structures and maintenance tracks
- Minor changes to the construction footprint to reflect the updated deposited plans lodged with NSW Land Registry Services showing land boundary and subdivision information
- Refinement of temporary drainage basins and associated infrastructure
- Other minor changes to construction works associated with the detailed design listed above, such as refinement of earthworks.

The need for the proposed changes is provided in Section 2.2.

The proposed changes to the construction footprint and construction activities are shown on Figure 2-2. The proposed changes to the operational footprint and key features of the detailed design are shown on Figure 2-3. These figures compare the exhibited project from the AR submissions report to the detailed design. The proposed changes are generally consistent with the project as described in the Division 5.2 Approval and EPBC approval.

The property adjustment plans for the project were considered as part of the consistency assessment. The project has minor impacts to a number of private properties outside of the project area. These impacts relate to property fences and driveways which require minor adjustments to tie-in with the project. The locations for property adjustment are shown on Figure 2-3. The property adjustments are not considered changes to the project but were reviewed to ensure consistency with the approval documents.



LEGEND
 — M12 Road Design (28/07/2021)
 — Watercourse

Paper Size ISO A3
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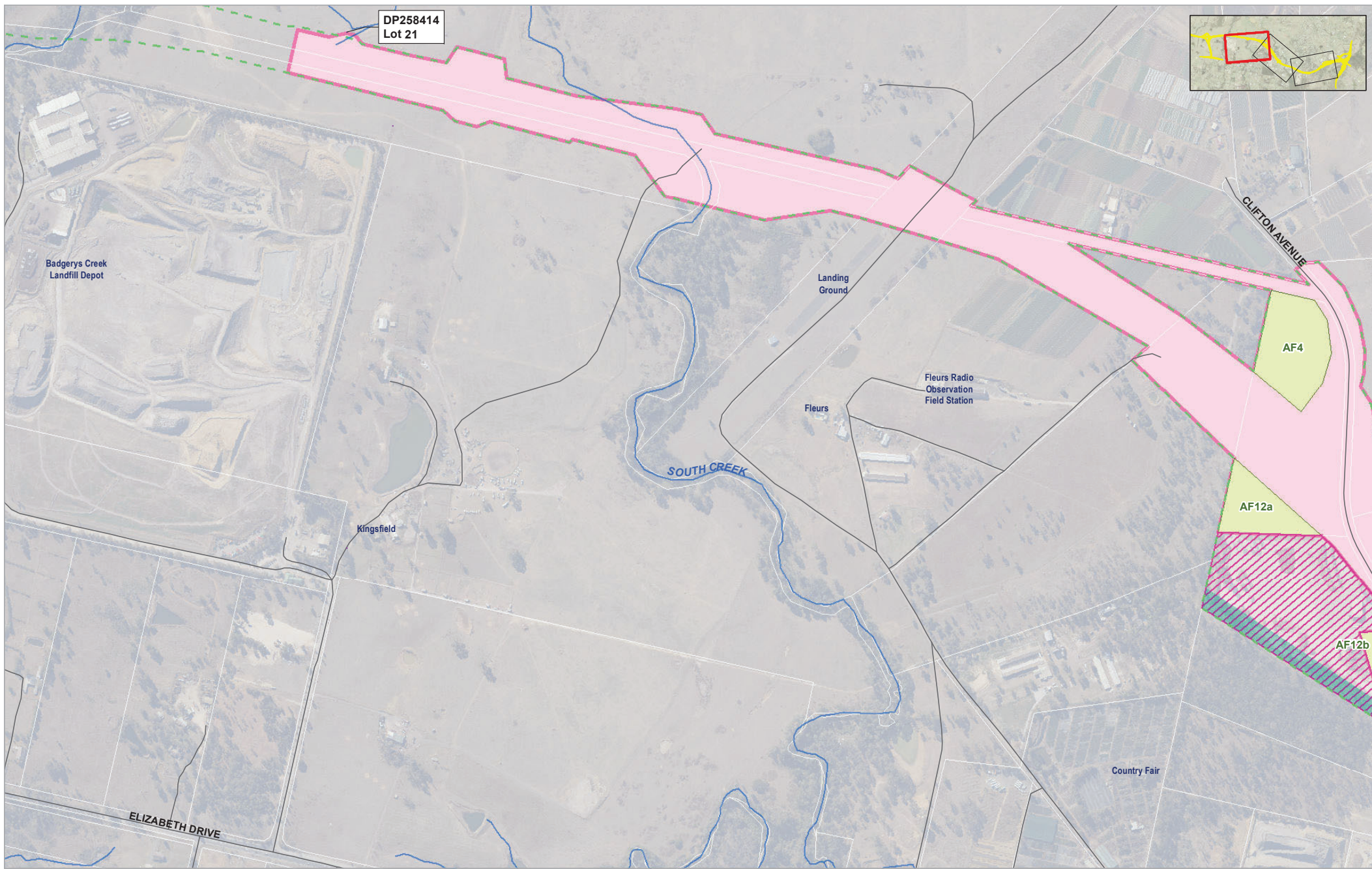
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Overview to proposed design changes
 to the M12 Central Section

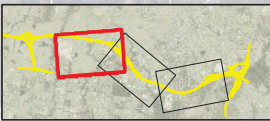
FIGURE 2-1

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- LEGEND**
- Amendment Report Submissions Report Boundary (December 2020)
 - 100% detailed design construction footprint (August 2021)
 - Latest assessed ancillary facilities as per the Amendment Report Submissions Report, including GHD amendments (August 2021)

- Exclusion zones (100% detailed design, July 2021)
- Exclusions zones (Amendment Report Submissions Report, December 2020)
- Cadastre
- Roads
- Watercourse

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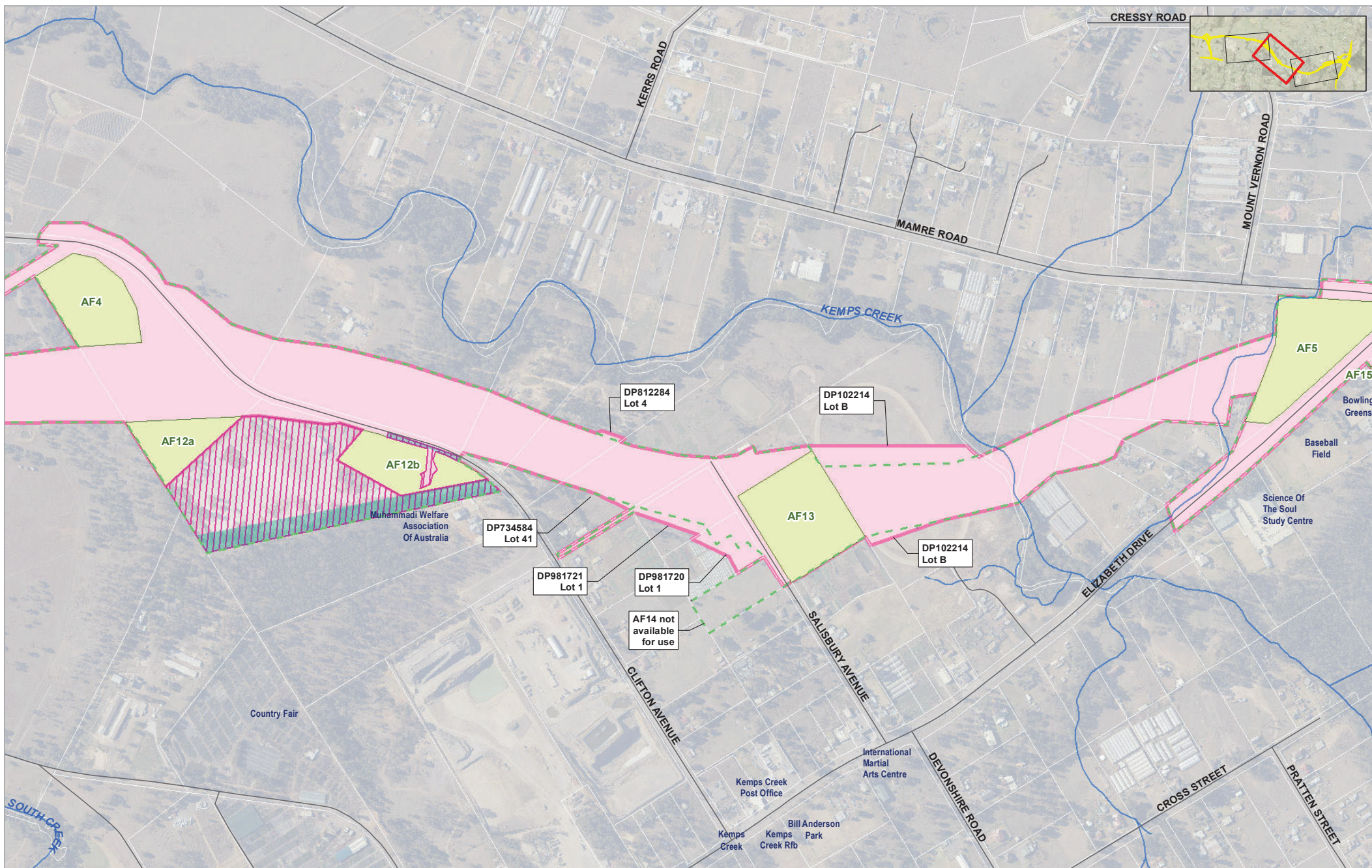
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Consistency Assessment
**Comparison of the amendment report
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and refined construction boundary**

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FIGURE 2-2-1

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- Cadastral
- Roads
- Watercourse

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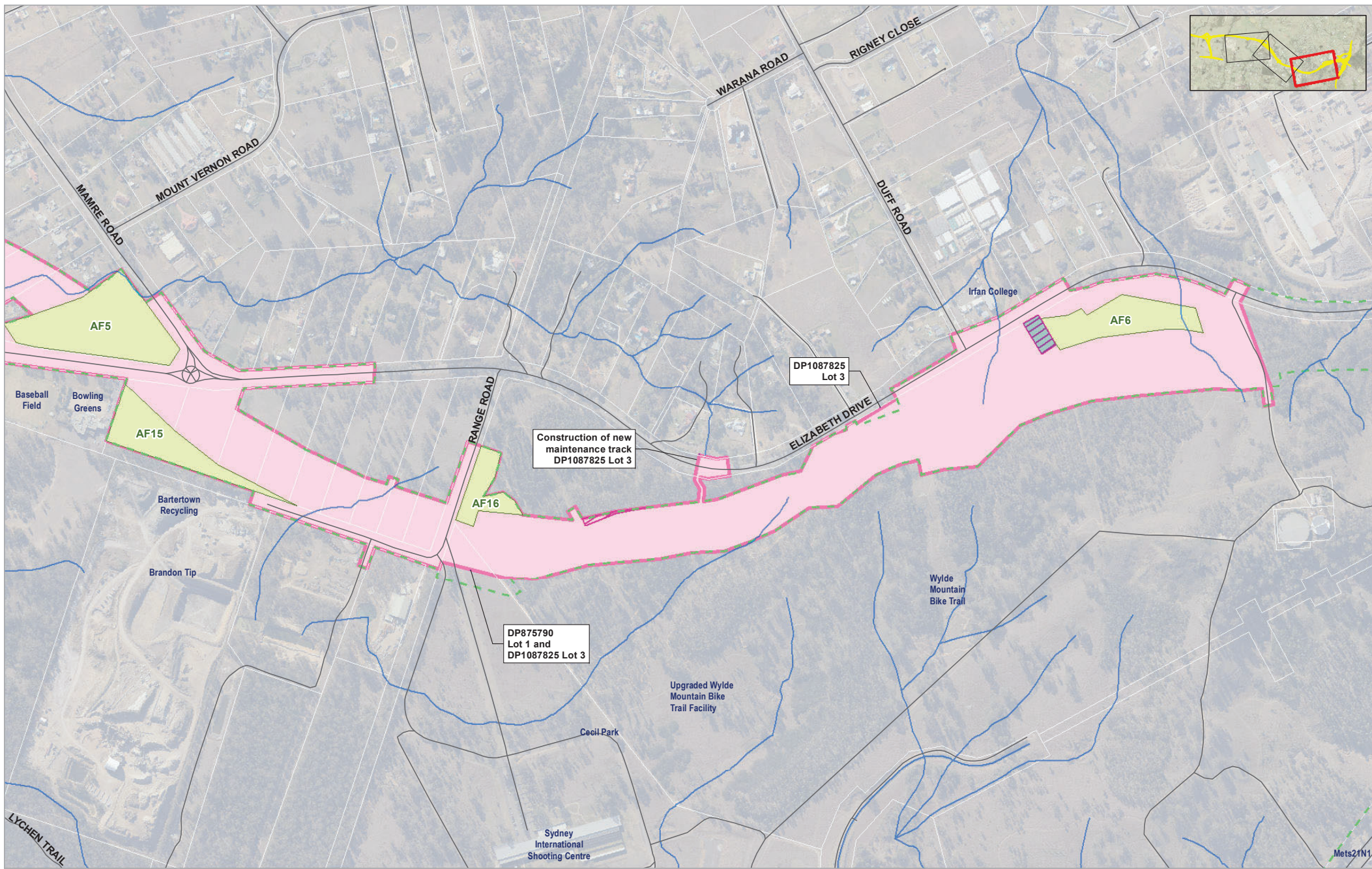
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**Comparison of the amendment report
submissions report construction boundary
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FIGURE 2-2-2

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- Exclusion zones (Amendment Report Submissions Report, December 2020)
- Cadastral

- Roads
- Watercourse

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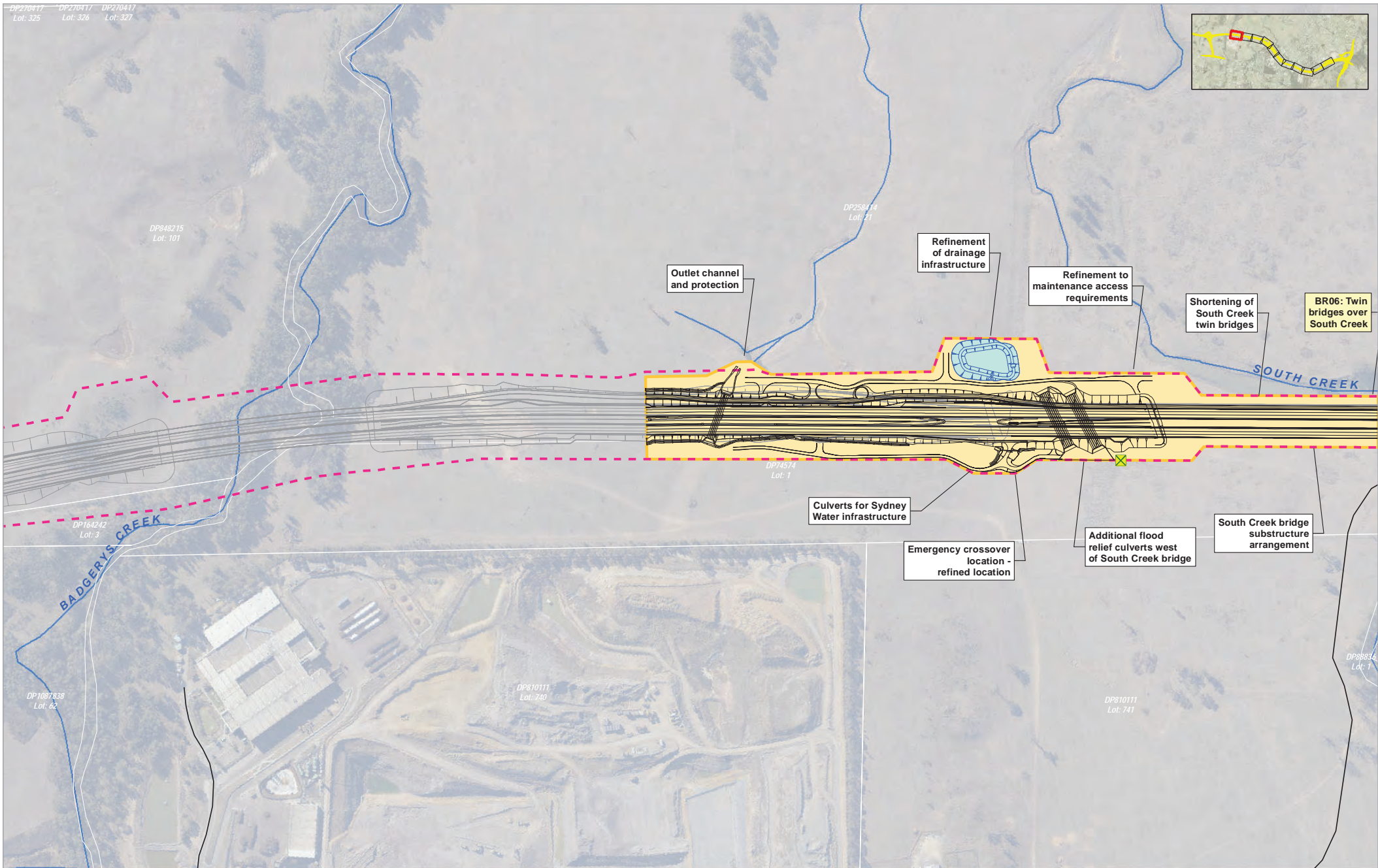
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**Comparison of the amendment report
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FIGURE 2-2-3

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- LEGEND**
- 100% detailed design operational footprint (August 2021)
 - 100% operational basins (July 2021)
 - Amendment Report Submissions Report - operational footprint (December 2020)
 - Cadastre
 - Variable message sign (VMS will be within operational footprint - indicative location only)

- Approved project (Amendment Report Submissions Report Dec 2020)
- Amended design (GHD July 2021)
- Roads
- Watercourse

Paper Size ISO A3
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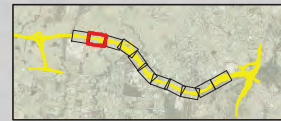
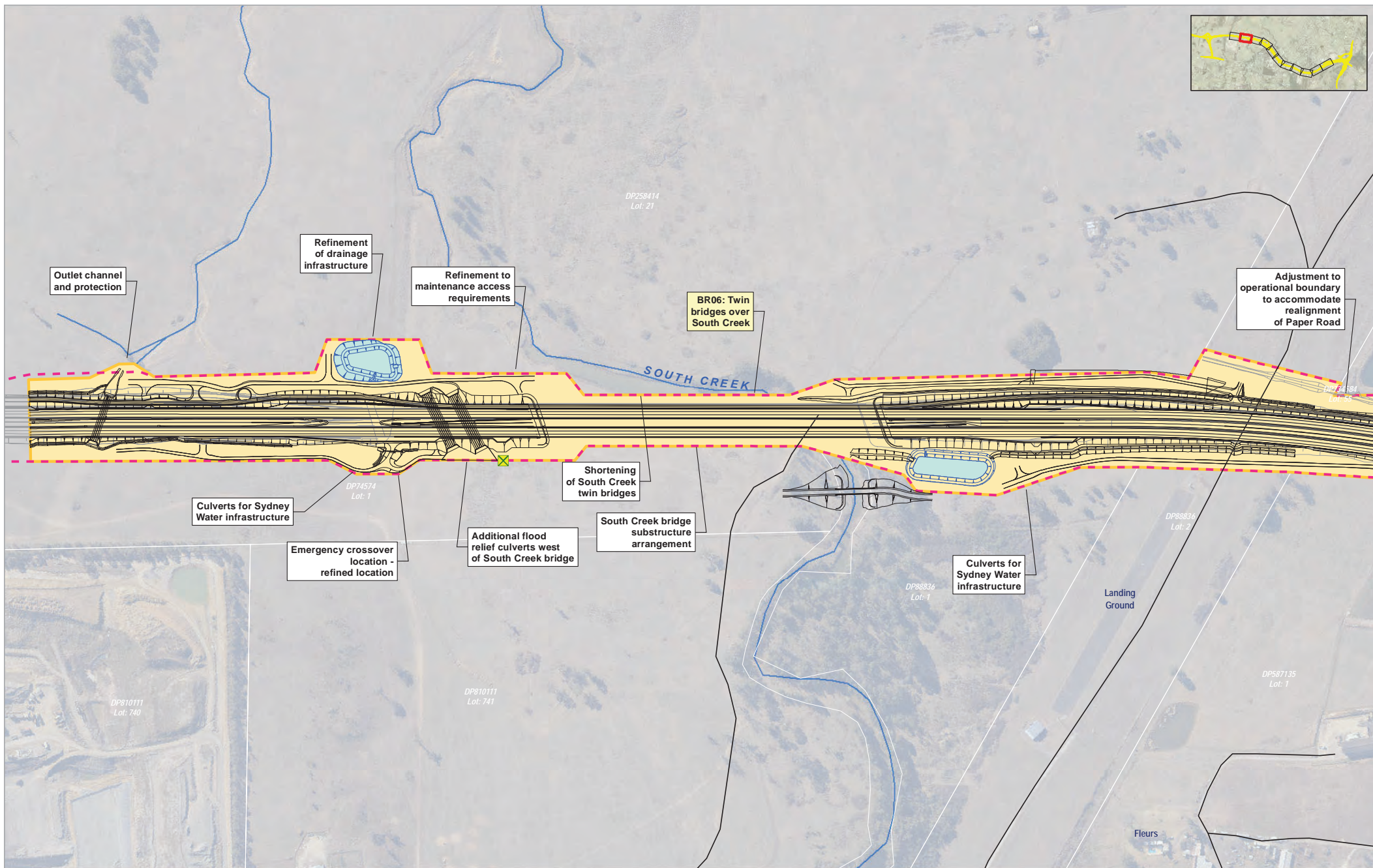
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**Comparison of the amendment report
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FIGURE 2-3-1

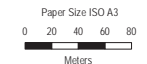
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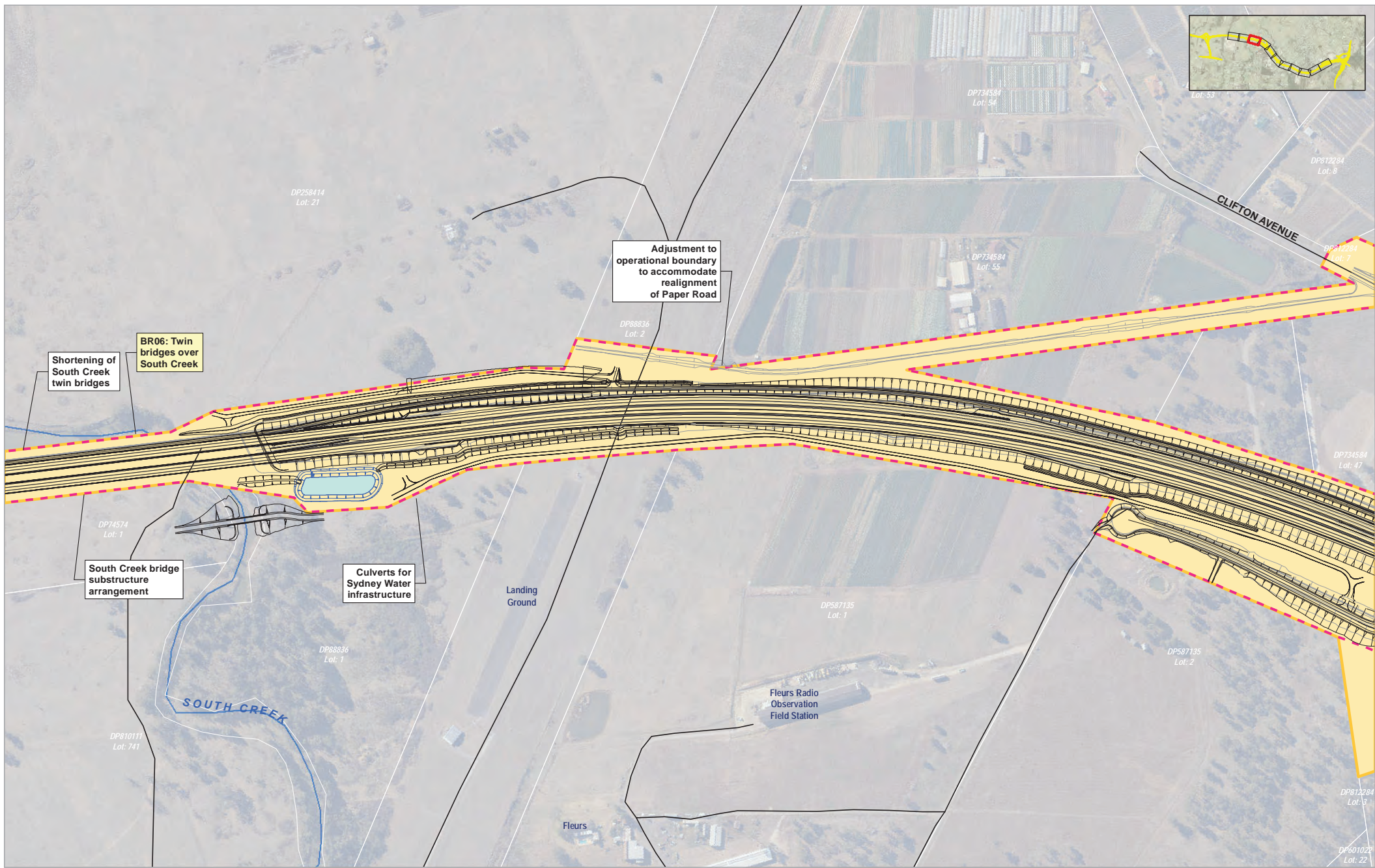
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FIGURE 2-3-2

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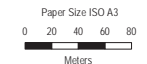
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LEGEND

- 100% detailed design operational footprint (August 2021)
 - 100% operational basins (July 2021)
 - Amended Report Submissions Report - operational footprint (December 2020)
- Cadastral

- Approved project (Amendment Report Submissions Report Dec 2020)
- Amended design (GHD July 2021)
- Roads
- Watercourse



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



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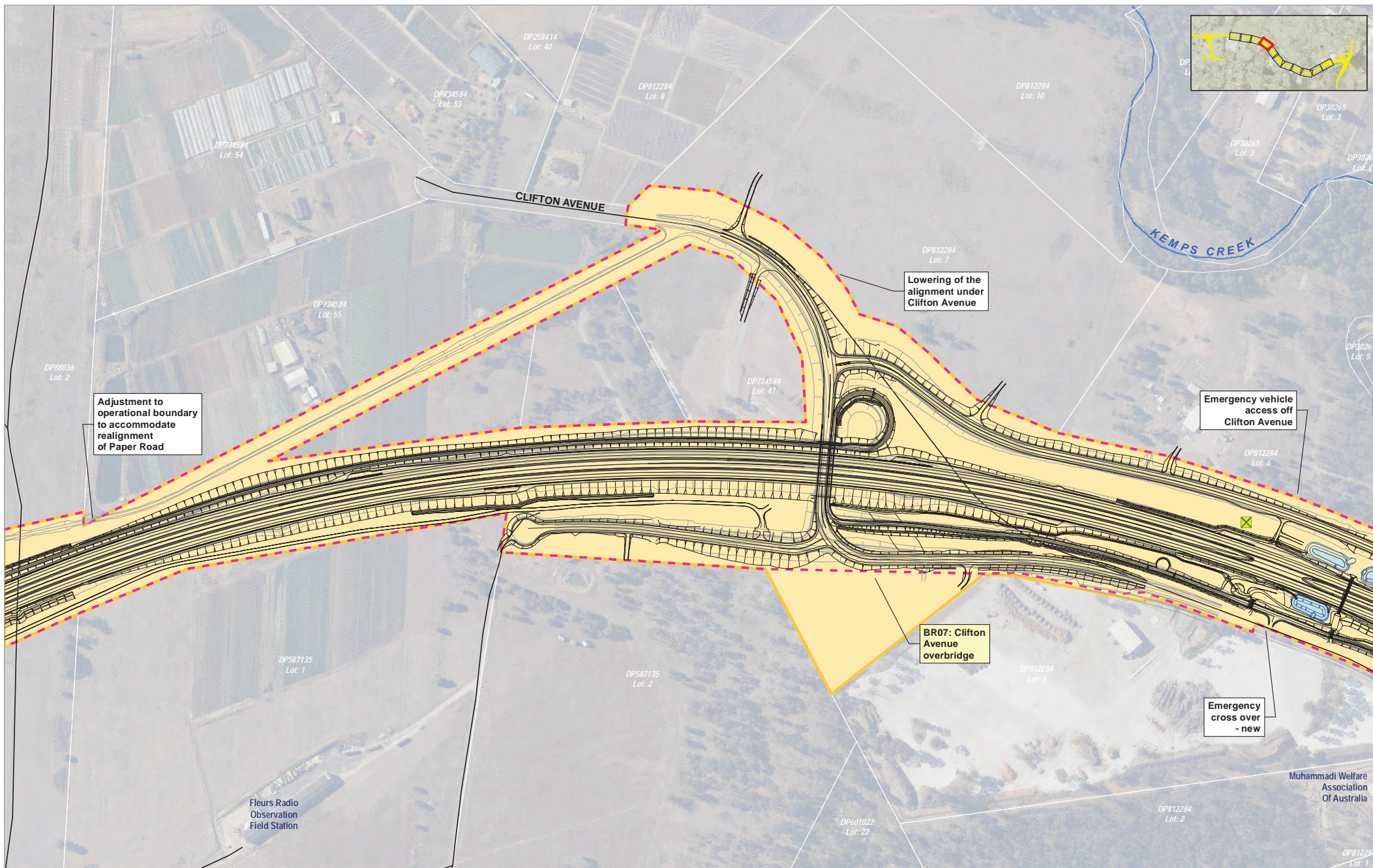
**Comparison of the amendment report
submissions report operational boundary
and refined operational project**

Project No. 21-12514239
Revision No. -
Date 13/10/2021

FIGURE 2-3-3

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- Cadastre
- Variable message sign (VMS will be within operational footprint - indicative location only)

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- Watercourse

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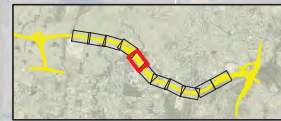
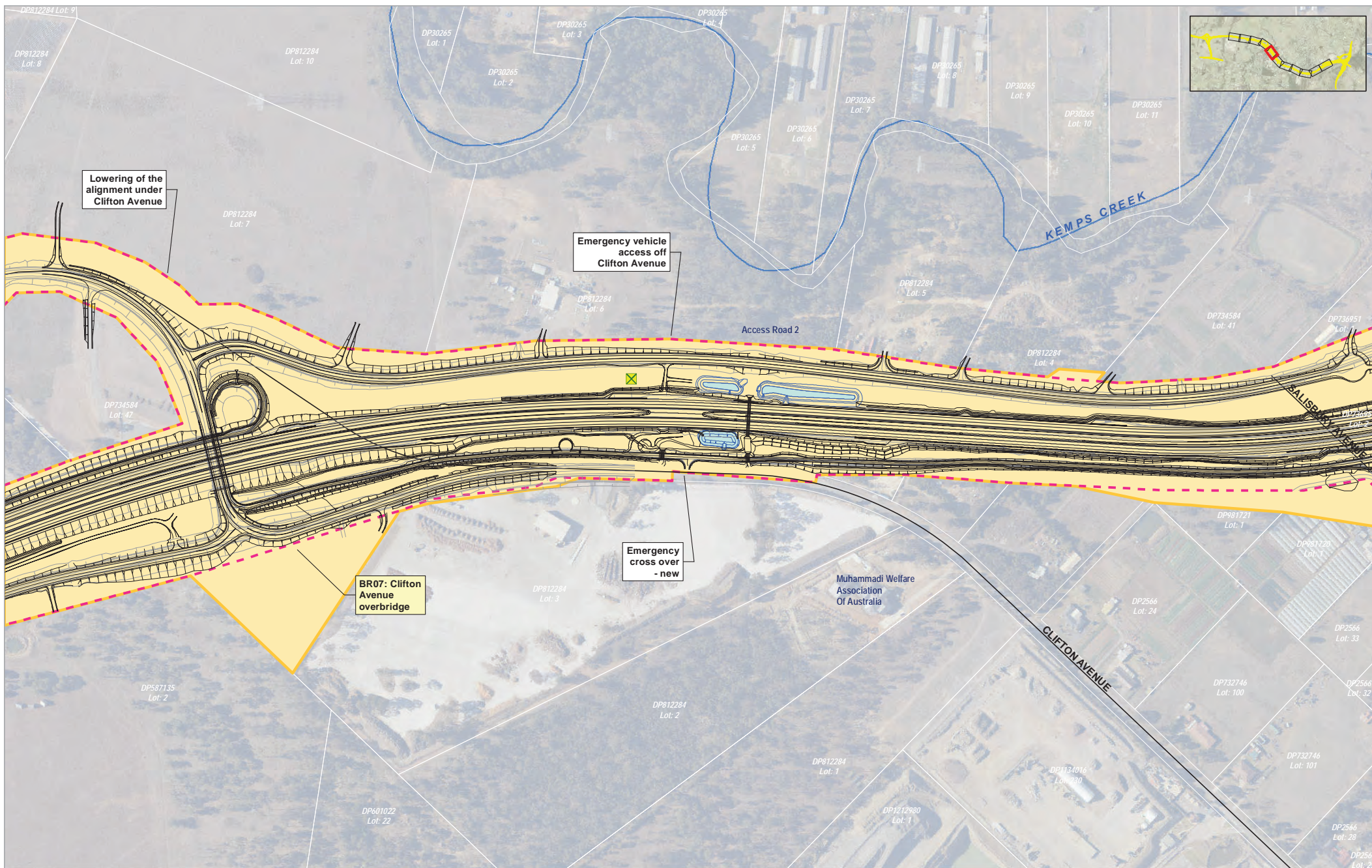
Transport for NSW
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**Comparison of the amendment report
 submissions report operational boundary
 and refined operational project**

Project No. 21-12514239
 Revision No. -
 Date 13/10/2021

FIGURE 2-3-4

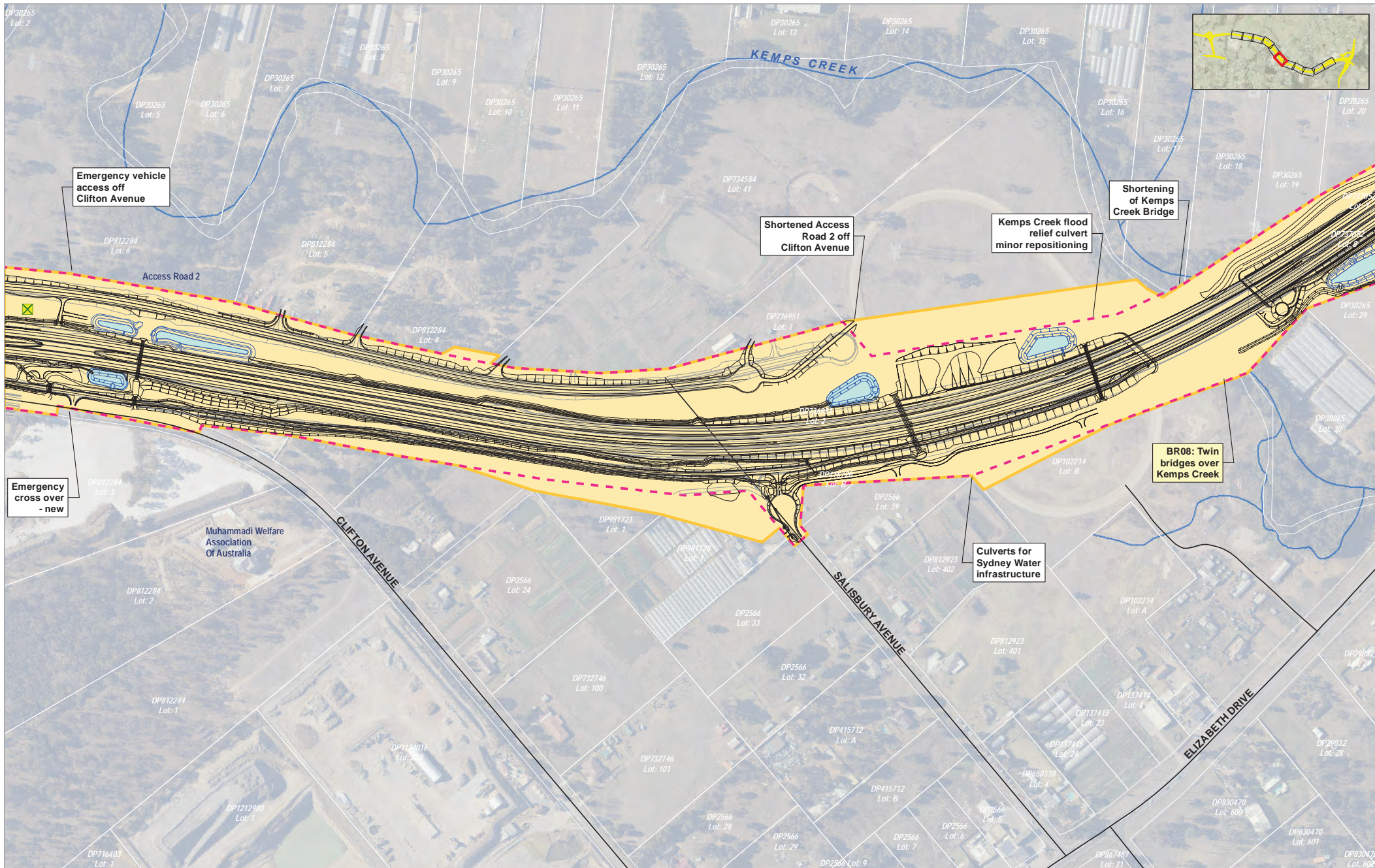
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LEGEND 100% detailed design operational footprint (August 2021) 100% operational basins (July 2021) Amendment Report Submissions Report - operational footprint (December 2020) Cadastre Variable message sign (VMS will be within operational footprint - indicative location only)		Approved project (Amendment Report Submissions Report Dec 2020) Amended design (GHD July 2021) Roads Watercourse		Paper Size ISO A3 Meters Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56		 		Transport for NSW M12 Motorway Central Package Consistency Assessment Comparison of the amendment report submissions report operational boundary and refined operational project		Project No. 21-12514239 Revision No. - Date 13/10/2021	
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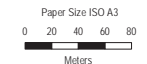
FIGURE 2-3-5



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- Amendment Report Submissions Report - operational footprint (December 2020)
- Cadastre
- Variable message sign (VMS will be within operational footprint - indicative location only)

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Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
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Transport for NSW
 M12 Motorway Central Package
 Consistency Assessment

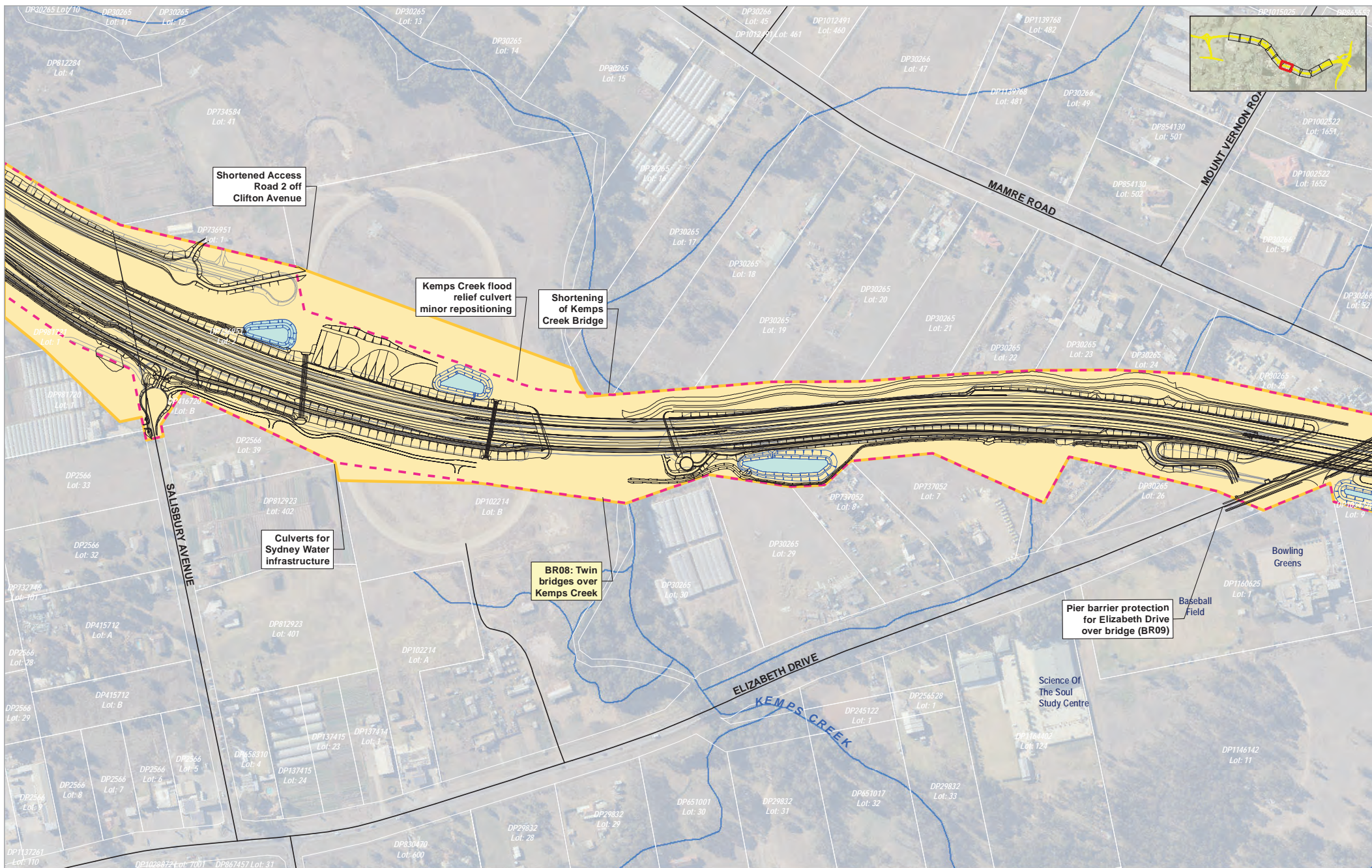
**Comparison of the amendment report
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Project No. 21-12514239
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 Date 13/10/2021

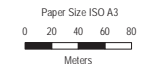
FIGURE 2-3-6

CU1112514239/025/Map03/References/21_12514239_2065_Consistency_DO_EnhancedProject_OperationalProject.mxd
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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



Transport for NSW
M12 Motorway Central Package
Consistency Assessment

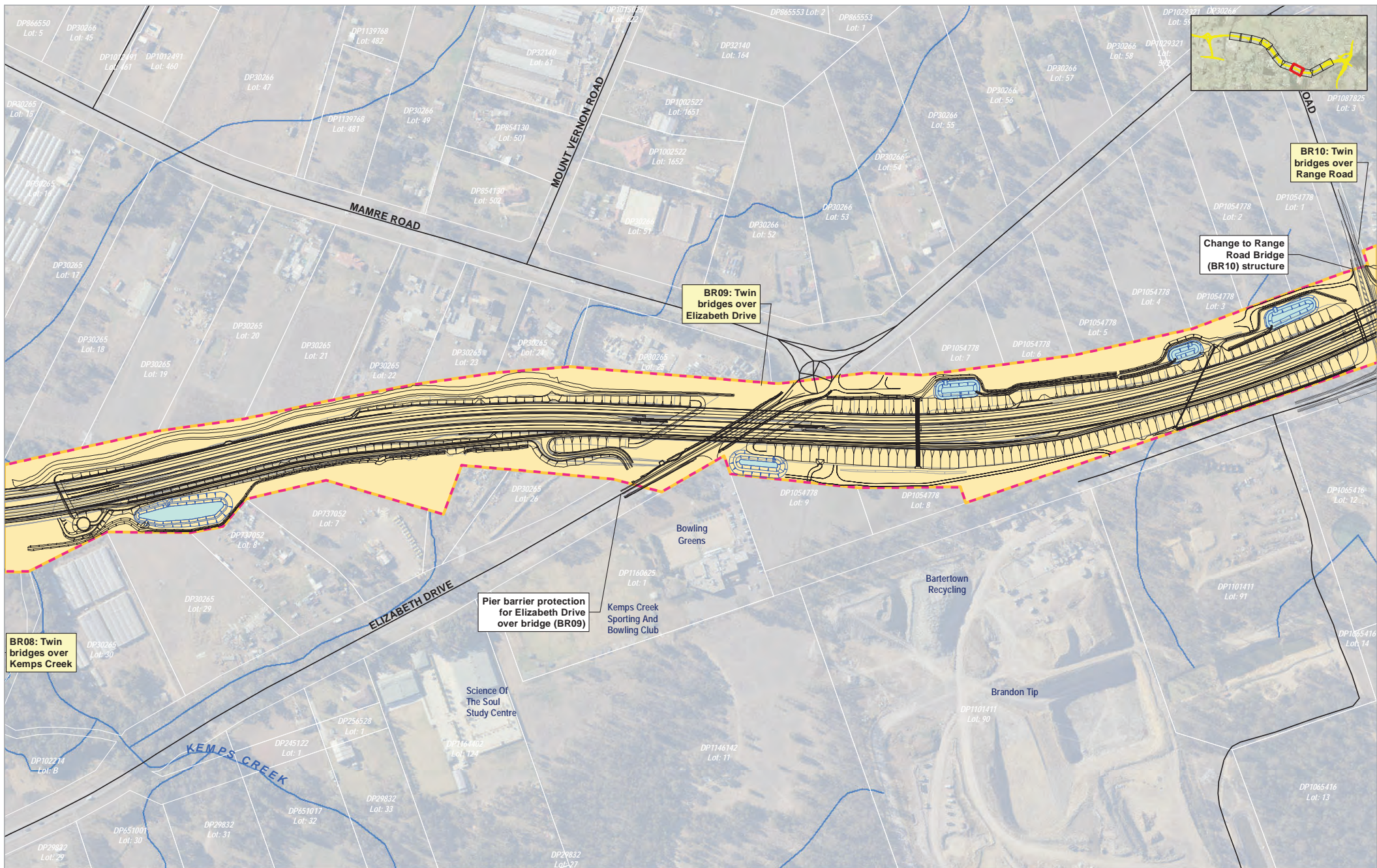
**Comparison of the amendment report
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and refined operational project**

Project No. 21-12514239
Revision No. -
Date 13/10/2021

FIGURE 2-3-7

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Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
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 M12 Motorway Central Package
 Consistency Assessment

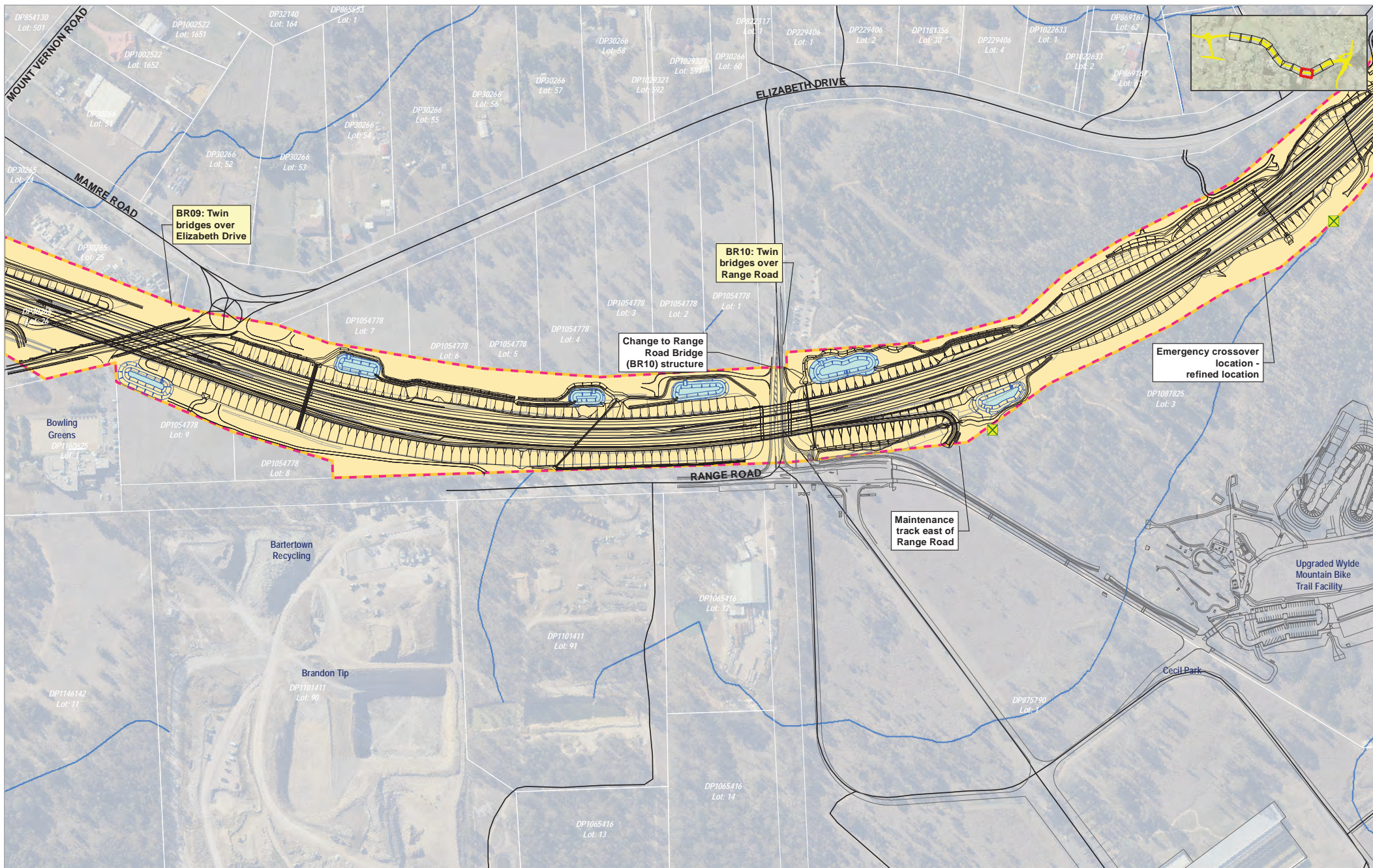
**Comparison of the amendment report
 submissions report operational boundary
 and refined operational project**

Project No. 21-12514239
 Revision No. -
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FIGURE 2-3-8

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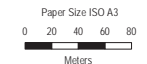
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LEGEND

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



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M12 Motorway Central Package
Consistency Assessment

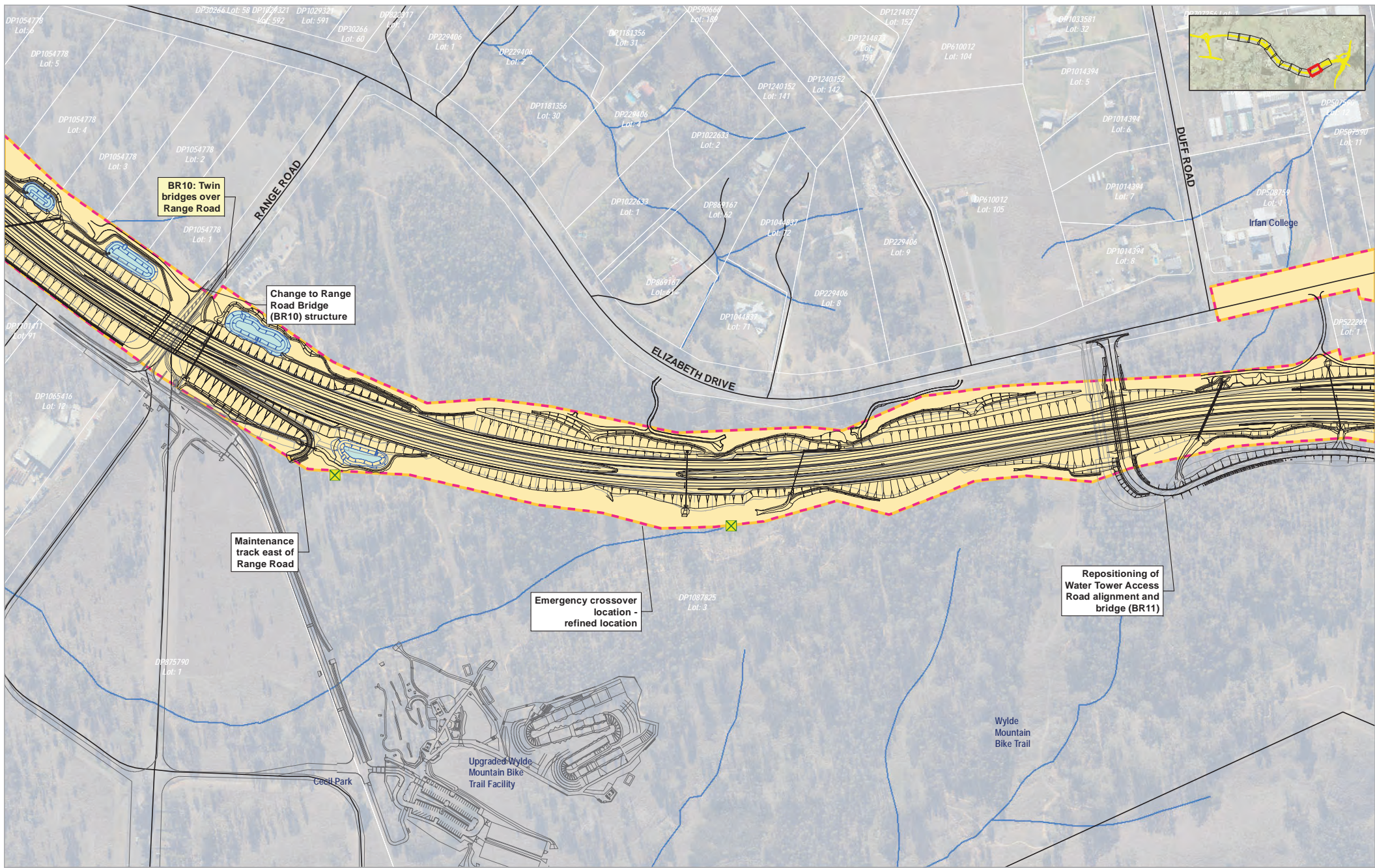
**Comparison of the amendment report
submissions report operational boundary
and refined operational project**

Project No. 21-12514239
Revision No. -
Date 13/10/2021

FIGURE 2-3-9

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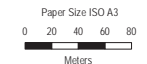
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Horizontal Datum: GDA2020
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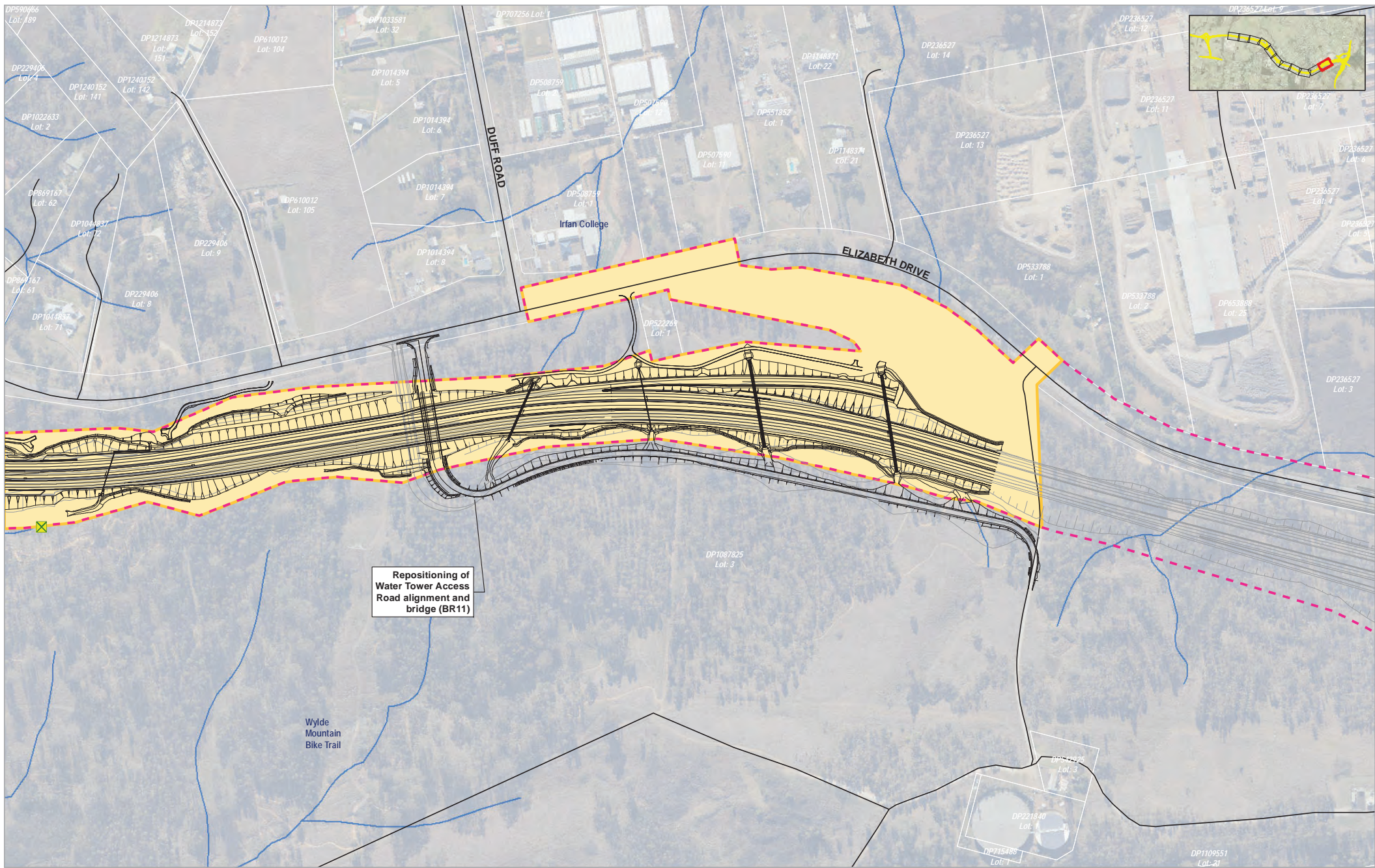
**Comparison of the amendment report
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and refined operational project**

Project No. 21-12514239
Revision No. -
Date 13/10/2021

FIGURE 2-3-10

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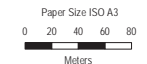
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**Repositioning of
Water Tower Access
Road alignment and
bridge (BR11)**

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**Comparison of the amendment report
submissions report operational boundary
and refined operational project**

Project No. 21-12514239
Revision No. -
Date 13/10/2021

FIGURE 2-3-11

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2.2 Need

Development of the design has progressed from the concept design presented in the approval documents through the following processes:

- Value engineering carried out at the start of detailed design to review the concept design
- General design review and development process
- Input from Transport Traffic Management Centre (TMC) following safety review as part of their incident management requirements
- Ongoing consultation with stakeholders such as utility suppliers, Western Sydney Parkland Trust (WSPT) and impacted property owners
- Review of Conditions of Approval and revised environmental management measures (REMM's) to ensure the design meets these requirements and carries out any additional assessment or refinements as required by the commitments.

The project objectives presented in the approval documents and considered throughout the design process are:

- Provide sufficient road capacity to meet traffic demand generated by the planned western Sydney urban development
- Provide a high standard connection to the airport with capacity to meet future freight and passenger needs
- Provide a road which supports and integrates with the broader transport network
- Support the provision of an integrated regional and local public transport system
- Preserve the access function of Elizabeth Drive
- Provide active local transport within the east-west corridor
- Make provision for connection to the future Outer Sydney Orbital.

The value engineering study included workshops carried out in May 2020 and comprised part of the 12 week 'review and challenge' period. The study identified the need for a number of changes to the approved project during detailed design to improve value of the project, including safety, compliance with environmental legislation and to meet sustainability targets. The study considered implications to hydrology, flooding and water quality, visual impact, property acquisition and the creeks.

The key value engineering options adopted and factors considered in the analysis of the project are presented in Table 2-1.

Table 2-1: Summary of value engineering options

Disciplines	Key value engineering options reviewed
Roads and Alignment	Lowering of the grade line between South Creek and Kemps Creek
	Lowering the grade line east of Elizabeth Drive by relocating Range Road underbridge
Structures	Reducing the number of spans and number of girders and columns per span on the South Creek and Kemps Creek bridges

Disciplines	Key value engineering options reviewed
Drainage and Water Quality	Deletion of some transverse culverts
	Standardisation of culvert sizes and rock armouring
	Reducing bridge spans in conjunction with structures above
ITS and Utilities	Review of signage provision and major utility relocations
Pavements and Geotechnical	Controlled subgrade (LS of existing subgrade material) or lower Upper zone Formation (UZF) on low height embankments
	Assessed options for adoption of higher subgrade California Bearing Ratio (CBR) value of CBR for pavement design
	Use of fly ash and recycled materials
	Alternative shared path pavement

The outcomes of the value engineering study were presented and subsequently agreed with the Transport Sydney Development Committee.

All other changes listed in Section 2.1 of this report were proposed following general design review and development process, input from TMC and further consultation with stakeholders.

3. Consultation

Consultation has been undertaken with property owners directly impacted by the proposed changes to the design since publication of the final approval documents listed in Section 1.1. The principle landowners impacted are Western Sydney Parklands Trust (WSPT) and private property owners listed in Table 4-11.

Issues discussed with WSPT were related to:

- Utilisation of existing maintenance tracks within the parklands for use by Transport during operation of the project. This included the projects need to add new gates from the project onto WSPT owned maintenance tracks and agreements to use the tracks.
- Additional land required to be leased from WSPT during construction of the project and removal of an area of WSPT land from the project's construction footprint that is no longer required.

Any impacted stakeholders and members of the community would be consulted about the proposed changes since the project was approved.

The proposed changes would be communicated as part of the changes to the wider project (including other stages) via briefings to stakeholders, ongoing consultation with affected property owners and community updates.

4. Environmental assessment

An assessment has been undertaken to compare the environmental impacts of the detailed design relative to the environmental impacts of the project, subject to the Division 5.2 Approval and the EPBC Approval. The assessment focuses only on the environmental issues and impacts relevant to the change.

Table 4-1 provides a summary of the environmental assessment of the proposed changes and indicates where further assessment is provided.

Table 4-1: Environmental assessment of the proposed change

Environmental issue	Consideration of the relative environmental impacts of the detailed design compared to the Division 5.2 Approval and EPBC Approval
Biodiversity	<p>The detailed design would result in a change to the areas of vegetation clearance presented in the approval documents. The detailed design has resulted in a minor increase overall of about 0.26 hectares of direct impacts to native vegetation.</p> <p>A summary of changes to biodiversity impacts is presented in Section 4.1 and the biodiversity technical memorandum is provided in Appendix A.</p>
Transport and traffic	<p>The detailed design would not result in substantial changes to the construction and operational transport and traffic assessment presented in the approval documents. The detailed design includes changes to the vertical alignment of the project which will reduce the volume of material required for construction of the project, which may reduce haulage vehicle movements during construction. Further detailed assessment is not considered to be necessary.</p> <p>The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage impacts associated with the detailed design. No additional or amended measures are required.</p>
Urban design, landscape character and visual amenity	<p>The detailed design would not alter the overall magnitude of the project and therefore the landscape character impact rating. The visual impact rating during construction remains unchanged from the rating identified in the approval documents.</p> <p>As a result of changes to the vertical alignment around Clifton Avenue, a review of the viewpoints at this location has been carried out and is discussed in Section 4.2.</p>
Socio-economic, land use and property	<p>As described in Section 2.1, the detailed design would include minor increases to the project area and construction footprint, and therefore temporary lease areas and property acquisition.</p> <p>All such proposed boundary changes are based on the revised deposited plans and to suit the land owner's requests. Access to private properties will continue to be maintained. These impacts are discussed in Section 4.3.</p>

Environmental issue	Consideration of the relative environmental impacts of the detailed design compared to the Division 5.2 Approval and EPBC Approval
Aboriginal heritage	<p>The AHIMS search findings are consistent with the findings of the approval documents.</p> <p>All proposed construction and operational boundary adjustments fall within the ‘detailed investigation area’ previously assessed for Aboriginal cultural heritage within the approval documents. The proposed boundary adjustments would not impact on additional Aboriginal archaeological sites. Minor additional impacts to the sites from the proposed boundary adjustments are considered to be consistent with the existing impacts identified in the approval documents.</p> <p>This is discussed in Section 4.4 and the Aboriginal technical memorandum is provided in Appendix B.</p>
Non-Aboriginal heritage	<p>Minor construction boundary changes and property adjustments have been assessed for additional impacts to non-Aboriginal heritage. In addition further assessment has been carried out where gaps in the original assessment have been identified.</p> <p>A summary of changes to non-Aboriginal heritage impacts is presented in Section 4.5 and the non-Aboriginal heritage technical report is provided in Appendix C.</p>
Noise and vibration	<p>The construction footprint for detailed design would result in a reduction in impacts around the former AF14 site. Detailed design has also reduced the number of receivers impacted during operation of the project.</p> <p>This is discussed in Section 4.6, and the noise and vibration technical memorandum is provided in Appendix D.</p>
Flooding	<p>An updated flood assessment has been carried out. This has included a wider study area and a more detailed analysis of flooding impacts. This assessment has focused upon operational design. Detailed design would not alter the flooding risks and management measures identified in the approval documents.</p> <p>This is discussed in Section 4.7 and the flooding technical memorandum is provided in Appendix E.</p>
Surface water quality and hydrology	<p>As described in Section 2.1, the detailed design would include minor increases to the project area and construction footprint and refinement to the design of structures.</p> <p>This is discussed in Section 4.8.</p>
Groundwater quality and hydrology	<p>As described in Section 2.1, the detailed design includes refinement to the vertical alignment of the design and additional excavations for culverts.</p> <p>This is discussed in Section 4.9 and the groundwater quality and hydrology technical memorandum is provided in Appendix F.</p>

Environmental issue	Consideration of the relative environmental impacts of the detailed design compared to the Division 5.2 Approval and EPBC Approval
Soils and contamination	<p>The detailed design includes changes to the vertical alignment of the project which will reduce the volume of material required for construction of the project, which may also reduce haulage vehicle movements during construction. Detailed design would not however result in substantial changes to the construction and operational soil profile and contaminated land assessment presented in the approval documents. Further detailed assessment is not considered to be necessary.</p> <p>The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage impacts associated with the detailed design. No additional or amended measures are required.</p>
Air quality	<p>The detailed design would not result in substantial changes to the construction and operational air quality assessment presented in the approval documents. Further detailed assessment is not considered to be necessary.</p> <p>The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage impacts associated with the detailed design. No additional or amended measures are required.</p>
Health and safety	<p>The detailed design would not result in substantial changes to the construction and operational health and safety assessment presented in the approval documents. Further detailed assessment is not considered to be necessary.</p> <p>The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage impacts associated with the detailed design. No additional or amended measures are required.</p>
Sustainability	<p>The detailed design would not result in substantial changes to the sustainability assessment presented in the approval documents. Further detailed assessment is not considered to be necessary.</p>
Waste	<p>The detailed design would not result in substantial changes to the construction and operational waste assessment presented in the approval documents. Further detailed assessment is not considered to be necessary.</p> <p>The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage impacts associated with the amended project. No additional or amended measures are required.</p>

Environmental issue	Consideration of the relative environmental impacts of the detailed design compared to the Division 5.2 Approval and EPBC Approval
Climate change risk and greenhouse gas	<p>The detailed design would not result in any significant changes to emission generating activities assessed in the approval documents and therefore would be unlikely to result in more than a negligible increase in the greenhouse gas emissions during construction.</p> <p>Detailed design would not result in a substantial change in traffic volumes, congestion (level of service), or average speeds and therefore would be unlikely to result in more than a negligible change in greenhouse gas emissions during operation.</p> <p>Detailed design would not result in a change to the climate change risks assessment outlined in the approval documents.</p> <p>Further detailed assessment is not considered to be necessary.</p> <p>The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage impacts associated with the amended project. No additional or amended measures are required.</p>
Cumulative impacts	<p>The detailed design assessed in this report would generally be consistent with the outcomes of the approval documents, taking into account revised impacts of the detailed design as outlined in Section 4 of this report. There is a combination of marginally reduced and increased impacts relating to the proposed changes, which do not significantly increase cumulative impacts. Further detailed assessment is not considered to be necessary.</p>

4.1 Biodiversity

4.1.1 Assessment methodology

As outlined in Section 2, the proposed changes to the project would result in minor changes to the project's construction and operational footprint and design. These changes have been considered against the outcomes of the biodiversity assessment that was carried out and presented in the approval documents listed in Section 1.1.

Additional field survey was carried out in June 2021 which comprised:

- Vegetation mapping
- Searches for threatened flora
- Terrestrial fauna habitat assessment
- Searches for the Cumberland Plain Land Snail (*Meridolum corneovirens*) in areas of suitable habitat.

A biodiversity technical memorandum has been prepared to provide the results of additional field surveys, review of threatened species and ecological communities that occur within the construction footprint for detailed design to assess biodiversity impacts and update calculations for biodiversity offsets, in comparison to the approval documents. The biodiversity technical memorandum is provided in Appendix A, and a summary is provided below. This section should be read in conjunction with Section 7.1 and Appendix E of the EIS and Section 6.1 and Appendix A of the amendment report.

4.1.2 Existing environment

The existing environment has not significantly changed since the preparation of the approval documents. The environment described in the project documentation listed in Section 1.1 including Appendix E of the EIS and Appendix A of the amendment report, is still applicable to the detailed design.

4.1.3 Assessment of potential impacts

The existing vegetation was surveyed in locations where the construction footprint has expanded. Some of these areas comprised biodiversity certified land and therefore did not require additional assessment.

The following plant community type (PCTs) are found within the M12 central section:

- 724 Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (HN512)
- 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (HN526)
- 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (HN528)
- 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition) (HN529)
- 1800 Swamp Oak open forest on river flats of the Cumberland Plain and Hunter valley (HN674).

The findings for the field survey within uncertified areas comprised:

- WSPT property just west of Duff Road- a patch of moderate condition PCT 850 Grey Box, Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
- New maintenance track within WSPT land between Range Road and Duff Road - surrounded by moderate condition PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion

- Transverse culvert at the western end of the project - exotic pasture grass and one hollow bearing tree adjacent to the boundary
- Locations identified for property adjustment plans - existing hardstand areas or areas of exotic agricultural land. Minor alterations of the boundary occurred for the property adjustment plans.

Desktop assessment and field surveys were undertaken to confirm the accuracy and currency of the vegetation mapping provided in the approval documents. This review was carried out to confirm the extent, type and condition of threatened species and ecological communities to be impacted by the project. Further detail is provided in Section 5.2 of Appendix A. No changes to the vegetation mapping presented in the approval documents were required.

Direct impact to native vegetation

The construction footprint for the detailed design, excluding certified areas, contains about 32.80 hectares of PCTs. This is an increase of about 0.26 hectares of direct impacts to native vegetation. All areas of native vegetation to be removed, except for PCT 883, fall within the definitions of TECs listed under the BC Act and/or the EPBC Act. The areas of each TEC that would be directly impacted as a result of the detailed design construction footprint are listed Table 4-2.

Table 4-2: Changes to direct Impacts to threatened ecological communities

TEC	Status	PCT(s)	Area (ha) within approved project (Total M12)	Area (ha) within central section of the approved project (AR submissions report)	Area (ha) within refined M12 central section construction footprint	Total change in area (ha) from the approved project for M12 central section
TECs listed under the EPBC Act						
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	CEEC		42.89	25.10	25.22	+0.12
Total area of TECs listed under the EPBC Act					25.22	+0.12
TECs listed under the BC Act						
Cumberland Plain Woodland in the Sydney Basin Bioregion	CEEC	850, 849	66.86	23.92	24.07	+0.15
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	835	3.18	0.52	0.52	0

TEC	Status	PCT(s)	Area (ha) within approved project (Total M12)	Area (ha) within central section of the approved project (AR submissions report)	Area (ha) within refined M12 central section construction footprint	Total change in area (ha) from the approved project for M12 central section
Moist Shale Woodland in the Sydney Basin Bioregion	EEC	830	0.44	0	0	0
Shale Gravel Transition Forest in the Sydney Basin Bioregion	EEC	724	6.91	6.91	7.11	+0.20
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	1800	2.82	0.63	0.66	+0.03
Total area of TECs listed under the BC Act			80.21	31.98	32.36	+0.38

Indirect impacts to native vegetation

Indirect impacts to native vegetation were calculated for areas within 30 metres of the construction footprint. Only vegetation that was categorised as a 'non-viable edge' or 'new edge' was included in the indirect impact calculations. A decrease of 0.34 hectares of native vegetation would be indirectly impacted due to the construction boundary changes when compared with the approved project. This would result in a total area of native vegetation that would be indirectly impacted as 4.7 hectares.

Threatened fauna habitat

The areas of potential habitat within the construction footprint for the detailed design have increased for all the subject species when compared to the approved project, except for the Cumberland Plain Land Snail and White Bellied Sea Eagle which has remained the same. Changes to potential habitat impacts for threatened fauna species are summarised in Table 4-3.

Table 4-3: Changes to threatened fauna habitat

Species	BC Act listing	EPBC Act listing	Associated PCT	Approved project (total M12) (ha)	Approved project (M12 central section) (ha)	Detailed design M12 central section construction footprint (ha)	Total change (M12 central section) (ha)
Southern Myotis (breeding habitat)	V		Hollow-bearing trees (breeding habitat)	1.05	0.51	0.67	+0.16 ha + 2 hollow bearing trees
Swift Parrot	E	CE	724, 830, 835, 849, 850, 883, 1800	80.78	32.55	32.81	+0.26
Grey-headed Flying-fox (foraging habitat)	V	V	835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Yellow-bellied Sheathtail-bat	V		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Eastern Coastal Free-tailed Bat	V		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Greater Broad-nosed Bat	V		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Large Bent-winged Bat (foraging habitat)	V		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Little Bent-winged Bat (foraging habitat)	V		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Eastern False Pipistrelle	V		835, 849, 850, 1800	72.86	25.07	25.25	+0.18

Note 1: E – Endangered; V - Vulnerable; CE - Critically Endangered

Threatened flora species

No change has been identified to direct impacts on threatened plant species.

Matters of national environmental significance

Six matters of national environmental significance (MNES) were impacted by the approved project. Three of these are impacted by the revised construction boundary for the detailed design. A comparison of MNES impacted by the approved project and the detailed design are shown in Table 4-4.

Table 4-4: Changes to MNES impacts

MNES	Approved project (total M12)	Approved project (M12 central section) (ha)	Detailed design M12 central section construction footprint (ha)	Total change (M12 central section) (ha)
Threatened Ecological Communities				
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	42.89 ha	25.10	25.22	+0.12
Threatened fauna				
Grey-headed Flying-fox	62.69 ha (foraging)	25.06	25.25	+0.18
Swift Parrot	80.78 (foraging)	32.55	32.81	+0.26

Additional impact from the new areas within the construction footprint

The direct impacts at the new areas included within the construction footprint are listed in Table 4-5 and shown in Figure 4-1. The changes in these two areas do not account for all the changes within the M12 central section. These areas have been identified as key areas where there were increases to native vegetation required to be cleared. A number of other minor boundary changes (including those that occurred through the property negotiation and acquisition process) have resulted in changes to biodiversity impacts.

No additional direct impacts to native vegetation will occur as a result of the new construction area for the transverse culvert at the western end of the project or new areas relating to the adjustment plans.

Table 4-5: Direct impacts in the new areas of the M12 central section detailed design construction boundary

Location	PCT	BC Act listing	EPBC Act listing	Area excluding certified land (ha)
WSPT west of Duff Road	850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a CEEC	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed as a CEEC	0.03 ha

Location	PCT	BC Act listing	EPBC Act listing	Area excluding certified land (ha)
Maintenance track in WSPT land	850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a CEEC	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed as a CEEC	0.04 ha
Total				0.07 ha

Changes to the design of Kemps Creek and South Creek bridges

The refined design of South Creek twin bridge (BR06) and Kemps Creek twin bridge (BR08) considered the impacts of providing piers within the channels of the creeks or the alternative of realigning creek channels. Given the angle of the road in respect to the creek channels and the length of the bridge spans, piers in the channel or creek realignment would be required.

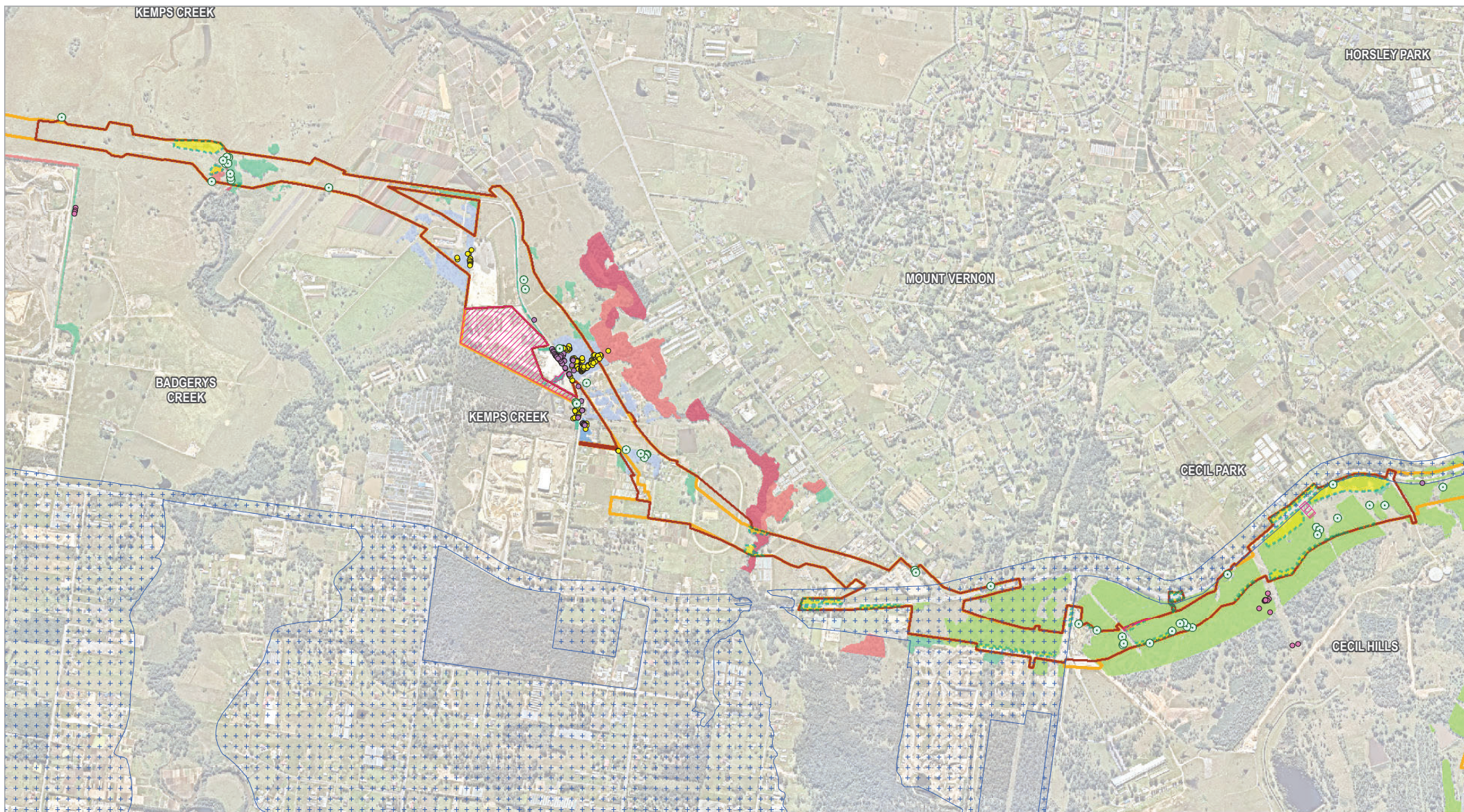
REMM B15 requires further biodiversity assessment as stated: *“Bridge pier locations within instream (main waterway channel) or on creek banks will be avoided during detailed design at the South Creek, Cosgroves Creek, Badgerys Creek and Kemps Creek crossings. Where avoidance is not possible, further biodiversity assessment will be required.”* In addition, creek adjustment impacts are considered in REMM F04. The measure states that *“Creek adjustments would be re-considered and/or further refined to minimise the impact on the creeks during detailed design.”*

The detailed design for each bridge is as follows:

- South Creek Bridge (BR06). The refined bridge structure includes a design where bridge piers are positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 9 of the eastbound carriageway and Pier 10 of the westbound carriageway have been positioned at the edge of the creek and not within the low flow portion.
- Kemps Creek Bridge (BR08) - The refined bridge structure includes a design where bridge piers are positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 3 on both carriageways is located within the creek, although the piers are positioned towards the creek bank and not within the low flow portion.

Additional environmental assessment was undertaken as per REMM B15 to assess the bridge piers locations during the early stages of detailed design development. The environmental assessment included a site visit to both South and Kemps Creek and the key outcomes included the following:

- During construction of the bridges, fish passage would be maintained and the creek channels would be rehabilitated at the completion of active construction work in accordance with the landscape plans for the project.
- Placement of piers wholly outside of the creek channel and banks was not considered feasible without the need to realign the creeks. Use of piers within the low flow portion rather than channel realignment would limit the modification of the waterway and should thus reduce direct impacts on aquatic habitat (including key fish habitat) in the long term. The design has met the requirement of REMM F04 by reviewing and avoiding the need for creek realignment.
- Pier locations have been designed to minimise the number of piers in the creeks and have been positioned in order to limit changes to flow velocity and scouring. Fish passage would be maintained throughout operation of the project.



Plant Community Types (Arcadis 2020, GHD 2021)

- Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
- Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion
- Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley

Threatened Flora EIS (Arcadis, GHD 2021)

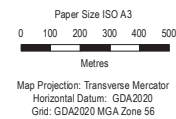
- Dillwynia tenuifolia*
- Grevillea juniperina*
- Pultanea parviflora*

Hollow Bearing Tree (CCS 2021, GHD 2021)

-

LEGEND

- Construction footprint - 100% (26/8/2021)
- Exclusion Zones (GHD, July 2021)
- Areas of retained vegetation
- Biocertified Land: Existing Certified



Transport for NSW
M12 Motorway Central Package
Detailed Design

Project No. 21-12514239
Revision No. -
Date 7/09/2021

Vegetation Clearing

FIGURE 4-1

4.1.4 Environmental management measures

Changes to biodiversity impacts for detailed design are generally consistent with the impacts described in the approval documents. The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage the biodiversity impacts associated with the detailed design. No additional or amended environmental management measures are required for the detailed design.

Areas of retained vegetation

Opportunities for retention of vegetation within the construction footprint have been identified in order to meet the requirement of REMM B03 and B10 and CoA E2. These areas are shown as 'areas of retained vegetation' on Figure 4-1.

A total of 3.49 hectares of 'areas of retained vegetation' has been identified within the construction footprint for the detailed design and includes one hollow-bearing tree and 0.01 hectares of Southern Myotis habitat. These areas of native vegetation have not been deducted from the total area of vegetation directly impacted within the central section. The construction contractor would be required to apply to Transport and provide a justification to impact these areas.

Table 4-6: Areas of native vegetation with the 'areas of retained vegetation'

PCT	Vegetation zone	Area within the central section
835	835 – Moderate/Good_Poor	0.15
849	849 – Moderate/Good_Medium	0.90
	849 – Moderate/Good_Poor	0
850	850 – Moderate/Good_Medium	0.89
	850 – Moderate/Good_Other (Revegetation)	1.39
1800	1800 – Moderate/Good_Poor	0.16
Total		3.49

4.1.5 Offsets

The amendments to the construction footprint would involve the following changes to ecosystem credits required for the central section of the M12 project:

- Ecosystem credits associated with the direct impacts to native vegetation – increase by 16.5 (see Table 4-7)
- Ecosystem credits associated with direct impacts to native vegetation listed under the EPBC Act – increase by 3.8 (see Table 4-8)
- Ecosystem credit associated with indirect impacts to native vegetation listed under the EPBC Act – decrease by 3.9 (see Table 4-9)
- Species credits required for vegetation removal in the M12 central section – increase by 3.5 (see Table 4-10).

While this is a slight increase in vegetation clearance, the project's impact on biodiversity is calculated based on the entire construction footprint. Requirements for contractors to minimise clearing during construction are likely to reduce the impact calculated in the approval documents, and associated offset requirements. Final offset calculations will be based on survey of actual vegetation cleared.

All offsets required will be provided to meet the conditions of approval.

Table 4-7: Ecosystem credits associated with the direct impacts to native vegetation for the M12 central section detailed design

PCT (offset code)	Total M12 approved project impact (ha)	M12 central section approved project impact (ha)	M12 central section detailed design impact (ha)	Total M12 approved project ecosystem credits	M12 central section approved project ecosystem credits	M12 central section detailed design ecosystem credits	Change in ecosystem credits
724	6.91	6.91	7.11	372	372	382.8	+10.8
835	3.18	0.52	0.52	105	17.2	17.2	0
849	6.34	4.13	4.18	210	136.8	138.5	+1.7
850	60.52	19.79	19.89	1908	623.9	627.1	+3.2
1800	2.82	0.63	0.66	75	16.8	17.6	+0.8
Total	80.21	30.98	32.36	2685	1166.7	1183.2	+16.5

Table 4-8: Ecosystem credits associated with direct impacts to native vegetation listed under the EPBC Act for the detailed design

PCT (offset code)	Total M12 approved project impact (ha)	M12 central section approved project impact (ha)	M12 central section detailed design impact (ha)	Total M12 approved project ecosystem credits	M12 central section approved project ecosystem credits	M12 central section detailed design ecosystem credits	Change in ecosystem credits
724	6.91	4.86	4.89	276	194.1	195.3	+1.2
849	6.34	1	1	65	10.3	10.3	0.0
850	60.52	19.23	19.33	1659	527.1	529.7	+2.6
Total	-	25.1	25.22	-	731.5	735.3	+3.8

Table 4-9: Ecosystem credits associated with the indirect impacts to native vegetation for the M12 central section detailed design

PCT (offset code)	Total M12 approved project impact (ha)	M12 central section approved project impact (ha)	M12 central section detailed design impact (ha)	Total M12 approved project ecosystem credits	M12 central section approved project ecosystem credits	M12 central section detailed design ecosystem credits	Change in ecosystem credits
850	11.67	4.59	4.25	133	52.3	48.4	-3.9
724	0.45	0.45	0.45	6	6	6	0
Total	-	5.04	4.70	139	58.3	54.4	-3.9

Table 4-10: Species credits required for vegetation removal in the M12 central section

Species	Total M12 approved project loss of habitat (ha) or individuals	M12 central section approved project loss of habitat (ha) or individuals	M12 central section detailed design loss of habitat (ha) or individuals	Total M12 approved project species credits	M12 central section approved project species credits	M12 central section detailed design species credit	Change in species credits
<i>Dillwynia tenuifolia</i>	244 individuals	244 individuals	244 individuals	4392	4392	4392	0
<i>Pultenaea parviflora</i> Sydney Bush-pea	Up to 100 individuals	93 individuals	93 individuals	1500	1395	1395	0
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail	5.10	0.52	0.52	66	6.7	6.7	0
<i>Myotis macropus</i> Southern Myotis	1.05	0.51	0.67	23	11.2	14.7	+3.5
Total	-	-	-	5981	5804.9	5808.4	+3.5

4.2 Urban design, landscape character and visual amenity

4.2.1 Assessment methodology

This assessment considers if the proposed changes outlined in Section 2.1 has an impact on the landscape character and visual amenity impacts described in the approval documents. The Landscape character and visual impact assessment report was provided in Appendix G of the EIS and updated in Appendix C of the amendment report.

The urban design concept for the project as described in the approval documents is still relevant and applicable to the detailed design. This includes urban design principles and objectives, connection to country design, urban design elements and concept plan. This is detailed in Section 7.3.4 of the EIS and has not been discussed further in this section.

4.2.2 Existing environment

The existing environment has not significantly changed since the preparation of the approval documents. The environment described in Section 7.3.3 of the EIS is still applicable to the detailed design.

4.2.3 Assessment of potential impacts

Construction

While the detailed design includes minor changes to the construction footprint as described in the approval documents, the visual impacts at viewpoints are similar in nature during construction, would remain temporary and would be consistent with those described in the approval documents.

The detailed design also includes the removal of one ancillary facility (AF14) adjacent to Salisbury Avenue, which is unavailable for use. In terms of ancillary facilities, impacts were assessed in the approval documents as moderate due to their scale and function. There would be a slight improvement to the viewership of AF14.

Overall, impacts during construction are temporary in nature and would be mitigated where possible through appropriate siting of infrastructure, materials and finishes of sheds and hoardings, and management of light spill.

A CEMP and Site Establishment Management Plan would be prepared by the construction contractor providing details and measures taken to reduce potential adverse impacts as a result of construction works and ancillary facilities establishment and operation.

Operation

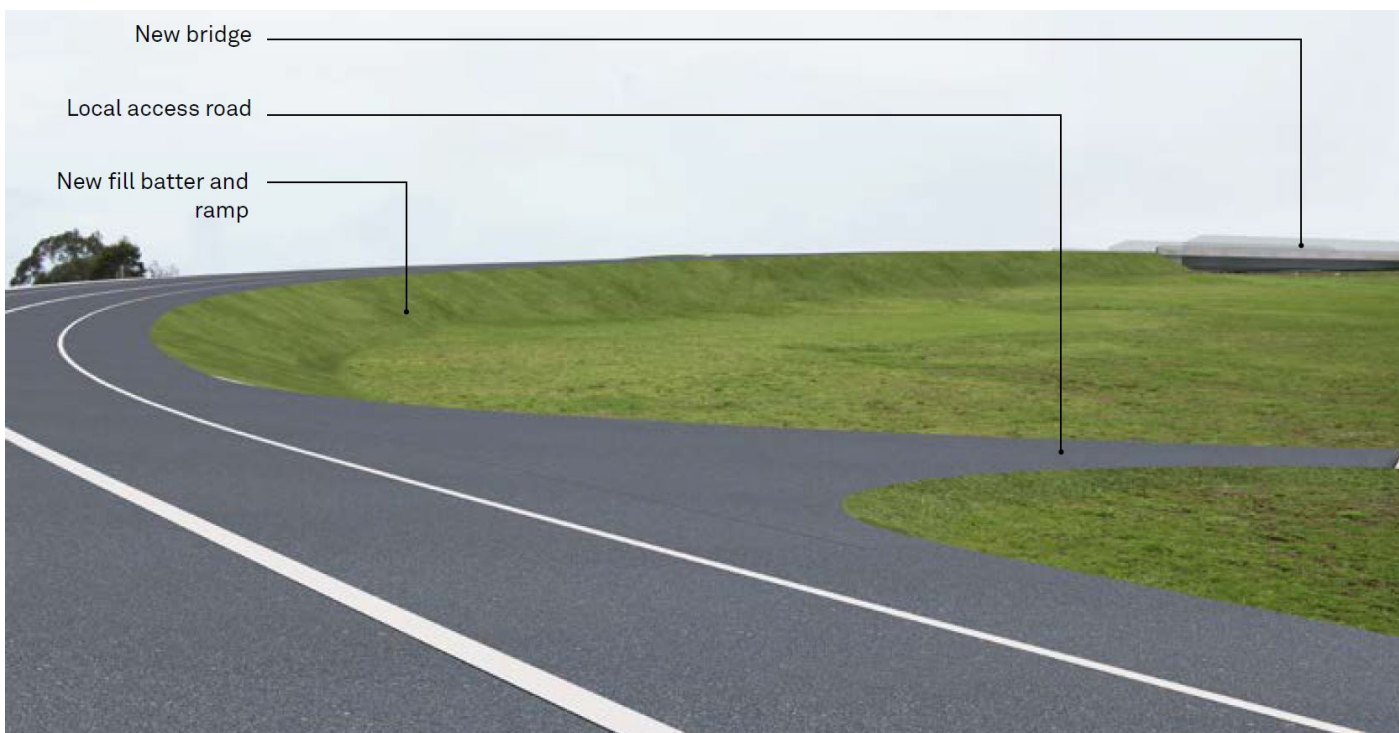
The vertical alignment of the main carriageway and the Clifton Avenue bridge would be lowered by around two metres around the location of the Clifton Avenue intersection. This change would be visible from Viewpoint 11 and Viewpoint 12.

Viewpoint 11 is located on the edge of the proposed local road tie in works along Clifton Avenue, looking in a southerly direction. The existing view is shown in Figure 4-2 and a visualisation of the project is shown in Figure 4-3. The vertical alignment of the project would be reduced by around two metres at this point while the horizontal alignment remains comparable to the Approved project. This change would be insignificant to the overall impact of the project and the visual impact assessment of moderate to low would remain unchanged from the assessment carried out as per Appendix G of the EIS.



Source: *Appendix G Landscape character, visual impact assessment and urban design report, pp 134.*

Figure 4-2: Viewpoint 11 view of existing condition



Source: *Appendix G Landscape character, visual impact assessment and urban design report, pp 134*

Figure 4-3: Visualisation of the project

Viewpoint 12 looks westerly from Mamre Road towards the Clifton Avenue intersection. The existing view is shown in Figure 4-4 and a visualisation of the project is shown in Figure 4-5. The vertical alignment of the project would be reduced by around two metres at this point. This change would be insignificant to the overall impact of the project and the visual impact assessment of negligible would remain unchanged from the assessment carried out as per Appendix G of the EIS.



Source: *Appendix G Landscape character, visual impact assessment and urban design report, pp 135.*

Figure 4-4: Viewpoint 12 view of existing condition



Source: *Appendix G Landscape character, visual impact assessment and urban design report, pp 135.*

Figure 4-5: Visualisation of the project

The approval documents identified that the project would have a moderate to high contribution to cumulative landscape character and visual impacts in the area. The proposed changes associated with the detailed design would not alter the overall magnitude of the project. The cumulative landscape character and visual impacts associated with the detailed design would be likely to remain unchanged from the assessment carried out as per Appendix G of the EIS and updated in Appendix C of the amendment report.

4.2.4 Environmental management measures

The landscape character and visual impacts associated with the detailed design are generally consistent with the impacts described in the approval documents. The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage the landscape character and visual amenity impacts associated with the detailed design. No additional or amended environmental management measures are required for the detailed design.

4.3 Socio-economic, land use and property

4.3.1 Assessment methodology

The methodology for the socio-economic, land use and property assessment is consistent with the methodology outlined in Section 7.4.2 of the EIS and Section 6.4 of the amendment report.

The primary and secondary study areas for the assessment remain unchanged to those presented in the EIS (see Figure 7-51 of EIS).

4.3.2 Existing environment

Section 7.4.3 of the EIS and Section 6.4.2 of the amendment report provides a detailed description of the existing environment within which the project is located. This includes existing and planned future land use; population, demography and housing characteristics, local business and industry; social infrastructure; community values; and transport and access.

While the existing environment has not significantly changed since the preparation of the approval documents, there have been some minor changes to the deposited plans lodged with NSW Land Registry Services showing land boundary and subdivision information.

4.3.3 Assessment of potential impacts

The potential socio-economic, land use and property impacts associated with the proposed changes to the design are described below for construction and operation. Only impacts that are additional or different from those documented in the approval documents have been outlined. Overall, the proposed design and construction changes would likely result in localised changes to socio-economic impacts and are considered to have minimal variation from the impacts described in the EIS.

Property impacts

Section 7.4.4 of the EIS and Section 6.4.3 of the amendment report identified the following types of property impacts:

- Directly affected properties
- Impacts of property acquisition
- Other property impacts.

There would be minor changes to impacts to all of the above as a result of the detailed design, in comparison the project as described in the approval documents. These potential impacts are discussed in detail in the following sections.

Directly affected properties

The detailed design would not require acquisition or temporary lease from any new properties.

Properties within the detailed design construction footprint are shown on Figure 2-2, including areas where the construction footprint has increased and decreased from the AR Submissions Report. Table 4-11 lists the properties where there has been increases to areas within the construction footprint for the central section of the project. There are a number of areas along the motorway alignment where the construction footprint has decreased, including for the removal of ancillary facility AF14 at DP2566 Lot 33. This property is no longer available for temporary lease during construction and therefore will not be impacted.

Properties within the detailed design operational footprint are shown on Figure 2-3, including areas where the operational footprint has increased and decreased from the AR Submissions Report. Table 4-12 lists the properties where there has been increases to areas within the operational footprint for the central section of the project.

Table 4-11: Summary of changes to land impacted by the detailed design construction footprint

Property	Ownership	Existing land use	Total property area (ha)	Area of land within the AR submissions report construction footprint	Area of land within the detailed design construction footprint	Change from the AR submissions report
DP258414 Lot 21	Private (The University of Sydney farms)	Rural land	153.9	5.9	6.0	+0.1 (updates to final deposited plans, operational footprint also impacted)
DP812284 Lot 4	Private	Rural land	5.7	1.8	1.9	+0.1 (updates to final deposited plans, operational footprint also impacted)
DP734584 Lot 41	Private	Rural land	13.1	2.2	2.3	+0.1 (updates to final deposited plans, operational footprint also impacted)
DP981721 Lot 1	Private	Rural residential	2.1	1.3	1.6	+0.3 (updates to final deposited plans, operational footprint also impacted)

Property	Ownership	Existing land use	Total property area (ha)	Area of land within the AR submissions report construction footprint	Area of land within the detailed design construction footprint	Change from the AR submissions report
DP981720 Lot 1	Private	Private Agriculture Horticulture	2.1	0.4	0.9	+0.5 (updates to final deposited plans, operational footprint also impacted)
DP102214 Lot B	Private	Commercial (horse training facility Bara Lodge)	18.8	4.5	6.0	+1.5 (updates to final deposited plans, operational footprint also impacted)
DP1087825 Lot 3	Public (Western Sydney Parklands Trust)	Western Sydney Parklands	669.2	29.3	29.5	+0.2 (additional temporary lease area required for construction)

Table 4-12: Summary of changes to land impacted by the detailed design operational footprint

Property	Ownership	Existing land use	Total property area (ha)	Area of land (ha) within the M12 operational footprint	Area of land (ha) within the M12 operational footprint	Change from the AR submissions report
DP258414 Lot 21	Private (The University of Sydney farms)	Rural land –	153.9	5.9	6.0	+0.1 (updates to final deposited plans, construction footprint also impacted)
DP812284 Lot 4	Private	Rural land	5.7	1.8	1.9	+0.1 (updates to final deposited plans, construction footprint also impacted)
DP734584 Lot 41	Private	Rural land	13.1	2.2	2.3	+0.1 (updates to final deposited plans, construction footprint also impacted)

Property	Ownership	Existing land use	Total property area (ha)	Area of land (ha) within the M12 operational footprint	Area of land (ha) within the M12 operational footprint	Change from the AR submissions report
DP981721 Lot 1	Private	Rural residential	2.1	1.3	1.6	+0.3 (updates to final deposited plans, construction footprint also impacted)
DP981720 Lot 1	Private	Private Agriculture – Horticulture	2.1	0.4	0.9	+0.5 (updates to final deposited plans, construction footprint also impacted)
DP102214 Lot B	Private	Commercial (horse training facility – Bara Lodge)	18.8	4.5	6.0	+1.5 (updates to final deposited plans, construction footprint also impacted)
DP734584 Lot 47	Private	Rural land	10.7	7.7	9.5	+1.8 (property has been acquired by Transport and will be used as an ancillary facility, area may be removed from the operational footprint depending on final plan for future use)

No additional residential properties or permanent structures would be impacted by the boundary changes. No changes are proposed to the other properties identified in the approval documents for acquisition or temporary lease. The types of impacts on the land use associated with the detailed design would be consistent with those described in Section 7.4.4 of the EIS. Access to properties subject to temporary lease would remain consistent with the access discussed in the EIS apart from the site proposed for ancillary facility AF14, off Salisbury Avenue, which is no longer available for use.

Acquisition of additional land required for the detailed design would be undertaken in accordance with the provisions of the *NSW Land Acquisition (Just Terms Compensation) Act 1991 and the Land Acquisition Reform 2016 process* (<https://www.propertyacquisition.nsw.gov.au/>). The acquisition process is ongoing and further consultation with landowners will be undertaken where required.

It is noted that property DP734584 Lot 47 has been acquired by Transport and will be used as an ancillary facility (AF12a) during construction of the project, which was outlined in the approval documents. The property has been included within the operational footprint for the purposes of detailed design, however may be removed depending on the proposed plan for future use and the need to include the area within the M12 Motorway controlled corridor.

Land use impacts

Seven properties in total would be impacted by increases to areas within the construction footprint, as shown in Table 4-11. Seven properties in total would also be impacted by increases to areas within the M12 operational footprint as shown in Table 4-12. All of the additional areas within the operational footprint are currently impacted by the construction work or are located within ancillary facility sites. No additional properties or permanent structures would be impacted by the footprint changes.

Other property impacts

There are a number of changes to roads in the area such as minor realignment to Elizabeth Drive and Clifton Avenue. Property adjustment plans for a number of private properties outside of the project area have been developed. These impacts relate to property fences and driveways which require minor adjustments to tie-in with the project. The locations are shown on Figure 2-3. These would not result in significant changes to property access. Transport will continue to consult with property owners affected by partial acquisition and temporary lease arrangements about property access and property adjustments as the project progresses.

As described in Table 4-11 commercial land and impact to Western Sydney Parklands comprise the largest area of the additional land impacted by the construction of the amended project (about 2.0 hectares). The following business will be further impacted by the detailed design:

- DP981720 Lot 1, market garden at 13 to 23 Salisbury Avenue – additional non-permanent commercial structures in the form of market garden shade house structures will be lost. Sheds and other buildings at this property were already approved for demolition but an additional area of 0.5 hectares of commercial infrastructure will be affected.
- DP120014 Lot B, Bara Lodge (Horse training facility) – The property accommodating this business is already substantially impacted by the project. As a result of the detailed design construction and operational boundaries, about 1.5 hectares of the property would be further impacted.

The detailed design would result in additional utility impacts to electricity transmission lines. This relates to an upgrade to overhead lines on Elizabeth Drive to provide a new connection into the project site, around 500 metres east of Range Road. These services would be upgraded during construction, in consultation with the relevant service provider to minimise any service disruptions. Transport would continue to engage with utility providers to refine potential utility modifications and protection measures through the design and construction process.

An additional 0.2 hectares of land that is part of the Western Sydney Parklands would be impacted during construction. This would not have further impacts on the facilities or functioning of the Wylde Mountain Bike Trail above that assessed in the approval documents.

Potential impacts of the detailed design on future growth and development for the Western Sydney Aerotropolis and Western Sydney Growth Area would be consistent with those described in the approval documents.

Other property impacts that would result from the detailed design would generally be consistent with the approval documents.

Access and connectivity

Minor changes to the alignment of Elizabeth Drive would result in the relocation of eastbound bus stop (Stop ID 217193). This would be relocated prior to construction commencing to a new permanent location. The bus stop is to be moved by 200 metres west of its current position along Elizabeth Drive.

The detailed design would not result in additional impacts upon other public or community infrastructure.

4.3.4 Environmental management measures

The environmental management measures identified in Section 7.1 of the AR submissions report are considered appropriate to manage the socio-economic, land use and property impacts associated with the detailed design. The proposed changes would not require any additional or amended environmental management measures.

4.4 Aboriginal heritage

4.4.1 Assessment methodology

This assessment considers if the proposed changes outlined in Section 2.1 has an impact on the Aboriginal heritage impacts described in the approval documents. An updated assessment was carried out by KNC and is provided in full in Appendix B.

The assessment methodology aligned with the methodologies outlined in the approval documents, notably the project documentation specific to Aboriginal cultural heritage:

- Jacobs Group (Australia) Pty Ltd, October 2019. *M12 Motorway Environmental Impact Statement: Appendix I Aboriginal Cultural Heritage Assessment Report*. Report to Roads and Maritime Services
- Jacobs Group (Australia) Pty Ltd, October 2019. *M12 Motorway Environmental Impact Statement: Archaeological Assessment Report*. Prepared for Roads and Maritime Services
- Jacobs Group (Australia) Pty Ltd, October 2020. *M12 Motorway Amendment Report: Appendix E Aboriginal heritage supplementary technical memorandum*. Prepared for Transport for NSW.

The assessment included an updated search of the Aboriginal Heritage Information Management System (AHIMS) database to confirm the location and status of Aboriginal archaeological sites. Search results are provided in Appendix B.

4.4.2 Existing environment

The existing environment has not significantly changed since the preparation of the approval documents. The environment described in the project documentation listed in Section 1.1 and is still applicable to the detailed design.

4.4.3 Assessment of potential impacts

The proposed amendments to the project are primarily related to changes and refinements to the construction and operational boundaries between Badgerys Creek in the west and the Cecil Park Reservoir access road in the east. These areas were identified where the construction and operational boundary has changed since the finalisation of the project documentation described above and the issue of project approval, and now exceeds the (former) approved construction footprint.

All boundary adjustment areas fall within the 'detailed investigation area' previously assessed for Aboriginal cultural heritage during preparation of the approval documents and existing project documentation. Identified Aboriginal archaeological sites in the vicinity are shown in Appendix B, including:

- BCE (part of South Creek Complex Aboriginal site complex)
- SCW T1 (part of South Creek Complex Aboriginal site complex)
- SCW T2 (part of South Creek Complex Aboriginal site complex)
- SCE (part of South Creek Complex Aboriginal site complex)
- KNW (part of Kemps Creek Complex Aboriginal site complex)
- KCW (part of Kemps Creek Complex Aboriginal site complex)
- KCE (part of Kemps Creek Complex Aboriginal site complex)

- PCP8
- RR.

These sites are located wholly or partially within the existing project boundary as per the approval documents and will be impacted by the project.

Minor additional impacts to the sites from the proposed boundary adjustments are considered to be consistent with the existing impacts identified in the EIS, Amendment Report and existing project documentation. As the impacts are considered to be consistent, the existing management requirements and recommendations for the sites should be maintained for the boundary adjustment areas.

The AHIMS search findings, provided in Appendix B, are consistent with the findings of Approval documentation. The AHIMS search findings are consistent with the findings of the approval documents. The proposed boundary adjustments would not impact additional AHIMS sites.

4.4.4 Environmental management measures

The boundary adjustment areas are consistent with the findings of the approval documentation. Existing management requirements and recommendations for the identified sites should be maintained for the boundary adjustment areas. The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage the impacts to Aboriginal heritage associated with the detailed design. No additional or amended environmental management measures are required for the detailed design.

4.5 Non Aboriginal heritage

4.5.1 Assessment methodology

The non-Aboriginal heritage supplementary technical report is provided in Appendix C, and a summary is provided below. This section should be read in conjunction with Section 7.6 and Appendix J of the EIS and Section 6.6 and Appendix F of the amendment report. The study area for this assessment is the area within the construction footprint, as shown in Figure 2-2.

The updated assessment considers the following changes:

- Minor boundary changes to the construction footprint as shown in Figure 2-2
- Locations identified for property adjustment plans
- No changes to operation of the project have been identified that would alter the heritage assessments included within the approval documents.

This assessment also considers impacts to features relating to the Fleurs Radio Telescope Site which had not been identified at the time the approval documents were completed. A site inspection undertaken on 15 July 2021 to identify the fabric remains of the Fleurs Synthesis Telescope (FST) antennas that were not previously assessed. The site inspection included the identification of additional elements, such as concrete plinths and concrete pads.

4.5.2 Existing environment

The existing environment has not significantly changed since the preparation of the approval documents. The environment described in Section 7.6 and Appendix J of the EIS and Section 6.6 and Appendix F of the amendment report is still applicable to the detailed design. Appendix J of the EIS included a separate assessment for the Fleurs Radio Telescope site carried out by Wallis Heritage Consulting.

The Fleurs Radio Telescope Site portion of the study area is located immediately north of Lot 1 DP74574 and the Suez Kemps Creek Resource Recovery Park. It is characterised by a cleared, semi-rural property. The Fleurs Radio Telescope is listed in part on the Penrith LEP 2010 (I832) and in part on the State

Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (I5) as an item of local heritage significance. A significance assessment of the site was prepared in 2016. This was updated for the 2019 EIS assessment. Both assessments identified that the Fleurs Radio Telescope Site may be an item of State or potentially National heritage significance. However, there is no indication that the item has been nominated or listed for either the State Heritage Register or National Heritage List.

The Fleurs Radio Telescope Site includes remains of the Mills Cross, Shain Cross, Chris Cross and FST antennas, all of which played a major role in the development of Australia’s radioastronomy industry. The majority of these items occupy land approximately one kilometre east of the study area. Later additions to the FST are present within the study area. The findings of the site inspection of the portion of the Fleurs Radio Telescope site that fall within the central section of the M12 project area shown in Figure 4-6.

Table 4-13 lists the new items, in addition to the previously reported items for this site. Further details are provided in Appendix C.

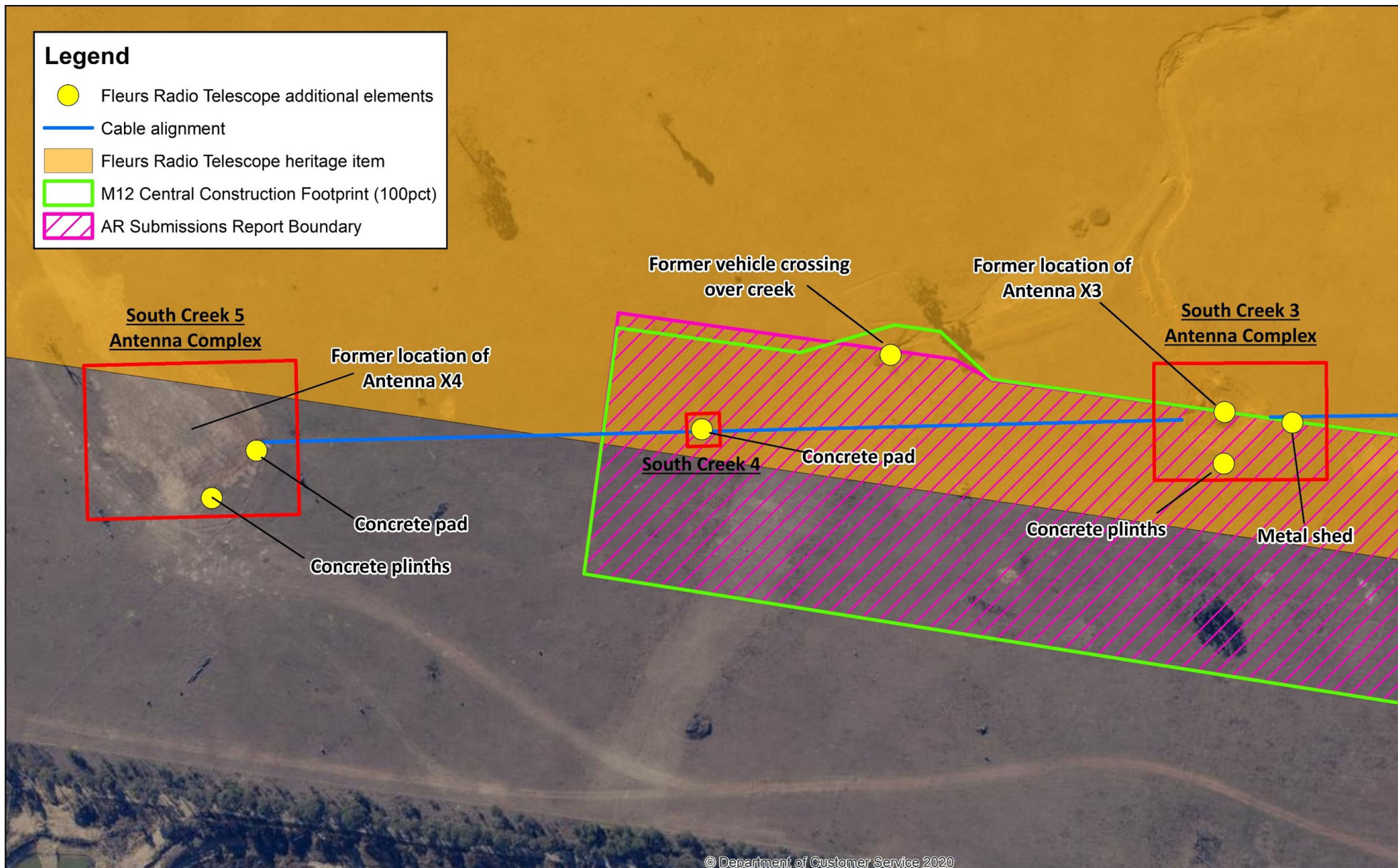
Table 4-13: Identified Fleurs Radio Telescope elements relevant to the current assessment

Document	Name	Identified Elements	Comments
EIS	South Creek 1 Antenna Complex	Signal box, three plinths, cable trench, antenna footing trench	The EIS suggests that SCAC1 was the site of an antenna that was subsequently moved to CSIRO Marsfield. However, aerial photographs and technical drawings of antenna locations do not indicate there was an antenna at this location. Antenna X1 was located east of the Chris Cross; Antenna X2 remains in a dilapidated state on site (EIS South Creek 2 Antenna Complex); Antenna X3 and X4 were not identified in the EIS and are assessed in this report (see South Creek 3 Antenna Complex and South Creek 4 Antenna Complex below).
EIS	South Creek 2 Antenna Complex	Antenna X2, signal box, power structure, fenced enclosure	Antenna X2 collapsed
This report	South Creek 3 Antenna Complex	Former location of antenna X3, metal shed, concrete plinths, cables	Antenna X3 removed, likely relocated to CSIRO Marsfield
This report	South Creek 4	Concrete pad, cables	Most equipment and housing shed have been removed

Document	Name	Identified Elements	Comments
This report	South Creek 5 Antenna Complex	Former location of antenna X4, concrete pad, concrete plinths, cables	Location of antenna X4 backfilled following the relocation of antenna X4 to Marsfield. Most equipment and hosing shed associated with concrete pad have been removed. The South Creek 5 Antenna Complex is located within the M12 west portion of the construction footprint, however was included in Appendix C for completeness.
EIS and this report	Underground cables	Cables, compressed air hoses, power supply cables identified at concrete pads and within metal shed	Aerial photographs suggest underground cable trench linking antenna X2, X3 and X4
This report	Former vehicle crossing over creek	Concrete culverts, deteriorated vehicle crossing	Aerial photographs suggest this creek crossing was used during installation of X3 and X4

Legend

- Fleurs Radio Telescope additional elements
- Cable alignment
- Fleurs Radio Telescope heritage item
- M12 Central Construction Footprint (100pct)
- AR Submissions Report Boundary



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	<p>Fleurs Radio Telescope Heritage Item and Additional Elements 21084 - M12 Central Consistency Assessment LGA: Penrith City Council Figure 4-6</p>	<p>SCALE 1:1,850</p>	<p>SIZE @A4</p>	<p>DATE 17/09/2021</p>		
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4.5.3 Assessment of potential impacts

Minor change to the construction boundary

A review of the minor changes to the construction boundary as shown in Figure 2-2, has been carried out. A minor increase to DP258414 Lot 21 is required to accommodate scour protection measures needed for a drainage culvert. This will impact the Fleurs Radio Telescope Site by an additional 0.1 hectare. Impacts to this site are discussed further below.

Other boundary changes do not impact non-Aboriginal heritage features.

Property adjustment plans

The locations identified for property adjustment plans comprise existing hardstand areas or areas of exotic agricultural land. The changes proposed mostly relate to driveways and property fencing. The location of the property adjustments do not impact upon any additional features of non-Aboriginal significance and do not increase impacts to already impacted sites.

Fleurs Radio Telescope Site

Fleurs Radio Telescope Site concrete pads, cables and cable trenches identified during the site inspection are associated with dish antennas established for the FST (formerly the Chris Cross) between 1975 and 1978. These were erected by the University of Sydney after it took over management of the site in 1963. Due to their associations with the FST and the Fleurs Radio Telescope site overall, they are considered to have little to moderate significance as individual elements of the former dish antennas. Table 4-14 provides an assessment of significance for additional Fleurs Radio Telescope site that were not subject to inspection and assessment for the approved project.

Table 4-14: Grades of significance for FST elements within the study area

Site	Element	Grading	Justification
South Creek 3 Antenna Complex	Former location of antenna X3	Little	In poor condition. Antenna removed, livestock and erosion are altering the appearance of the excavated basin, remaining visible conduits are generally in poor condition.
	Metal shed	Moderate	In poor condition. Shed collapsing, hazardous to access. Conduit access points for high pressure hoses, power supply, and other cables still in place, former server rack collapsed and in poor condition. Power supply board intact.
	Concrete plinths	Moderate	Original function unknown, evidence from late 1980s that the concrete plinths were used as a survey marker and to orient GPS equipment; similar to concrete plinths identified in the M12 EIS at South Creek 1 Antenna Complex and North Antenna Complex.
South Creek 4 Complex	Concrete pad	Little	Element in poor condition, most fabric has been removed, potential remains of a former server or control equipment.

Site	Element	Grading	Justification
South Creek 5 Antenna Complex (located in M12 west)	Former location of antenna X4	Little	Former location of antenna X4 has been backfilled and is no longer visible.
	Concrete pad	Little	Element in poor condition, most fabric has been removed, potential remains of a former server rack, concrete pad eroding exposing PVC conduits.
	Concrete plinths	Little	Original function unknown, similar to concrete plinths identified in the M12 EIS at South Creek 1 Antenna Complex and North Antenna Complex.
Cable alignment	Cables and high-pressure hose	Moderate	Likely to be in good condition – sub-surface. The range of cables and high-pressure hoses that are installed on the alignment between X2, X3 and X4 is indicated by the PVC conduits and cables/hoses visible at SC3AC, SC4C, and SC5AC. The cables and high-pressure hose remains have significance as an element of the FST operation. However, with the antennas removed, most of the operating equipment removed, and cables/hoses severed, their original function and operation is not easily interpreted based on remaining evidence.
Former vehicle creek crossing	Concrete culverts overlaid with fill	Little	Access to antennas during construction and use, deteriorated and in poor condition.

The former location of antenna X4 is outside the heritage curtilage of the Fleurs Radio Telescope heritage item. However, due to antenna X4 being an integral part of the Fleurs Radio Telescope site, it is assessed as part of that heritage item.

This assessment has identified evidence to suggest that both antenna X3 and antenna X4 were removed by the CSIRO in 2004/2005, refurbished, and installed at CSIRO Marsfield. The refurbishment and continued use of these dishes by the CSIRO is a positive heritage outcome. No identified portion of antenna dish X3 and dish X4 will be impacted by the M12 project.

Remains of equipment for control and power of antennas X3 and X4 will be partially impacted, including the concrete plinths associated with X3, the former location of Antenna X4 and associated concrete pad, and the concrete pad between antennas X3 and X4. Impacts to the former location of antenna X3 and associated metal shed would be avoided, as well as the concrete plinths associated with antenna X4 and the former vehicle access track. However, much of the control and power equipment at these sites have been removed, and what remains is in generally poor condition.

The M12 EIS assessed overall impacts to the Fleurs Radio Telescope site as **minor**. Due to the previous removal of antennas X3 and X4, and the generally poor condition of remaining control equipment, impact to additional FST remains assessed in this report will result in a **minor** overall impact to the Fleurs Radio Telescope heritage item, which is consistent with the M12 EIS impact assessment for the Fleurs Radio Telescope site. The predicted impacts for the detailed design therefore remain consistent with the approved project. Table 4-15 summarises the impacts resulting from the detailed design in comparison to the approved project.

Table 4-15: Comparison of adverse heritage impacts

Heritage item name	Register listing and significance	Approved project (based upon the AR submissions report construction footprint)	Detailed design
The Fleurs Radio Telescope Site	<p>Penrith local environment plan (LEP) 2010 Item no. 1832.</p> <p>Assessed as local on LEP.</p> <p>Assessed as State with potential for National in 2016 Strategic Route Options Analysis and 2019 EIS.</p>	Minor – no change from M12 EIS impact assessment	Minor – no change from M12 EIS and M12 AR Submissions Report

4.5.4 Environmental management measures

The impacts to non-Aboriginal heritage associated with the detailed design are generally consistent with the impacts described in the approval documents. The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage the impacts with the addition of the following to REMM NAH05 to manage the additional items within the Fleurs Radio Telescope site, where text in bold are new requirements.

REMM NAH05:

All extant elements of the radio telescopes and associated infrastructure, including rubbish mounds situated outside the construction footprint will be left intact

Ground penetrating radar, or other remote sensing survey techniques, will be carried out under the supervision of a suitably qualified and experienced archaeologist before any ground disturbance within the heritage curtilage of the Fleurs Radio Telescope Site contained within the construction footprint to identify any sub-surface cables

- **If additional sub-surface FST components are unexpectedly identified during ground penetrating radar survey which have not been discussed as part of the consistency assessment, then additional assessment and management would be required. This would include, but may not be limited to, archival survey and recording**

Measures will be included in the CHMP to describe how the heritage values of the site will be conserved and managed during construction.

Transport will engage a suitably qualified heritage consultant to prepare an archival photographic recording of the impacted areas of the property, in accordance with ~~DPC (Heritage)~~ **Heritage NSW** guidelines (Heritage Council of NSW 2006). The archival recording report will include but not be limited to:

- **Detailed survey drawings and photographic archival recording of remaining above-ground elements of the Fleurs Radio-telescope site. This survey will detail the exact location and orientation of remnant fabric within the landscape, including fabric associated with the former location of FST antenna X3 and antenna X4, the concrete pad between antennas X3 and X4, and the former vehicle access track Survey drawings will be included in the archival recording report**
- **Outcomes of the remote sensing survey undertaken by GHD in 2021 to provide a comprehensive record of the site (or as comprehensive as possible prior to excavation)**

- **Details of sample cables collected including original exact location by description, co-ordinates and mapping.**

Prior to construction TfNSW will consult with relevant interested organisations (such as CSIRO, Universities, amateur telescopic organisations, local heritage bodies and other special interest groups) to determine if there is interest in retaining sub-surface cabling (including details on the type and length cabling to be retained) or other structures identified during archival recording, remote sensing or any unexpected additional cables found during construction

The M12 West and M12 Central Contractor will (with advice from TfNSW Overarching Archival Recording Contractor) be responsible for the following:

- **Retrieval of a sample of each type of cable / compressed air hose along the cable alignment between antennas X3 and X4 with supervision by a heritage specialist. This will include retrieval of 1-2m (or a length directed by TfNSW following consultation with stakeholders) of each type of cable / compressed air hose including the relevant attachment. The selection of the types and length of cables / hose to be collected will include consideration of the following:**
 - **Physical review of the cables / hose types visible at South Creek 3 Antenna Complex, South Creek 4 Complex, and South Creek 5 Antenna Complex**
 - **Any additional information identified through remote sensing survey of the cable alignment**
 - **Discussion with archival recording or other relevant heritage specialists where required**
 - **Outcomes from the consultation undertaken by TfNSW with interested parties**
 - **Cable samples will be collected, with consideration given to potentially contaminated materials, such as asbestos and PCBs. Appropriate WHS measures will be implemented in accordance with the Contractor's WHS Plan**
 - **Cable samples will be tagged, including exact location by description and relevant coordinates of the cabling prior to its extraction**
 - **Safe storage of cable samples until collection by interested parties. If samples are unclaimed by interested parties within three months, they will be appropriately disposed of at a licensed landfill by the contractor**
- **Where cabling is not impacted by construction works, it can remain in-situ, otherwise the contractor is responsible for appropriate disposal.**

Concrete plinths:

- **Prior to construction, the contractor must establish an exclusion zone around the concrete plinths at South Creek 3 Antenna Complex (Central) and South Creek 5 Antenna Complex (West) to protect against inadvertent impacts during construction**
- **If leaving the plinths in situ during construction is not practicable, they will be removed and stored temporarily with survey information providing details of their position relative to each other and orientation. The Contractor will then investigate opportunities for re-establishing the concrete plinths on site close to their original location and/or as part of the interpretative display for the Radio Telescope site. If re-established, the survey information collected prior to their removal must be used to ensure that the plinths are located in the same orientation and arrangement**
- **Prior to removal of the concrete plinths, the contractor is to identify whether any of the plinths are used as state survey marks. The contractor must comply with the preservation of survey infrastructure requirements in TfNSW specification G71. It is noted TS7279 is located on one of the plinths at X3.**

Measures for M12 Central only:

- **Prior to construction the contractor must establish an exclusion zone around the former location of antenna X3 at South Creek 3 Antenna Complex to protect against inadvertent impacts during construction**
- **Prior to construction the contractor must establish an exclusion zone around the metal shed at South Creek 3 Antenna Complex to protect against inadvertent impacts during construction.**

The heritage interpretation framework for the project (NAH02) will include interpretation measures that will improve community awareness of the history of the Fleurs Radio Telescope as well as determine suitable locations for the presentation of information that are publicly accessible.

4.6 Noise and vibration

4.6.1 Assessment methodology

This assessment considers if the proposed amendments outlined in Section 2.1 changes the noise and vibration impacts described in the approval documents. An updated assessment is provided in full in Appendix D and summarised below.

This assessment has reviewed the approval documents listed in Section 1.1 and the following reports relating to noise and vibration impacts, prepared for the approval documents:

- Transport for NSW (2019, October), M12 Motorway Environmental Impact Statement, Appendix K Noise and Vibration Assessment Report
- Transport for NSW (2020, May), M12 Motorway Amendment Report, Appendix G Noise and vibration updated technical report
- GHD (2021), M12 Motorway Noise and Vibration Assessment Report (NVAR)
- GHD (2021), M12 Motorway Operational Noise and Vibration Review (ONVR).

This assessment accords to the same methodology presented within the approval documents. The assessment uses the same noise catchment areas as defined in the approval documents.

The following guidelines have been referenced for the assessment:

- Interim Construction Noise Guideline (ICNG) (DECC, 2009)
- Road Noise Policy (RNP) (DECCW, 2011)
- Noise Criteria Guideline (NCG) (Transport for NSW, 2015)
- Noise Mitigation Guideline (NMG) (Transport for NSW, 2015)
- Construction Noise and Vibration Guideline (CNVG) (RMS, 2016)
- Draft Construction Noise and Vibration Guideline (RMS, 2019).

The assessment criteria is discussed in Appendix D.

As required by REMM NV14 from the AR submission report, an ONVR has been prepared to analyse operational mitigation measures. The ONVR has provided a qualitative review of the operational changes proposed for detailed design.

4.6.2 Existing environment

The existing environment has not significantly changed since the preparation of the approval documents. The environment described in the project documentation listed in Section 4.6.1 is still applicable to the detailed design. The existing environment remains dominated by road traffic noise from Elizabeth Drive and Mamre Road and natural noise sources during periods of low traffic.

The central section includes sensitive receivers located in the following NCAs:

- **NCA03:** located to the north of Elizabeth Drive and west of the M7 Motorway, extending to the west of Mamre Road
- **NCA04:** located to the north of Elizabeth Drive and west of the M7 Motorway and extends west to the intersection of Devonshire Road and Cross Street
- **NCA05:** located to the south of Elizabeth Drive and west of the M7 Motorway and extends west to Kemps Creek
- **NCA06:** located to the west of Kemps Creek and east of South Creek and extends to the north and south of Elizabeth Drive
- **NCA07:** located to the west of Kemps Creek, east of Cosgrove Creek, and north of Elizabeth Drive.

4.6.3 Assessment of potential impacts

Construction

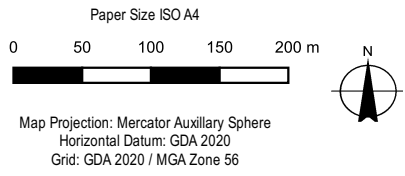
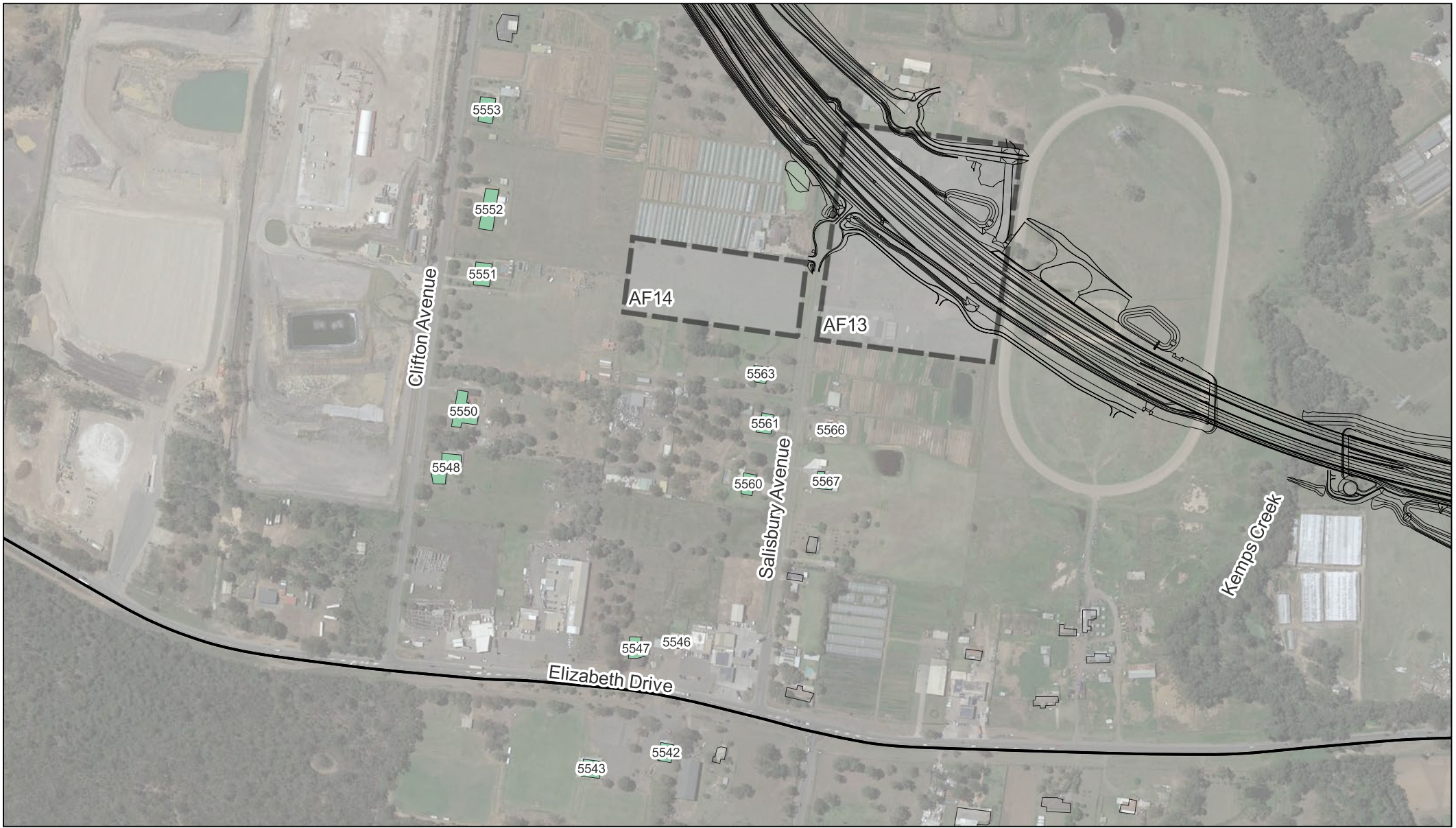
The amendment report considered two construction compounds (AF13, AF14) in the vicinity of Salisbury Avenue. Construction compound AF14 has been removed as it is not available to use during construction and construction noise impacts at sensitive receivers located near AF14 have the potential to decrease. The locations of the construction compounds are shown in Figure 2-2.

Construction noise modelling from operation of the following compound scenarios near Salisbury Avenue was undertaken to determine the change in impacts from the removal of AF14.

- Operation of two compounds: AF13 and AF14
- Operation of one compound: AF13.

Activity sound power levels are based on the details provided in Annexure C of the amendment report.

Construction noise levels are predicted to reduce at up to 15 sensitive receivers with the reduction in noise level ranging from 0.1 dBA at receivers on the eastern side of Salisbury Avenue to 12 dBA at receivers located along Clifton Avenue. No change in the predicted construction noise impacts detailed in the amendment report are anticipated at other sensitive receivers. The highest reduction in noise levels is located at receivers on Clifton Avenue as the removal of the proposed compound AF14 results in construction compound activities being located at further distances. The residences where construction noise levels are predicted to decrease as a result of the removal of AF14 are shown in Figure 4-7.



- Legend**
- Road design
 - Compound location
 - Decrease in noise level



Transport for NSW
M12 Motorway Central Section
Consistency Assessment - Noise and Vibration
Locations with a predicted decrease
in compound construction noise
levels

Project No. **12514239**
 Revision No. **A**
 Date. **16/08/2021**

Figure 4.7

Operation

A qualitative assessment of the likely noise impacts associated with the design, parameter and model input changes has been completed. Changes between the detailed design alignment and the AR submission report alignment include horizontal and vertical alignment and road surface. A summary of the impacts related to detailed design are provided in Table 4-16. Only items that have changed between the amendment report noise model and the detailed design noise model have been included in this table. All other modelling parameters and design inputs are deemed to be consistent with the approved project.

Predicted noise levels are anticipated to decrease due to the change in road surface correction from concrete to diamond grind. This would not increase the requirements for mitigation (such as at-property treatments or noise walls). The impacts from the detailed design are deemed to be consistent with the approved project.

The operational changes and assessment are detailed in the *M12 Motorway Noise and Vibration Assessment Report* (NVAR) (GHD, 2021) prepared for the project.

Table 4-16: Likely changes to predicted noise levels

Parameter/ model input	Change between AR and detailed design model	Likely impact on noise level predictions
Building footprints	Yes	Minor impact. Additional buildings identified or changes in the building occupation type may affect the number of receivers qualifying for consideration of additional noise mitigation.
Receiver locations	Yes	The most-impacted façade used for the barrier analysis is not defined in the EIS assessment. Changes to the most-impacted façade between assessments may have a minor impact on barrier analysis results.
Receiver heights	Yes	Minor to moderate impact as source heights have the potential to change significantly. Ground floor receivers are unlikely to change significantly, however first floor receivers may change as height between floors will increase from 2.8 m to 3.0 m.
Road source heights	Yes	Minor to moderate impact due to vertical realignment of the proposed road alignment and additional effects due to the detailed design terrain adjacent the road.
Road surface corrections	Yes	Predicted noise levels would be lower due to changing the road surface along the project road from concrete (+3.0) to diamond grind (+0.0) correction.
Road source traffic volumes	Yes	Road traffic volumes along Salisbury Avenue have changed between the AR and the NVAR due to the removal of traffic volumes associated with the Devonshire Road to Mamre Road link. The removal of this link would increase traffic volumes along Elizabeth Drive and Mamre Road however the impacts are expected to be low due to high levels of existing traffic on these roads.

Parameter/ model input	Change between AR and detailed design model	Likely impact on noise level predictions
Noise barrier locations (mitigation)	Yes	No noise barriers are proposed as part of the approved project based on a reasonable and feasible assessment. No changes to this assessment would be expected.

The project remains generally consistent with the approval documents however the combined effect of the detailed design has resulted overall in a reduction in the number of receivers impacted and who qualify for mitigation within the M12 central section.

4.6.4 Environmental management measures

The removal of AF14 is predicted to reduce construction noise levels from compound operations at up to 15 sensitive receivers. No change to the construction noise and vibration management measures would be required as a result of the removal of this compound as these receivers would still be impacted by other activities associated with road construction.

The CNVG additional management measures are detailed in Table 7-2 of Appendix G Noise and Vibration Updated Technical Report to the amendment report. The management measures for construction noise and vibration would be consistent with the measures outlined in the approval documents.

The management measures for operational noise would generally be consistent with the measures outlined in the approval documents however the change in road pavement surface has the potential to reduce the number of receivers that would require mitigation.

Operational noise and vibration mitigation measures would be detailed in the ONVR that would be finalised following detailed design in accordance with NV14 of the AR submissions report. This report would summarise the changes to the operational noise management measures.

4.7 Flooding

4.7.1 Assessment methodology

The revised flooding assessment provided in Appendix F has utilised the same flood model used for the EIS and amendment report. The amendment report included only minor updates to the flooding component of the EIS, related to the cumulative impacts of future development to private land. These impacts have been assessed through the detailed design flood model, while a cumulative flood study of the Western Sydney Aerotropolis area was considered beyond the scope of the central section of the project.

During the detailed design phase of the project, flooding criteria were updated in accordance with the requirements of the NSW conditions of approval. It should be noted that the conditions of approval are more stringent in places than the REMMS in the approval documents.

The approved project flood assessment focused on the key areas influenced by flooding which for the central section comprised the South Creek and Kemps Creek bridge crossings. Flood modelling of minor waterways and drainage lines were not included in that assessment, and culverts were separately designed for free-flowing drainage.

As part of the detailed design process the flood model was updated to include the entire M12 central section alignment including all transverse drainage culverts. In addition the minor waterways and drainage lines were assessed within the flood model.

4.7.2 Existing environment

A detailed description of the existing environment is provided in Appendix L and Section 5 of the EIS. The project is located within the South Creek sub-catchment of the Hawkesbury-Nepean catchment and intersects Cosgroves Creek, Badgerys Creek, Kemps Creek and South Creek. The M12 central section project covers the Kemps and South Creek crossings. The project also intersects a number of minor drainage lines, including Ropes Creek. A detailed description of the existing surface water environment is provided in Appendix M and Section 4 of the EIS.

4.7.3 Assessment of potential impacts

Changes in flood affectation

The results of the updated flood assessment have identified a number of increases in flood level assessed that are above the criteria set out in condition of approval E17. These are listed in Table 4-17. Condition of approval E17 requires a maximum increase in flood level of 100 millimetres (mm) in land zoned as rural or environmental and a maximum increase of 50 mm in land zoned as residential, industrial or commercial. Where the criteria cannot be met, the conditions of approval allow for consultation with affected landowners.

Only South Creek and Kemps Creek in the M12 central section were assessed in the approval documents, other locations were not assessed. At South Creek, the EIS predicted 1 per cent Annual exceedance probability (AEP) afflux of 93 mm and 143 mm at the upstream and downstream of the M12 operational boundary respectively. The latest flood modelling predicts higher upstream impacts (up to 206 mm) largely occurring as result of the design of the Sydney University access bridge (BRXX) and approaches upstream of the M12 which have been modelled in greater detail, compared to the EIS.

Changes to peak stormwater flows, downstream velocity and scour potential

The updated flood assessment has identified a number of increases in flood velocity that do not meet the criteria outlined in the conditions of approval. These are listed in Table 4-17. Condition of approval E17 requires a maximum increase in velocity of 10 per cent where the resulting velocity is greater than 1.0 metre per second (m/s). The conditions of approval allow increases above the criteria where adequate scour protection measures are implemented, where velocity increases do not exacerbate erosion or where alternate mitigation can be negotiated with the landowner.

Locations other than South Creek and Kemps Creek were not assessed during the EIS. While the EIS did note that velocity increases in excess of 20% would occur at South Creek which is consistent with the findings of the updated assessment, the terms of the Infrastructure Approval prevail and must be complied with.

Changes in flood hazards

No significant increases in flood hazard category outside of the project area were observed. As such the detailed design has not resulted in any changes to flood hazard compared to what was assessed in the approval documents and is consistent with the approved project.

Changes to hydraulic flow conveyance and beneficial floodplain inundation

The detailed design is consistent with the approved project in that flow distributions are largely unaltered and flood plain storage is retained by minimising changes in flood levels in the waterways outside the project area.

Changes to flow conveyance are consistent with the approved project with the exception that the South Creek and Kemps Creek adjustments proposed in the approval documents have been removed and existing flow conveyance at South Creek and Kemps Creek is largely retained.

Impacts on emergency management, evacuation and access

Flood evacuation routes in the vicinity of the project are improved due to the flood immunity of the project.

The detailed design has not resulted in any changes to emergency management and evacuation as assessed in the approval documents and is consistent with the approved project.

Climate change

The 0.5 per cent AEP and 0.2 per cent AEP storm events have been considered as an approximation to the representative future emissions scenarios leading to climate change. These results have been compared with the 1 per cent AEP results as a sensitivity check.

The detailed design has not resulted in any negative changes to the assessment of climate change in the approval documents and is consistent with the approved project.

Summary of impacts

The updated assessment has included the wider study area and more detailed analysis of flooding impacts using the updated flood model and the latest detailed design of bridges and transverse culverts. Table 4-17 summaries the flood impacts where the final conditions are approval criteria are not achieved and where further assessment is required or consultation is needed. The location of each area is shown on the figures provided in Appendix F. Flood level afflux refers to the increase in flood level due to the proposed design when compared with the existing condition.

Table 4-17: M12 central section flood impacts where further assessment is required

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C20090	Velocity increase exceeds criteria in Conditions of Approval (E17 (g))	Sydney University	<p>Velocities increased from 1.4 m/s to 1.7 m/s over small area of land near the M12 operational boundary in a 1% AEP flood event. Impacts are reduced in more frequent flood events.</p> <p>Additional land was acquired at the downstream side of the culvert to assist with transitioning culvert to a more natural velocity near the project boundary.</p>	Not assessed in approval documents	<p>In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present.</p> <p>The site specific assessment would involve consulting with Sydney University, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.</p>

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
South Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(e)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Sydney University	Afflux 0.11 m exceeds 0.10 m allowable impact criteria in land zoned environment and recreation over small portion of land upstream of M12 operational boundary at the western edge of the floodplain. The predicted flood level increase is 0.01 m higher than the Conditions of Approval criteria allow and this is the limit of accuracy of the flood model. Various relief culvert configurations were trialed to minimise the impact. A second flood relief culvert was introduced into the design with the aim of reducing flood level impacts during detailed design. Limited project corridor space precluded further refinement. Velocities increase from 1.3 m/s to 2.0 m/s downstream of M12 in a 1% AEP flood event. This impacts a small area of land adjacent to South Creek zoned Environment and Recreation within the Sydney University property.	Afflux 0.93 m recorded at upstream project operational boundary at South Creek in approval documents	Afflux: The predicted flood level increase is 0.01 m higher than the Conditions of Approval criteria allow and this is the limit of accuracy of the flood modelling. In accordance with the conditions, it is proposed to consult with Sydney University to obtain acceptance of the impact which occurs in the floodplain immediately upstream of the M12 corridor. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present. The site specific assessment would involve consulting with Sydney University, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
BRXX Sydney University Access Bridge) and South Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(e)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Sydney University	Afflux 0.21 m exceeds 0.10 m allowable impact criteria in land zoned environment and recreation Velocities increase from 2.1 m/s to 2.4 m/s on floodplain and from 1.2 m/s to 2.0 m/s in South Creek. The Sydney University access bridge was part of the EIS Concept Design however the localised flooding impacts of this bridge were not assessed for the EIS. Lowering of the bridge is not expected to reduce afflux due to additional head losses associated with the bridge deck being submerged. Additionally this would increase the risk of flood damage to the bridge and creek scour depths would be increased due to pressure scour from the interaction of flood water with the bridge deck.	Afflux 0.93 m recorded at upstream project operational boundary at South Creek in approval documents	Afflux: The predicted flood level increase is attributable to the presence of the University access bridge. In accordance with the conditions, it is proposed to consult with Sydney University to obtain acceptance of the impact which occurs in the floodplain immediately upstream of the M12 corridor. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Scour protection has been provided in the design under the Sydney Uni access bridge and downstream on the eastern bank of South Creek. This will be placed in vulnerable areas of the creek banks following a site inspection and assessment of existing creek bank vegetation, prior to the construction phase. The site specific assessment would involve consulting with Sydney University, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C22981	Flood level afflux exceeds criteria in Conditions of Approval (E17(d)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Lot 6, DP812284	Afflux 0.20 m exceeds 0.05 m allowable impact criteria in land zoned Enterprise. The M12 outflow joins the Kemps Creek 1% AEP flood extent some 10 m downstream of the boundary. As noted in the EIS there is an increase in flowrate predicted downstream of the M12 boundary at this location. The corridor does not provide space to provide detention storage to mitigate the flow increase. Velocities increase from 0.9 m/s to 1.1 m/s downstream of M12. The velocity impact is not considered likely to result in scour.	Appendix M (Surface Water Quality and Hydrology Assessment) of the EIS predicted an increase of 0.16 m at this location.	Afflux: In accordance with the conditions of approval, it is proposed to consult with the affected landowner to obtain acceptance of the impact which occurs in the floodplain immediately downstream of the M12 corridor. Mitigation may include acquisition of a drainage easement in accordance with landowner approval, as proposed as a possible mitigation solution in the EIS. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present. The site specific assessment would involve consulting with the affected landowner, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C23810	Flood level afflux exceeds criteria in Conditions of Approval (E17(e))	Lot 2, DP736951	Afflux 0.31 m exceeds 0.10 m allowable impact criteria in land zoned Environment and Recreation.	Not assessed in approval documents	Land is to be acquired by TfNSW. No mitigation is required.
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot B, DP102214	Afflux exceeds 0.01 m at building floor level upstream of the project boundary. The building appears to be a shed located with the 5% AEP flood extent of Kemps Creek. The land is zoned Environment and Recreation. Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation and approval from with the owner Lot B, DP102214.	EIS determined a 1mm impact upstream of the M12	Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the shed and its contents and seek permission to undertake a site visit. If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary to depart from the criteria set out in the Conditions of Approval would need to be obtained.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot 30, DP30265	<p>Afflux exceeds 0.01 m at building structures upstream of the project boundary. The structures appear to be greenhouse structures located with the 5% AEP flood extent of Kemps Creek.</p> <p>The land is zoned Environment and Recreation.</p> <p>Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation, additional consistency assessment and approval from with the owner Lot B, DP102214.</p>	EIS determined a 1mm impact upstream of the M12	<p>Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the structures and their contents and seek permission to undertake a site visit.</p> <p>If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary to depart from the criteria set out in the Conditions of Approval would need to be obtained.</p>

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot 13 DP30265	<p>Afflux exceeds 0.01 m at building floor level downstream of the project boundary. The structure appears to be shed located with the 1% AEP flood extent of Kemps Creek.</p> <p>The land is zoned Environment and Recreation.</p> <p>Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation and approval from with the owner of Lot B, DP102214.</p>	EIS did not determine a downstream impact at this location	<p>Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the structure and its contents and seek permission to undertake a site visit.</p> <p>If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary to depart from the criteria set out in the Conditions of Approval would need to be obtained.</p>

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot 8, DP30265	<p>Afflux exceeds 0.01 m at building floor level downstream of the project boundary. The structures appear to be greenhouse structures located with the 1% AEP flood extent of Kemps Creek.</p> <p>The land is zoned Environment and Recreation. Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation, additional consistency assessment and approval from with the owner Lot B, DP102214.</p>	EIS did not determine a downstream impact at this location	<p>Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the structure and its contents and seek permission to undertake a site visit.</p> <p>If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary to depart from the criteria set out in the Conditions of Approval would need to be obtained.</p>

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C24090 (Kemps Creek Bridge Flood Relief Culvert)	Increase in inundation time exceeds criteria in Conditions of Approval. ¹ (E17(a))	Lot B, DP102214	<p>Increase in duration of inundation exceeds 1 hour within existing racetrack on west bank of Kemps Creek. Increase of between 1 and 2 hours in 1% annual exceedance probability (AEP). Options are being investigated to reduce the impact.</p> <p>The land is zoned Environment and Recreation. Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation, additional consistency assessment and approval from with the owner Lot B, DP102214.</p>	Not assessed in approval documents	Further options will be investigated to mitigate this impact. If this impact cannot be mitigated, Planning Secretary agreement will be required for this impact.

¹ Time of inundation refers to the duration of time that flooding depths are above 50 mm. CoA require that the increase in time of inundation is not greater than 1 hour when compared with the existing condition.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C26440	Flood level afflux exceeds criteria in Conditions of Approval (E17(e)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Western Sydney Parklands	Afflux 0.11 m exceeds 0.10 m allowable impact in land zoned environment and recreation in bushland downstream of M12 operational boundary. Velocities increase from 1.3 m/s to 1.8 m/s and 1.8 m/s to 2.0 m/s in bushland downstream of M12. These impacts are partly due to increased runoff from conversion of bushland to pavement and partially through the need to divert a small portion of the Hinchinbrook Creek catchment to the Kemps Creek. This was required because it was not possible to achieve the Water NSW NorBE requirements for flowrate and water quality in Hinchinbrook Creek within the confined corridor space. An option to install a gross pollutant trap was investigated but no suitable space was available and the road grading made outletting a buried structure difficult at this location due to a lack of fall between the road pavement level and the boundary level.	Not assessed in approval documents	Afflux: In accordance with the conditions of approval, it is proposed to consult with Western Sydney Parklands to obtain acceptance of the impact which occurs in the bushland immediately downstream of the M12 corridor. The afflux is 0.01 m above the 0.10 m allowable impact. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present. The site specific assessment would involve consulting with Western Sydney Parklands, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C27191	Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Western Sydney Parklands	Velocities increase from 1.1 m/s to 1.3 m/s upstream of culvert inlet outside M12 operational boundary.	Not assessed in approval documents	<p>In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present.</p> <p>The site specific assessment would involve consulting with Western Sydney Parklands, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary</p>

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C27350	Flood level afflux exceeds criteria in Conditions of Approval (E17(e))	Western Sydney Parklands	<p>Afflux 0.38 m exceeds 0.10 m allowable impact in land zoned environment and recreation in bushland upstream of M12 operational boundary. Impact is localised at culvert inlet upstream of water tower access road.</p> <p>These works lie outside the M12 operational boundary and it is not considered feasible to meet the Conditions of Approval 0.1 m afflux limit at the inlet of the culvert. The impact is confined to a small area of bushland adjacent to the Water Tower Access Road culverts extending less than 5 m upstream of the culvert.</p>	Not assessed in approval documents	In accordance with the conditions of approval, it is proposed to consult with Western Sydney Parklands to obtain acceptance of the impact which occurs in the bushland upstream of the M12 corridor.

4.7.4 Environmental management measures

The flooding impacts associated with the detailed design are generally consistent with the impacts described in the approval documents. The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage flood impacts.

No additional or amended environmental management measures are required for the detailed design.

As the flood assessment during detailed design has modelled a wider area and in greater detail than the assessment prepared for the approved projects, additional flooding impacts have been identified. No additional or revised environmental management measures have been proposed because the conditions of approval relating to flooding are considered adequate to manage these impacts. Further assessment and consultation with affected landowner will be ongoing and where impacts cannot be designed out, Transport would seek approval from the Planning Secretary, as required by condition of approval E17.

Further discussion regarding conditions of approval and REMMS which relate to flooding is provided in Section 5.

4.8 Surface water quality and hydrology

4.8.1 Assessment methodology

This surface water quality and hydrology assessment should be read in conjunction with Section 7.9 and Appendix M of the EIS and Section 6.9 and Appendix I of the amendment report. This assessment has considered the Division 5.2 Approval and the EPBC Approval and the project presented in the approval documents listed in Section 2. The study area was updated to include the amended construction and operational footprints as shown in Figure 2-2 and Figure 2-3.

Water quality criteria used for the detailed design is largely consistent with that used for the project.

The methodology included:

- A review of the proposed changes associated with the detailed design compared to the approved project, as they relate to surface water quality, hydrology, geomorphology, environmental water availability and water quality objectives
- A review of and confirmation of the sensitive receiving environments crossed by and adjacent to the project area
- A review of the environmental management measures and other treatment or monitoring measures proposed for the project as described in the approval documents
- Assessment of the impact of construction and operation activities of the detailed design on water quality and hydrology.

This assessment has also reviewed the approval documents listed in Section 2 and the following:

- The Erosion and Sediment Management Report (ESMR) SEEC (2021a)
- The Impact Assessment of Sediment Control Basin Discharges to Waterways SEEC (2021b)
- M12 Motorway – Central Package Detailed Design, Detailed Design Report, Constructed Wetlands Report, (GHD 2021), prepared on behalf of Transport
- M12 Motorway – Central Package Detailed Design, Detailed Design Report Stormwater Drainage Report (GHD, 2021) prepared on behalf of Transport.

This assessment considered the ability of the detailed design to meet the appropriate water quality limits for sediment basin discharges and ensure consistency with the specified water quality objectives. The indicators selected for the environmental values, adopted turbidity criteria, Total Suspended Solids and water quality objectives are as specified within the approval documents. The assessment considered DPI (2013) guidance on how to conserve and manage fish habitat, which includes avoiding impacts on water quality and fish passage.

4.8.2 Existing environment

Section 4.4 of Appendix M of the EIS and Section 6.9 of the amendment report describe the existing environment.

The key watercourses (and the tributaries) within the study area for the central section are South Creek and Kemps Creek. These are sensitive receiving environments due to their highly sensitive fish habitat. Hinchinbrook Creek is also a sensitive receiving environment due to its highly sensitive fish habitat. It is located outside of the study area and is situated approximately 600 metres from project boundary.

Ropes Creek which is an ephemeral first order tributary of South Creek is not identified as being a sensitive receiving environment. An unnamed tributary of Hinchinbrook Creek also has minimal fish habitat.

South Creek and Kemps Creek are deemed to be a sensitive receiving aquatic environment and are mapped as key fish habitat. Based on the presence of residual pools, woody debris and aquatic vegetation it is considered to be Type 1 (highly sensitive) key fish habitat.

WaterNSW mains includes the Upper Canal in a tunnel below Western Sydney Parklands around 400 metres to the south east of the M12 central section project area. The WaterNSW Upper Canal is classified as a 'controlled area' (access is restricted) under the *Water NSW Act 2014*, in order to protect the water supply infrastructure that is part of Greater Sydney's drinking water catchment. The Upper Canal begins at Pheasants Nest Weir on the Nepean River and transfers water 64 kilometres to the Prospect water filtration plant.

The general soil profile across the Kemps Creek study area is alluvium typically comprising stiff to very stiff clay overlying medium dense alluvial sand/ clay mixtures. These soils would have low scour potential due to their cohesive properties. The South Creek study area is characterised by depositional soils generally consisting of stiff to hard clays, sandy clays and gravelly clays overlying a weathered siltstone (Bringelly Shale) bedrock.

4.8.3 Assessment of potential impacts

Construction

Surface water bodies

Additional assessment was carried out to review the proposed changes to South Creek twin bridges (BR06) and Kemps Creek twin bridges (BR08). The designs include pier locations within the main waterway channel and on the creek banks. REMM B15 of the AR submissions report requires further biodiversity assessment to be carried out as follows:

“Bridge pier locations within instream (main waterway channel) or on creek banks will be avoided during detailed design at the South Creek, Cosgroves Creek, Badgerys Creek and Kemps Creek crossings. Where avoidance is not possible, further biodiversity assessment will be required.”

In addition creek adjustment impacts are considered in mitigation measures F04. The measure states that *“Creek adjustments would be re-considered and/or further refined to minimise the impact on the creeks during detailed design.”*

Bridge lengths have been optimised following flood modelling based on a reduced waterway opening. A review of the potential impacts to the creek and the removal of the need to adjust the alignment of the waterway contributed to the revised bridge design. Further investigation was undertaken into optimising the location of all piers that were located in the main channel. The amendments to the design included:

- South Creek bridges – The length of the bridge has been reduced from 17 x 33 metre spans (overall bridge length of 562 metres) to 12 x 33 metre spans with an overall bridge length of 396 metres. This has provided the opportunity to move the twin bridges to the east by around 18 metres, resulting in the column lengths at Piers 10E, 11E and 11W to be shortened due to the existing ground profile sloping upwards away from South Creek. This provided the opportunity to change to position of piers located in the creek channel. Pier 9 of the eastbound carriageway and Pier 10 of the westbound carriageway, have been moved to the edge of the creek. This design removes the requirement to re-align the creek.
- Kemps Creek bridges – The length of the bridge has been reduced to 5 x 30 metre spans, with an overall bridge length of 150 metres from around 244 metres. The refined bridge structure includes a design where bridge piers are positioned within the creek channel, however removes the requirement to re-align the creek. This design provided the opportunity to relocate Pier 3 on both carriageways towards the creek bank and not within the low flow portion.

Construction of the twin bridges would require installation of temporary waterway crossings and temporary working platforms during construction. The potential deposition of debris from construction, including sediment, in the waterway could impact water quality temporarily. The presence of pipes during construction would allow movement of fish in low flow periods, and there would be no complete blocking of fish passage.

The changes to the construction methodology do not impact other surface water bodies.

Water quality objectives

Water quality objectives for the Hawkesbury-Nepean River are determined by the nature of the local land use and the prevailing waterway conditions. All waterways intersected by the project have been previously affected by urban development. The desirable range of 6 to 50 Nephelometric Turbidity Units (NTU) is recommended by ANZECC (2000) for protection of aquatic ecosystems.

As part of obtaining an environment protection licence (EPL) from the Environment Protection Authority (EPA) for this project, an assessment of construction sediment basin discharges has been prepared (SEEC, 2021b) to assess the appropriate water quality limits for sediment basin discharges and ensure consistency with the water quality objectives for this location. This assessment has been prepared to address REMM SWH07 and SWH08 presented in the AR submissions report and NSW conditions of approval CoA E105.

A review was conducted of the design and the existing environment to determine how these might impact effective implementation of erosion and sediment control during construction. This review is reported in full in SEEC (2021b). The results of the discharge assessment can be summarised as follows:

- The desktop assessment method as defined in the Transport (2020a) draft guideline is appropriate for use for this project. It has utilised collected data from site and simulated streamflow estimated from a calibrated Australian Water Balance Model of South Creek.
- Following construction-phase sediment basin discharge events, average turbidity levels are predicted to be less than the threshold Water Quality Objective of 50 NTU.
- Based on this assessment, discharges from construction-phase sediment basins should have turbidity as follows:
 - No greater than 65 NTU into South Creek
 - No greater than 57 NTU to Kemps Creek
 - No greater than 50 NTU to Hinchinbrook Creek and Ropes Creek.

- Further to the limits determined above, it is recommended that a discharge threshold of 50NTU be established across the entire project to reduce the risk of site personnel applying an incorrect criterion when discharging water. The most conservative value of the above (50 NTU) is adopted.
- Based on modelling in this assessment, turbidity in all waterways already naturally exceeds 50 NTU during and after heavy rainfall events, and this is expected to continue to occur during construction.

Providing the recommendations detailed in the ESMR (SEEC, 2021a) are adopted during the construction phase (or appropriate alternatives are adopted instead, in consultation with a soil conservationist), the risk of pollution from erosion and subsequent sediment runoff can be managed in accordance with recognised best-practice in NSW (Landcom 2004 and DECC, 2008). This will meet the requirements of the water quality objectives, REMM's and CoA. Given that water quality controls (in the form of construction-phase erosion and sediment controls) have been adjusted accordingly, this change does not alter the water quality outcomes for the project.

As such, the detailed design has not resulted in any changes to potential water quality impacts compared to what was assessed in the approval documents and is consistent with the approved project.

A review of the minor boundary adjustments was carried out. Minor adjustments to the positioning of erosion and sediment controls was required as a result to maintain water quality objectives, but no additional or amended controls were required. An updated set of Erosion and Sediment Control Plans was prepared and is appended onto the ESMR (SEEC, 2021a). Runoff water quality from the updated boundary is likely to be the same or very similar to the runoff water quality from the area initially assessed, particularly given that soils within the additional area are the same as those along the main M12 Motorway alignment.

Operation

Surface water bodies

Section 7.9.4 of the EIS and Section 6.9 of the amendment report identified the surface water bodies and hydrology impacts that may occur during operation of the project. While all proposed changes to the design of the project have been reviewed, the majority would not substantially alter these impacts, as the relevant changes are similar when compared to the design of the project as described in the approval documents. The changes to the design of Kemps Creek and South Creek bridges is discussed below.

Scour at piers in group 3 westbound at Kemps Creek bridges may initially result in local erosion of the western creek bank, however rip rap would be installed around these piers to resist this scour process. Over time it is possible that the west bank may gradually migrate locally until a stable waterway section is formed. Piers in group 3 eastbound will be subject to development of scour holes within the permanent waterbody during storm events. Between flood events, fine suspended sediments may deposit within these holes.

Although appropriate sediment and erosion control measures will be implemented, the design is still likely to result in some localised, short term, downstream impacts. These impacts are considered to be minimal in terms of the natural flow-regime and sediment loads of Kemps Creek and South Creek. The piers at both Kemps Creek and South Creek have the potential to collect woody debris during flood events. Operation would result in localised changes in water quality and the presence of piers in the creek will alter flow regimes to some degree in the creek but will not block fish passage. Use of piers rather than creek realignment also allows for maintenance of more natural geomorphic processes (such as the natural meander of South Creek). Water would travel between the piers, which would have only limited impact on fish passage.

The avoidance of significant creek realignment has resulted in a decreased impact on riparian and in-stream habitats in comparison, as substantially more clearing and earthworks would be required. The repositioning of piers and avoidance of significant channel realignment has resulted in a minor improvement to South Creek and Kemps Creek from the approved project.

The detailed design also has a small improvement to a farm dam north of the paper road, the location is shown on Figure 2-3. Through adjustment of the design and project boundary, impacts to the farm dam are avoided.

To mitigate water quality and quantity risks to the Upper Canal, the M12 central section point of discharge to the Upper Canal catchment has been removed from the design. It was found that it would be impractical to provide water quality treatment for road runoff at this location due to boundary and topographical constraints which would preclude space for provision and maintenance access to water quality treatment facilities. By removing this discharge point, potential impacts to the Upper Canal are avoided.

The detailed design is generally consistent with the approved project but does provide a number of minor improvements to surface water bodies.

Water quality

Water quality was modelled using the MUSIC version 6.2, developed by eWater for catchment hydrology. MUSIC can simulate the quantity and quality of runoff from various land use types. It can simulate the generation of pollutants and the performance of various stormwater treatment measures including swales, wetlands, ponds and bio-retention systems. Water quality modelling has been undertaken to determine impacts at the corridor boundary, particularly where runoff eventually discharges to South Creek and Kemps Creek.

The water quality assessment results indicate that the design target of 80% Total Suspended Solids (TSS) reduction and the CoA (E105) requirement of contribution to water quality objectives has been achieved for the South Creek and Kemps Creek catchments. Ropes Creek was not assessed because there will be no discharges to this water body during operation. The results of the modelling are shown in Table 4-18. The following observations are made with respect to the MUSIC modelling results:

- Modelled post M12 TSS concentrations are below the ANZECC trigger values in both South Creek and Kemps Creek.
- Modelled post M12 Total Phosphorus (TP) concentrations are below the trigger value in South Creek but exceed the trigger value in Kemps Creek. However modelled TP concentrations are significantly lower than observed baseline concentrations in both creeks.
- Modelled post M12 Total Nitrogen (TN) concentrations exceed the trigger value in both South Creek and Kemps Creek. However modelled TN concentrations are significantly lower than the observed baseline concentrations in both creeks.

The design has achieved this with the combination of swales, bioretention and water quality basin treatment trains. Basin locations and design levels remain largely as per the approved project, with some basins experiencing minor adjustments to facilitate the connections of incoming channels and pipe above the basin spillway level where possible. The changes to basin designs are shown on Figure 2-3.

Table 4-18: MUSIC model predicted pollutant concentrations

Pollutant	MUSIC modelled M12 discharge to South Creek	Sampled background concentrations in South Creek	MUSIC model M12 discharge to Kemps Creek	Sampled background concentrations in Kemps Creek	ANZECC guidelines trigger values
Total Suspended Solids (TSS)	17.1 mg/l	86 mg/l	34.9 mg/l	24 mg/l	<40 mg/l
Total Phosphorus (TP)	0.014 mg/l	0.21 mg/l	0.12 mg/l	0.79 mg/l	0.025 mg/l
Total Nitrogen (TN)	0.65 mg/l	1.81 mg/l	0.97 mg/L	2.51 mg/l	0.35 mg/l

The detailed design is generally consistent with the approved project in relation to surface water quality. It is considered that the water quality treatment provisions for the M12 will contribute towards REMM SWH10 in meeting the NSW Water Quality Objectives for South Creek and Kemps Creek on the assumption that measured baseline concentrations in these creeks are reflective of existing land use practices within the existing M12 corridor and broader catchments.

4.8.4 Environmental management measures

The surface water impacts associated with the detailed design are generally consistent with the impacts described in the approval documents. The environmental management measures identified in Section 7.1 of the AR submissions report are therefore considered appropriate to manage water quality of surface water bodies.

No additional or amended environmental management measures are required for the detailed design.

4.9 Groundwater quality and hydrology

4.9.1 Assessment methodology

This assessment considers if the proposed amendments outlined in Section 2.1 changes the impacts to groundwater described in the approval documents. An updated assessment is provided in full in Appendix F and summarised below.

The groundwater assessment methodology adopted for the EIS is outlined in Section 7.10.2 of the EIS. The methodology for this assessment is generally consistent with the EIS methodology, although excludes additional site investigations. The study areas considered the area between South Creek to Kemps Creek. The following tasks have been undertaken:

- Desktop assessment to confirm existing groundwater environment.
- Identification of additional areas of groundwater interception due to the proposed changes and analytical calculations of groundwater dewatering and drawdown.
- Groundwater impact assessment to confirm whether impacts from the proposed changes are consistent with the project approvals and are in accordance with the NSW Aquifer Interference Policy.

- Assessment of suitability of mitigation measures proposed in the approval documents.

4.9.2 Existing environment

The existing environment relevant to groundwater is outlined in Section 4 of Appendix N of the EIS. The following potential changes to the existing environment were reviewed as part of this assessment:

- Location of registered bores in the vicinity of the proposed changes to the project
- Groundwater levels in the vicinity of the proposed changes to the project.

An updated search of the Bureau of Meteorology's (BOM) Australian Groundwater Explorer was undertaken and compared to the results of the search presented in the EIS. It was found that there have been no changes to the number or location of registered bores in study area (i.e. in the South Creek to Kemps Creek area). Figure 7-137 of the EIS and Figure 4-3 of Appendix N of the EIS, is correct for this area.

Additional groundwater level data, presented in the Geotechnical Report, were reviewed as part of this assessment since there are limited groundwater level data presented in the approval documents for the Clifton Avenue area. The *M12 Motorway Central Package Detailed Design, Geotechnical Interpretive Report* (Transport for NSW, 2021) (the Geotechnical Report) includes data from additional monitoring bores installed in the Clifton Avenue area. The Geotechnical Report indicates that groundwater elevations in this area (referred to as the study area) range from 41.2 to 49.5 metres Australian height datum (AHD). Based on available data, the maximum groundwater elevation in the South Creek alluvium is around 36.0 to 37.0 metres AHD while the maximum groundwater elevation in the Kemps Creek alluvium is around 45.5 metres AHD.

4.9.3 Assessment of potential impacts

Groundwater impacts during construction have been assessed by calculating potential dewatering rates and drawdown from excavations associated with the proposed changes. Construction impacts are detailed below. Operational impacts to groundwater are likely to be similar to or less than construction impacts. This is consistent with the assessment presented in the EIS.

The principal changes to the approved project that are considered in this assessment are outlined below:

- Main carriageway vertical alignment – lowering of the main carriageway by about 2.0 metres for a length of about 1.2 kilometres in the area of Clifton Avenue
- Culverts for Sydney Water infrastructure – installation of three culverts extending to a depth of around 5.0 metres from the existing ground surface at locations near the South Creek and Kemps Creek crossings, with widths ranging from 1.0 to 40.0 metres. The approximate location of these culverts are shown on Figure 2-3.

A review of the design changes for both operation and construction of the project, including minor boundary changes, has not identified other amendments that would alter the approved groundwater assessment.

Groundwater interception

The lowered carriageway design level in the area of Clifton Avenue was compared to groundwater level data within the study area. It is considered that groundwater interception of up to 1.0 metre within the bedrock groundwater system (siltstone) is possible within the study area. The floor elevation of the design ranges from 43.95 to 49.55 metres AHD, compared to the groundwater elevation of 41.2 to 49.5 metres AHD.

In addition, the excavations for the proposed culverts, which will extend up to 5.0 metres below the existing ground surface level, may intercept alluvial groundwater to a depth of up to 4.0 metres. The predicted depth of interception is as follows:

- 1.0 metre wide culvert west of South Creek – up to 5.0 metres
- 40.0 metre wide culvert east of South Creek – up to 2.0 metres
- 10.0 metre wide culvert west of Kemps Creek – up to 5.0 metres.

Dewatering rates and radius of drawdown

Dewatering rates and the radius of drawdown for the study area and the largest culvert excavation (40 metres wide culvert located 200 metres east of South Creek) have been calculated. The calculation methodologies outlined in Sections 3.6.2 and 5.1 of Appendix N of the EIS were adopted for this assessment.

Results for the study area are presented in Table 4-19. For the dewatering calculations, a seepage area of 600 m² was adopted based on a length of potential groundwater interception of 500 metres, width of 100 metres and average seepage depth of 0.5 metres. Flow into the excavation was assumed to be predominantly horizontal with minimal vertical flow through the cut floor. For the radius of drawdown calculations, a storage value of 0.03 was adopted and transmissivity was based on a saturated thickness of 1.0 metre.

Calculated dewatering rates (Q) for the various hydraulic conductivity and hydraulic gradient (i) values range from 0.1 to 16.2 m³/day (or < 0.1 to 5.9 ML/year). A dewatering rate at the lower end of this range (< 1 m³/day) is more likely, since the groundwater seepage within the cut will come from the bedrock groundwater system (siltstone) which has a hydraulic conductivity in the order of 0.005 m/day.

The calculated radius of drawdown extends up to 111 metres after five years for the highest hydraulic conductivity scenario. Again, a value at the lower end of the range is more likely. The values presented in Table 4-19 are generally consistent with values presented in the EIS and amendment report.

Table 4-19: Dewatering rates and drawdown radius for the study area

Hydraulic conductivity (m/day)	Hydraulic gradient (m3/day)	Calculated dewatering rates (m3/day)	Calculated dewatering rates (ML/year)	Radius (m), one year	Radius (m) five years
0.005	0.04	0.1	0.0	12	26
0.005	0.1	0.3	0.1	12	26
0.005	0.3	0.9	0.3	12	26
0.04	0.04	1.0	0.4	33	74
0.04	0.1	2.4	0.9	33	74
0.04	0.3	7.2	2.6	33	74
0.09	0.04	2.2	0.8	50	111
0.09	0.1	5.4	2.0	50	111
0.09	0.3	16.2	5.9	50	111

Results for the 40 metre wide culvert excavation are presented in Table 4-20. For the dewatering calculations, a seepage area of 560 m² was adopted based on excavation dimensions of 100 metres by 40 metres and average seepage depth of 2.0 metres. Again, flow into the excavation was assumed to be predominantly horizontal with minimal vertical flow through the cut floor. For the radius of drawdown calculations, a storage value of 0.03 was adopted and transmissivity was based on a saturated thickness of 4.0 metres.

Table 4-20: Dewatering rates and drawdown radius for 40 metres wide culvert

Hydraulic conductivity (m/day)	Hydraulic gradient (m ³ /day)	Calculated dewatering rates (m ³ /day)	Calculated dewatering rates (ML/year)	Radius (m) one year	Radius (m) five years
0.005	0.04	0.1	0.0	23	52
0.005	0.1	0.3	0.1	23	52
0.005	0.3	0.8	0.3	23	52
0.04	0.04	0.9	0.3	66	148
0.04	0.1	2.2	0.8	66	148
0.04	0.3	6.7	2.5	66	148
0.09	0.04	2.0	0.7	99	222
0.09	0.1	5.0	1.8	99	222
0.09	0.3	15.1	5.5	99	222

Calculated dewatering rates for the various hydraulic conductivity and hydraulic gradient values range from 0.1 to 15.1 m³/day (or < 0.1 to 5.5 ML/year). A dewatering rate at the lower end of this range is most likely (say 1-2 m³/day), based on the hydraulic conductivity of the alluvium reported in Table 4-7 in Appendix N of the EIS (0.023 m/day). The dewatering rates for the other smaller culvert excavations is expected to be similar to this since they would have similar seepage areas to the 40 metres culvert (ie smaller width excavations but larger seepage depth).

The calculated radius of drawdown for the 40 metre wide culvert excavation extends up to 222 metres after five years for the highest hydraulic conductivity scenario. Again, a value at the lower end of the range is more likely for all culverts. For the study area, the values presented in Table 4-20 are generally consistent with values presented in the approval documents.

Groundwater drawdown

Groundwater drawdown in the study area is expected to be greatest (by around 1.0 metre) in the vicinity of the excavations, with some drawdown impact (less than 1.0 metre) extending in the order of tens of metres from the excavation. For the culvert excavations, drawdown of up to 2.0 to 5.0 metres is expected in the vicinity of the excavation, with some drawdown impact extending over 100 metres from the excavation. The radius of drawdown would be less for the other culvert excavations due to the smaller excavation dimensions.

Based on the locations of potential groundwater dependent ecosystems and licensed bores presented in Figure 4-2 and Figure 4-3 of Appendix N of the EIS, no groundwater dependent ecosystems or registered bores are within the radius of drawdown or any of these groundwater interference activities associated with the proposed changes to the project.

In addition, the beneficial use of the groundwater to be intercepted by these excavations is limited based on the poor (saline) groundwater quality, as reported in the EIS. Therefore, the beneficial use category of the groundwater is unlikely to be reduced as a result of these minor groundwater interference activities.

Overall, the groundwater impacts from construction and operation of the project associated with the proposed changes to the project are considered to meet the minimal impact considerations of the NSW Aquifer Interference Policy and are consistent with the current project approvals. There will be a minor increase to the total groundwater take of the project (from both the alluvium and bedrock groundwater sources) due to the additional groundwater interception, however licensing of the groundwater take is not required as outlined in the EIS.

4.9.4 Environmental management measures

The proposed changes to the project will likely result in additional groundwater interception compared to that reported in the approval documents. However, the impacts of this additional interception is expected to be minor and localised for both construction and operation and meet the minimal impact considerations of the NSW Aquifer Interference Policy.

Two new mitigation has been developed to support the management of these additional impacts. These are outlined in Table 4-21. These new requirements have been proposed as a result of potential additional impacts from the detailed design, however overall the impacts remained consistent with the approved project.

Table 4-21: Environmental management measures - groundwater

Reference	Impact	Environmental management measure	Responsibility	Timing
GW05 (new)	Alteration of groundwater flows and levels	<p>Groundwater quality, levels and inflows will be monitored at Clifton Avenue (Cut 9) and the location of the Sydney Water culverts during construction and operation as outlined in the M12 Central consistency assessment report (GHD, 2021).</p> <p>The groundwater indicators to be monitored will be as per Section 7.2.5 of Appendix N of the EIS. Groundwater inflows are to be monitored at monthly intervals. As part of observing inflows at the identified cuts, the groundwater inflow rate is to be estimated and the areas where groundwater inflow is occurring noted.</p> <p>During construction, if groundwater inflow rates are observed from the cuts identified through the detailed design of the M12 Motorway Central including Cut 9 and at the Sydney Water culvert excavations, the groundwater quality from the cut is to be sampled.</p>	Contractor	Construction and operation

Reference	Impact	Environmental management measure	Responsibility	Timing
		Operational phase groundwater quality sampling, including the quality sampling of Cut 9 inflows and at the Sydney Water culvert excavations, is to occur at monthly intervals for at least six months		
GW07 (new)	Alteration of groundwater flows and levels	<p>Prior to construction commencing, the Construction Contractor will use their earthworks methodology to estimate the potential groundwater inflows that are expected in the first year of construction in order to confirm the inflows expected and if the proposed mitigation measures are sufficient to manage higher inflows that are likely during early earthworks activity.</p> <p>The estimate of groundwater inflows is to be undertaken for Cut 9 and at the Sydney Water culvert excavations. The estimate is to include groundwater inflow from both the walls and base of the cuts, and will take into account the construction methodology and staging for each cut. In addition, the estimate will utilise the maximum observed groundwater levels (as sourced from M12 Central groundwater monitoring data).</p> <p>The Construction Contractor will assess the results of the estimated groundwater inflows to confirm whether evaporation will be sufficient to mitigate the potentially higher inflows likely to be expected during early earthwork activities. If evaporation is determined not to be a sufficient mitigation measure, the Construction Contractor will identify and implement additional mitigation measures and these will be documented in the Construction Contractor's CEMP and Construction Soil and Water Management Plan.</p>	Contractor	Construction

5. Consistency assessment – the Division 5.2 Approval

5.1 Minister's Conditions of Approval

The proposed changes have been assessed in Table 51 in relation to the relevant conditions of approval. This section includes measures that relate to the detailed design of the proposal.

Table 5-1: Consistency against relevant Minister's conditions of approval for the project

No.	Condition of Approval	Discussion	Consistent
A1	<p>The Proponent must carry out the CSSI in accordance with the terms of approval and generally in accordance with:</p> <ul style="list-style-type: none"> (a) M12 Motorway Environmental Impact Statement (dated October 2019); (b) M12 Motorway Submissions Report (dated October 2020); (c) M12 Motorway Amendment Report (dated October 2020); (d) M12 Motorway Amendment Report – Submissions Report (dated December 2020); and (e) M12 Motorway Amendment Report – Submissions Report - Amendment (dated 8 March 2021). 	<p>The proposed change described in Section 2.1 of this report can be carried out in accordance with the terms of this approval and is generally in accordance with the description of the CSSI provided in A1.</p>	Yes
A2	<p>The CSSI must only be carried out in accordance with all procedures, commitments, preventative actions, performance outcomes and mitigation measures set out in the documents listed in Condition A1 unless otherwise specified in, or required under, this approval.</p>	<p>The proposed changes can be carried out in accordance with all procedures, commitments, preventative actions, performance criteria and mitigation measures set out in the approval documents listed in A1. No new mitigation measures are required as a result of the proposed changes.</p>	Yes
A3	<p>In the event of an inconsistency between:</p> <ul style="list-style-type: none"> (a) the terms of this approval and any document listed in Condition A1, the terms of this approval will prevail to the extent of the inconsistency; and (b) any document listed in Condition A1, the most recent document will prevail to the extent of the inconsistency. <p><i>Note: For the purpose of this condition, there will be an inconsistency between a term of this approval and any document if it is not possible to comply with both the term and the document.</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E2	The clearing of native vegetation must be minimised with the objective of reducing impacts to threatened ecological communities and threatened species habitat.	<p>Vegetation clearance has been recalculated to incorporate the boundary changes and additional exclusion areas.</p> <p>This has identified a net increase of 0.26 ha of native vegetation to be impacted by the revised construction boundary within M12 central when compared to the approved project, with the total area of vegetation to be impacted in M12 central now being 32.81 ha.</p> <p>Areas of vegetation to be retained have been identified in order to minimise vegetation clearance. The contractor would be required to apply to Transport to clear these areas.</p>	Yes
E4	The Proponent may review and update the ecosystem and species credit requirements in Table 1, Table 2 and Table 3 to reflect the final construction footprint and resulting extent and type of plant community types to be cleared and the extent of threatened species habitat impacted by the construction of the CSSI (excluding certified areas). Where the construction of the CSSI is staged, the Proponent may review and update the ecosystem and species credit requirements in Table 1, Table 2 and Table 3 for each stage of the CSSI. Amendments to the ecosystem and species credit requirements must be undertaken in consultation with EES and DAWE and submitted to the Planning Secretary for approval within six (6) months of determining the final construction footprint and, where the CSSI is staged, within six (6) months of determining the final construction footprint for each stage.	<p>Appendix A outlines the ecosystem and species credits required to offset the direct and indirect impacts to native vegetation and threatened species resulting from the revised construction boundary. The credits were calculated based on the impacts of the M12 central section as a percentage of the total impacts of the entire M12 project. The total impact has been taken from the AR submissions report and the amendment to this report (March 2021).</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E5	<p>The review and update of credit requirements must be undertaken by:</p> <p>(a) using the vegetation mapping in the EIS, <i>M12 Motorway Amendment Report - Appendix A Biodiversity supplementary technical report</i> (October 2020), and <i>M12 Motorway Amendment Report – Submissions Report</i> (December 2020); and/or</p> <p>(b) completing verification surveys to confirm the extent, type and condition of threatened species and ecological communities to be impacted.</p>	<p>Updates to the credit requirements was undertaken by using the information provided in a) using the vegetation mapping in the EIS, <i>M12 Motorway Amendment Report - Appendix A Biodiversity supplementary technical report</i> (October 2020), and <i>M12 Motorway Amendment Report – Submissions Report</i> (December 2020); and the amendment to the AR submissions report (March 2021).</p>	Yes
E6	<p>Where verification surveys are required, they must be undertaken in consultation with EES. Any additional surveys must be undertaken at the time of year when groundcover is most likely to be predominantly native. If verification surveys are not possible at a time when groundcover is most likely to be native, the assumed presence of any relevant species and ecosystems may be applied to conservatively evaluate impacts and associated credit requirements.</p>	<p>Updates to the credit requirements was undertaken by using the information provided in a) using the vegetation mapping in the EIS, <i>M12 Motorway Amendment Report - Appendix A Biodiversity supplementary technical report</i> (October 2020), and <i>M12 Motorway Amendment Report – Submissions Report</i> (December 2020); and the amendment to the AR submissions report (March 2021).</p>	Yes
E11	<p>The Proponent must minimise impacts to Key Fish Habitat (KFH) as defined in <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013 update). Residual impacts to KFH must be offset at a ratio of 2:1 habitat offset requirement in accordance with the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013 update) and in consultation with DPI Fisheries.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p> <p>Offset requirements have been recalculated and are discussed in Appendix A and Section 4.1.3. The detailed design minimises impacts to key fish habitat by removing the creek realignments. This is discussed in Appendix A and Section 4.1.3.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E14	A minimum width of three (3) metres and a minimum height of 1.5 metres must be provided to maintain fauna passage below the Badgerys Creek, Cosgroves Creek, South Creek and Kemps Creek bridges. The three-metre wide passage must consist of a natural substrate or other surface type that will not hinder fauna movement.	The proposed changes to the bridge design of South Creek and Kemps Creek would not impact on the ability to comply with this requirement.	Yes
E16	Measures identified in the documents listed in Condition A1 that are aimed at minimising the impact of the CSSI on flood behaviour must be incorporated into the detailed design of the CSSI. The incorporation of these measures into the detailed design must be reviewed and endorsed by a suitably qualified and experienced person in consultation with directly affected landowners, DPI Water, DPI Fisheries, EES, Infrastructure NSW (INSW) and relevant councils.	Measures to minimise the impact of the CSSI on flood behaviour have been incorporated into the detailed design. The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E17	Unless otherwise agreed by the Planning Secretary, the CSSI must be designed and constructed to limit impacts on flooding characteristics in areas outside the project boundary during any flood event up to and including the 1% AEP flood event, to the following: a) a maximum increase in inundation time of one hour; b) a maximum increase of 10 mm in above-floor inundation to habitable rooms where floor levels are currently exceeded; c) no above-floor inundation of habitable rooms which are currently not inundated; d) a maximum increase of 50 mm in inundation of land zoned as residential, industrial or commercial; e) a maximum increase of 100 mm in inundation of land zoned as rural, primary production, environment zone or public recreational; f) no significant increase in the flood hazard or risk to life; and	a) Increase in inundation above one hour has been minimised throughout the project, with the exception of at the racetrack at Kemps Creek, which experiences in time of inundation of up to 2 hours, contained within the racetrack as noted in Table 4-17. Further assessment will be carried out to mitigate this impact. If the impact cannot be mitigated, Planning Secretary approval will be sought. b) No increase of above floor inundation where floor levels are currently exceeded is recorded across the project with the exception of a number of sheds and outdoor structures identified within the existing 1% flood extent of Kemps Creek. c) No above floor inundation of habitable rooms which are not currently inundated, have been recorded.	Yes

No.	Condition of Approval	Discussion	Consistent
		<p>d) Some increases greater than 50 mm in residential, industrial or commercial zones are recorded in Table 4-17.</p> <p>e) Some increases greater than 100 mm in rural, primary production, environment zone or public recreational zones are recorded in Table 4-17.</p> <p>f) A significant increase flood hazard or risk to life has been defined as an increase in the hazard category from H2 to H3 or above. No significant increase in flood hazard has been created by the project.</p>	
E17 cont.	<p>g) maximum relative increase in velocity of 10%, where the resulting velocity is greater than 1.0 m/s, unless adequate scour protection measures are implemented and/or the velocity increases do not exacerbate erosion as demonstrated through site-specific risk of scour or geomorphological assessments.</p> <p>Where the Proponent cannot meet the requirements set out in clauses (d), (e) and (g) alternative flood levels or mitigation measures may be agreed to with the affected landowner. In the event that the Proponent and the affected landowner cannot agree on the measures to mitigate the impact as described in clauses d), e) and g), the Proponent must engage a suitably qualified and experienced independent person to advise and assist in determining the impact and relevant mitigation measures. Measures identified in the documents listed in Condition A1 that are aimed at minimising the impact of the CSSI on flood behaviour must be incorporated into its detailed design. The incorporation of these measures must be reviewed and endorsed by a suitably qualified and experienced person in consultation with directly affected landowners, EESG, DPI Fisheries, NSW State Emergency Service (SES) and relevant councils</p>	<p>g) Some increases greater than 10% where the resulting velocity is greater than 1.0 m/s are recorded in Table 4-17. Proposed mitigation is also outlined in Table 4-17.</p> <p>Where the design does not meet the requirements of (d), (e) and (g) and the proponent and affected landowner cannot agree on the measures to mitigate the impact TfNSW will engage a suitably qualified and experienced independent person to advise and assist in determining the impact and relevant mitigation measures. Finally in the event that suitable mitigation measures cannot be included in the design, or where landowner agreement to the impacts cannot be reached, Planning Secretary approval for the impact will be sought.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E18	All updated hydrologic and hydraulic assessments undertaken during detailed design must be consistent with the Australian Rainfall and Runoff – A Guide to Flood Estimation (GeoScience Australia, 2019).	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E19	Updated flood modelling must be undertaken for the full range of flood events, including 5% AEP, 1% AEP, PMF and 0.5% AEP or 0.2% AEP and must have regard to the <i>Wianamatta (South) Creek Catchment Flood Study - Existing Conditions (Revision H)</i> (Advisian Worley Group, November 2020) when validating existing flood behaviour and constraints. The modelling must identify changes in post-development flood behaviour including cumulative flood impacts associated with Western Sydney International Airport and Sydney Metro Western Sydney Airport, where this information is available, prior to detailed design being finalised.	The updated flood modelling includes all events specified and has been run to assess post development flood behaviour. The updated flood modelling has been developed and validated with regard to the Wianamatta (South) Creek Catchment Flood Study – Existing Conditions (Revision H) (Advisian Worley Group, November 2020). Where relevant, the flood assessment that is being undertaken for detailed design utilises the latest information available on the Western Sydney International Airport and Sydney Metro Western Sydney Airport projects.	Yes
E20	Flood information including flood summary reports, models and geographic information system outputs, and work as executed information on finished ground levels and the dimensions and finished levels of all structures within the flood prone land, must be provided to the relevant council, EES and INSW in order to assist in preparing relevant documents and to reflect changes in flood behaviour as a result of the CSSI. The relevant council(s), EES and INSW must be notified in writing that the information is available no later than one (1) month following the operation of the CSSI. Information requested by the relevant council(s), EES or INSW must be provided no later than six (6) months following the completion of construction or within another timeframe agreed with the relevant council(s), EES and INSW.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
E21	The flood models, data and summary reports must be uploaded to the NSW Flood Data Portal and access provided to the relevant councils, EES and INSW.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E22	The designs of all bridge, culvert and other cross drainage structures must include for potential blockages consistent with the procedures in the <i>Australian Rainfall and Runoff – A Guide to Flood Estimation</i> (GeoScience Australia, 2019).	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E23	The CSSI must not preclude the future raising of Elizabeth Drive to achieve a minimum of 1% AEP level of flood immunity, unless otherwise agreed by the Planning Secretary.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E24	For property/ies zoned primary production and where hydrologic modelling predicts that the CSSI will potentially reduce and adversely affect the available stormwater runoff yield to a farm dam, the Proponent must, in consultation with the affected landowner: (a) calculate the nature and extent of impacts on water supply; (b) determine what measures may be implemented to prevent, mitigate, compensate or offset a loss in water supply; and (c) implement the measures agreed with the potentially affected landowner at no cost to the landowner. The agreed measures must be implemented prior to undertaking any works that would directly affect the flow of water into the a landowner's farm dams. In the event that the Proponent and landowner cannot agree on the measures to mitigate the impact, the Proponent shall engage a suitably qualified and experienced independent person to advise and assist in determining appropriate mitigation measures.	Hydrologic modelling has been carried out for property/ies zoned primary production to identify if any properties are adversely affected through a change to the available stormwater runoff yield to a farm dam. The nature and extent of impacts have been assessed and mitigation measures reviewed. Small changes to the overall catchment have been identified but no reduction in yield is noted.	Yes
E25	Construction and operation of the CSSI should aim to not diminish the potential of the following heritage items for nomination to the State Heritage Register beyond the impacts to significance already identified in the documents listed in Condition A1 : McGarvie Smith Farm, McMaster Field Station and Fleurs Radio Telescope Site.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
E27	<p>A Heritage Interpretation Plan(s) must be prepared that identifies and interprets the key heritage values and stories of the heritage items impacted by the CSSI. The Heritage Interpretation Plan must include, but not be limited to:</p> <ul style="list-style-type: none"> (a) integration of heritage themes and values in the design of the CSSI; (b) design elements (form and fabric) and themes for the CSSI; (c) consideration of the design concepts for Western Sydney International Airport and Sydney Metro Western Sydney Airport; and (d) opportunities for design responses for Aboriginal and non-Aboriginal heritage. <p>The Heritage Interpretation Plan must be provided to Western Sydney International Airport and Sydney Metro Western Sydney Airport to assist in guiding opportunities for integration of heritage themes and values into their design.</p> <p>The Heritage Interpretation Plan must be prepared in accordance with the Interpreting Heritage Places and Items Guidelines (NSW Heritage Office, 2005), and in consultation with Heritage NSW, Aboriginal Cultural Heritage Advisory Committee, LALC and relevant council(s).</p> <p>The Plan must be implemented and inform the Place, Design and Landscape Plan required by Condition E69.</p> <p>The Heritage Interpretation Plan must be submitted to the Planning Secretary and Heritage NSW for information prior to finalising the Place, Design and Landscape Plan required by Condition E69.</p> <p><i>Note: Nothing in this condition prevents the Proponent from preparing separate Heritage Interpretation Plans for Aboriginal and Non-Aboriginal Heritage.</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p> <p>This plan will be required to include the additional non-Aboriginal heritage assessment and recommendations outlined for the Fleurs Radio Telescope Site (Item 2, Penrith LEP 832) as detailed in Appendix C and included within REMM NAH05.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E50	<p>An independent and experienced noise specialist must be approved by the Planning Secretary to verify the validity (including being accurate and consistent with the requirements of this approval) of the:</p> <ul style="list-style-type: none"> (a) operational noise modelling required under Conditions E51; (b) Operational Noise Review required under Condition E52; and (c) Operational Noise Compliance Report required under Condition E60. <p>The Planning Secretary's approval of the noise specialist must be sought no later than one (1) month before undertaking operational noise modelling.</p> <p>Each verification must be submitted to the Planning Secretary for information within 30 days of the verification and be attached to submitted documentation as relevant.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E51	<p>Noise modelling of the detailed design must be undertaken and address the following parameters:</p> <ul style="list-style-type: none"> (a) application of source emission corrections to take into account the proportions of heavy vehicles; (b) modelling heavy vehicles using three distinct sources in line with Appendix B4 of the NSW Road Noise Policy (DECCW, 2011); (c) road surface corrections to address the assessment timeframes outlined in the NSW Road Noise Policy (DECCW, 2011) corresponding to the year of opening, and ten (10) years after opening; and (d) meteorological conditions in accordance with the NSW Road Noise Policy. <p>The operational noise modelling must be verified as being accurate and consistent with the requirements of this approval by an acoustic expert or the AA, who is independent of the design and construction of the CSSI.</p>	<p>Noise modelling of the detailed design has been undertaken as part of the ONVR. Changes to the parameters are discussed in Section 9 of this report.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E52	<p>An Operational Noise Review (ONR) must be prepared (based on the detailed design of the CSSI) to confirm noise mitigation measures that would be implemented for the operation of the CSSI. The ONR must be prepared in consultation with the Planning Secretary and relevant council(s) and must:</p> <ul style="list-style-type: none"> (a) confirm the appropriate operational noise objectives and levels for existing sensitive receivers; (b) confirm the operational noise impacts based on the final design of the CSSI and modelling undertaken under Condition E51, including operational daytime LAeq,15 hour and night-time LAeq, 9 hour traffic noise contours; (c) review the suitability of the operational noise mitigation measures identified in the documents listed in Condition A1 and, where necessary, investigate and identify additional noise and vibration mitigation measures required to achieve the noise criteria outlined in the NSW Road Noise Policy (DECCW, 2011), including the timing of implementation; (d) include a consultation strategy to seek feedback from directly affected landowners on the noise and vibration mitigation measures; and (e) procedures for the management of operational noise and vibration complaints. <p>The ONR must be undertaken at the Proponent's expense and be submitted to the Planning Secretary for information prior to implementing at-property noise mitigation, unless otherwise agreed by the Planning Secretary.</p> <p>The Proponent must implement the identified noise mitigation measures and make the ONR publicly available following its submission to the Planning Secretary for information.</p> <p><i>Note: The design of noise barriers and the like must be undertaken in consultation with the community as part of the Place, Design and Landscape Plan required under Condition E69.</i></p>	<p>An ONVR has been prepared to identify the noise mitigation measures that would be implemented.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E62	The CSSI must be constructed and operated with the objective of minimising light spillage to surrounding properties. All lighting associated with the construction and operation of the CSSI must be consistent with the requirements of <i>Australian Standard 4282-2019 Control of the obtrusive effects of outdoor lighting</i> , relevant Australian Standards in the series <i>AS/NZ 1158 – Lighting for Roads and Public Spaces</i> , and the <i>National Airports Safeguarding Framework (NASF) Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports</i> . Additionally, mitigation measures must be provided to manage residual night lighting impacts to protect properties adjoining or adjacent to the CSSI, in consultation with affected landowners.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E63	Active transport facilities must be designed, constructed and/or rectified in accordance with the <i>Guide to Road Design Part 6A: Paths for Walking and Cycling</i> (Austroads, 2017) and relevant Australian Standards (AS) such as <i>AS 1428.1-2009 Design for access and mobility</i> . The active transport links must also incorporate relevant Crime Prevention Through Environmental Design (CPTED) principles.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E64	The place, design and landscaping outcomes of the CSSI must be informed by and be consistent with the Urban Design Concept and have consideration of the Urban Design Opportunities as detailed in <i>Appendix G Landscape character, visual impact assessment and urban design report</i> of the EIS. This has considered details outlined in the approval documents.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E65	Landscaping must improve parkland, open space and native vegetation and fauna connectivity, including between areas of existing parkland and open space adjacent to and intersecting the CSSI, and through the revegetation of areas with local provenance species, where practicable, between adjoining areas of remnant Cumberland Plain Woodland to re-link them. In implementing these requirements, the Proponent must have regard to wildlife strike risk in proximity to the Western Sydney International Airport.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
E75	The Proponent must identify the utilities and services (hereafter “services”) potentially affected by Work to determine requirements for diversion, protection and/or support. Alterations to services must be determined by negotiation between the Proponent and the service providers. The Proponent in consultation with service providers must ensure that disruption to services resulting from the CSSI are avoided where possible and where unavoidable customers are advised in accordance with the Communication Strategy required under Condition B1.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E93	The Planning Secretary's approval is required before any heavy vehicles used for spoil and fill haulage or concrete deliveries (for the purpose of the CSSI) are driven on local roads within one (1) kilometre of early works, construction and construction ancillary facilities and that are not identified for use by heavy vehicles in the documents listed in Condition A1. The local roads must be identified in the Early Works Environment Management Plan and Traffic Management CEMP Sub-plan.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
E94	<p>All requests to the Planning Secretary for the approval to use local roads in accordance with Condition E93, must include a traffic and pedestrian impact assessment and be prepared in consultation with the relevant local council(s). The assessment must be undertaken by an appropriately qualified and experienced person and must include a swept path analysis if required by the Department. The traffic and pedestrian impact assessment must:</p> <p>(a) demonstrate that the use of local roads will not compromise the safety of the public and have no more than minimal amenity impacts;</p> <p>(b) provide details as to the date of completion of the road dilapidation surveys for the subject local roads; and</p> <p>(c) describe the measures that will be implemented to avoid where practicable the use of local roads past schools, aged care facilities and childcare facilities during their peak times for operation.</p> <p>The outcomes and recommendations of the traffic and pedestrian impact assessment must be incorporated into the Site Establishment Management Plan or Traffic Management CEMP Sub-plan as relevant.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	<p>Yes</p>
E105	<p>The CSSI must be designed, constructed and operated so as to maintain the <i>NSW Water Quality Objectives</i> where they are being achieved as at the date of this approval, and contribute towards achievement of the <i>NSW Water Quality Objectives</i> over time where they are not being achieved as at the date of this approval, unless an EPL in force in respect of the CSSI contains different requirements in relation to the <i>NSW Water Quality Objectives</i>, in which case those requirements must be complied with.</p> <p><i>Note: If it is proposed to discharge construction stormwater to waterways, a Water Pollution Impact Assessment will be required to inform licensing, consistent with Section 45 of the POEO Act. Any such assessment must be prepared in consultation with the EPA and be consistent with the National Water Quality Guidelines, with the level of detail commensurate with the potential water pollution risk.</i></p>	<p>A Water Pollution Impact Assessment has been prepared for the central section of the project and is outlined in Section 4.9.3. The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	<p>Yes</p>

No.	Condition of Approval	Discussion	Consistent
E110	<p>All new or modified drainage systems associated with the CSSI must be designed to:</p> <p>(a) where stormwater drainage is discharged to a council's stormwater system, meet the capacity constraints of any council's drainage system to receive and convey the proposed flows from the CSSI, or otherwise upgrade council's drainage system at the Proponent's expense, in consultation with the relevant council(s);</p> <p>(b) minimise impacts on the receiving environment at the final outflow point resulting from any additional flow volume (including, but not limited to scour, flooding, water quality impacts and impacts on riparian vegetation, aquatic ecology and property); and</p> <p>(c) ensure mitigation measures are implemented where increased flows through cross drainage systems adversely impact on council's or Sydney Water drainage infrastructure and the receiving environment.</p>	<p>The Penrith City Council drainage culvert in Clifton Avenue has been upgraded to mitigate impacts from the operation of the M12. New or modified drainage systems have been designed to minimise flow increases to Council drainage systems in the South Creek and Kemps Creek catchments. In the Ropes Creek catchment, downstream flood levels north of Elizabeth Drive are compliant with the CoA. This has resulted in no further upgrades to Council systems being required.</p> <p>The project is therefore compliant with the requirement to minimise impacts on the receiving environment at the final outflow point as the design does not increase flow volume.</p>	Yes

The proposed change can be accommodated within the conditions of approval.

5.2 Revised environmental management measures (REMMs)

The proposed change has been assessed in Table 5-2 in relation to the relevant commitments / environmental management measures in the context of the Division 5.2 Approval.

New and amended REMMs are labelled in the number reference column and all new or amended text is shown in bold text. These changes have been identified as being required as per the findings of this consistency assessment.

Table 5-2: Consistency against relevant Statement of Commitments / environmental management measures

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
B02	A Habitat Compensation Plan (HCP) will be prepared and implemented as part of the CFFMP for the project. The HCP will targeted those species that will be impacted by the loss of hollows. Measures will include: nest boxes, reuse of salvaged hollows and/or new technologies eg chainsaw hollows), as well as replacement of woody debris and bushrock with consideration to Guide 5 and Guide 8 of Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011).	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
B03	Native vegetation, threatened species and threatened species habitat removal will be minimised where practicable through detailed design. This will include avoiding the nest and surrounds of the White-bellied Sea-Eagle, where practicable.	A review of the construction footprint and construction methodology has been carried out. Additional exclusion areas have been identified and included within the design. In addition a number of 'areas of vegetation to be retained' have been identified which will be recommended to the construction contractor for retention, where feasible. These areas would require approval from Transport to clear in the specifications.	Yes
B10	Removal of riparian vegetation at creek crossings will be minimised and vegetation connectivity across the riparian zone will be maintained where possible.	Investigation during the design process identified locations where connectivity could be maintained or improved through providing fauna structures and habitat replacement. Patches of vegetation at South Creek and Kemps Creek have been identified as 'areas of retained vegetation' and comprise potential opportunities for the construction contractor to avoid and minimise impacts to the vegetation. The bridges and culverts have been designed to provide alternate breeding habitat for the Southern Myotis, and roosting habitat for the Eastern Bentwing Bat and Little Bentwing Bat	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
B13	Creek adjustments will be investigated and removed or minimised during detailed design where feasible. Proposed creek adjustments will be designed such that they result in minimal changes to flow velocities.	Creek adjustments have been minimised through the use of piers at Kemps Creek and South Creek. Pier locations have been designed to: <ul style="list-style-type: none"> Minimise the number of piers in the creeks and avoidance of piers within the low flow channel Limit changes to flow velocity and scouring etc. 	Yes
B14	Creek corridors will be revegetated with locally native riparian vegetation, in accordance with the requirements of the Policy and guidelines for fish habitat conservation and management (DPI, 2013) and in consideration of the Guidelines for instream works on waterfront land (DPI, 2012b). The creek channels will be rehabilitated to preconstruction conditions or better.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
B15	Bridge pier locations within instream (main waterway channel) or on creek banks will be avoided during detailed design at the South Creek, Cosgroves Creek, Badgerys Creek and Kemps Creek crossings. Where avoidance is not possible, further biodiversity assessment will be required.	The design team reviewed the pier locations of the approved project and has been able to refine these to locations that minimise the number of piers in the creeks and limit changes to flow velocity, scouring and creek adjustments. Due to the length of the spans, piers are still required within the creeks. Additional biodiversity assessment has been carried out and is summarised in Appendix A.	Yes
B17	Permanent and temporary waterway crossings will be designed and constructed to maintain fish passage in accordance with <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge, 2003). Crossing types should be matched to waterway type as per Table 1 in Fairfull and Witheridge (2003)	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
B21	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
B22	Changes to existing surface water flows will be minimised through detailed design.	<p>As per Section 4.7 above, the potential impacts of the detailed design on flooding behaviour and the scour potential within receiving drainage lines has been considered during the detailed design of the project.</p> <p>The design has developed a number of measures to manage and minimise changes to existing surface water flows, including:</p> <ul style="list-style-type: none"> • Water sensitive design measures such as swales, wetlands and biofiltration basins • Culverts have been designed with scour protection where required and to be large enough to allow for blockages. No additional structures such as debris deflectors, trash racks or similar on drainage inlets have been identified as necessary. <p>The design checks have indicated that the finalised drainage design for the project can be developed to ensure performance is consistent with the commitments made in the Approval documents.</p>	Yes
B23	Connectivity measures will be implemented in accordance with <i>Wildlife Connectivity Guidelines for Road Projects</i> (Transport for NSW, under preparation). Fencing will be located to reduce roadkill of fauna species and funnel animals to creek crossings where safe passage will be available. Detailed design is to retain fauna passage at all four main creek lines (Cosgroves, South, Kemps and Badgerys Creeks).	The proposed changes to the project would not impact on the ability to comply with this requirement. Detailed design has retained fauna passage at both South Creek and Kemps Creek.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
B24	<p>Exclusion zones will be set up at the limit of clearing in accordance with Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA, 2011) (Guide 2: Exclusion zones).</p> <p>Exclusion zones will be set up to protect potential indirect impacts to threatened flora in accordance with the areas identified in the EIS and the amendment report (including Figure 1-2 of Appendix A of the amendment report).</p>	<p>Detailed design has maintained approved exclusion zones and additional exclusion areas have been provided in the detailed design, including additional areas at Clifton Avenue and on the northern side of the alignment within the Western Sydney Parklands</p>	Yes
B28	<p>Shading impacts will be minimised through detailed design of bridge and culvert structures.</p> <p>The need for artificial lighting during construction and operation will be minimised through detailed design where feasible, including directing lighting away from vegetated areas where practicable.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
B29	<p>Additional targeted surveys for <i>Pimelea spicata</i> will be conducted in optimal conditions, as defined by NSW Bionet Threatened Biodiversity Profile Data Collection (DPIE). <i>Pimelea spicata</i> must be surveyed at least three occasions, with each occasion at least a month apart unless the species is found prior. A reference population must also be surveyed on each occasion.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
TT07	<p>Existing property access would be maintained at all times.</p> <p>Any changes to access arrangements or alternative access that are necessary during construction will be done with consultation with the landowner. Any changes to access will provide the same equivalent pre-existing level of access unless agreed to by the land owner</p> <p>Property access that is physically affected by the project will be reinstated to at least an equivalent standard, in consultation with the landowner.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
TT10	Investigate and develop an appropriate traffic solution to manage the expected traffic delays during construction in the vicinity of Devonshire Road. The options considered and the preferred solution will be documented in a memo and then implemented through the CTTMP for the project.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA01	<p>An Urban Design and Landscape Plan (UDLP) will be prepared to minimise landscape character and visual impacts, and detail and guide the implementation of landscape features to be installed as part of the project, including re-vegetation requirements.</p> <p>This will include requirements for the provision of vegetative screening to soften the appearance of structural elements of the project such as noise walls and provide screening of sensitive views. The UDLP will also consider the requirements of the heritage interpretation framework that will be prepared for the project (NAH02).</p> <p>The UDLP will be prepared in accordance with applicable guidelines, be consistent with the concept project identity in the EIS and relevant urban design objectives and principles for the project including consideration of implementation of Crime Prevention Through Environmental Design (CPTED) principles, and in consultation with relevant councils.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA02	A detailed Landscape Plan will be prepared for the project and implemented throughout construction. The plan will guide the implementation of measures to minimise landscape character and visual impacts, including revegetation requirements.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA03	Existing vegetation within the construction footprint will be retained and protected where possible. This includes densely vegetated areas such as remnant riparian forests and Cumberland Woodlands in Western Sydney Parkland.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
LVIA04	Site levels and grades for the project will integrate with the surrounding terrain to help the visual assimilation of the project into the surrounding landscape where practicable. Engineer slopes with gradients no steeper than 3H:1V where possible to maximise the establishment of vegetation on these batters and allow for appropriate maintenance.	Landscape and urban design plans have integrated the design with the surrounding terrain and minimised vegetation clearance where possible. The design team reviewed potential locations for 3:1 batters or less steep batters, however due to constraints of boundaries combined with maintenance tracks, drainage channels and sedimentation basin requirements it was identified that there were no feasible length where this could be undertaken.	Yes
LVIA06	Where noise mitigation such as noise barriers are required, they will be designed with the aim of minimising visual impacts.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA07	Temporary and permanent lighting will be designed and implemented with consideration of: <ul style="list-style-type: none"> • The need to orientate lighting to minimise light spill and glare impacts on nearby receivers • The need to minimise vandalism and maintenance requirements • Requirements of the National Airports Safeguarding Framework (NASF) (National Airports Safeguarding Advisory Group, n.d.) for operational lighting • Opportunities to implement sustainability initiatives in design such as energy efficient or solar lighting. 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA09	The findings and recommendation of the Aboriginal cultural heritage design process managed by Balarinji will be incorporated into the urban design and implemented as part of the project, including interpretive initiatives.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
LVIA10	Shared user paths to be delivered as part of the project will not preclude connections to future open space corridors and land use as identified in the Western Sydney Land Use and Infrastructure Implementation Plan (LUIIP) (DPE 2018). Where further design of adjacent open space corridors is undertaken, shared user paths will be provided to connect at an appropriate location. Shared user paths will be designed to be located away from road-side edges to provide an immersive landscape experience for pedestrians and cyclists, where possible.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA12	Highly visible elements of the project including potential noise barriers, retaining walls, bridge structures and urban design material selection will be designed to satisfy functional requirements and adopt the design principles detailed in the M12 EIS Landscape Character, Visual Impact Assessment and Urban Design Report. The proposed designs will be documented in the relevant UDLP for the project.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA13	Consider a standard design for retaining walls and major structures across the project, to present a coordinated 'suite of elements'.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA14	The project must consider CPTED principles during detailed design to minimise safety risks to all users. The project must carry out periodic CPTED reviews by a qualified professional and implement any additional recommendations where reasonable and feasible.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
LVIA15	<p>A tree management strategy will be prepared for the project, outlining:</p> <ul style="list-style-type: none"> • Measures to minimise tree removal to retain and protect as many trees within the construction footprint as reasonable and feasible • Measures to avoid damage to trees that are to be retained within the construction footprint to ensure the maintenance of health and stability of the trees in accordance with AS4970-2009 Protection of trees on development sites • Requirements for the pruning of trees to be carried out by a suitably qualified person in accordance with AS 4373-2007 Pruning of amenity trees • Consideration of maintenance requirements and safety standards • Requirements for the replacement trees where removal cannot be avoided including: • Net increase in the number of trees (not identified as within an EEC) • Where it is not practicable to plant trees in the operational footprint an alternative location will be identified in consultation with relevant councils and in consideration of future development in the local area • Minimum pot size in accordance with part 3.2.1 (Rural road reserves) in the Roads and Maritime Landscape Guideline (2018b) subject to long-term viability of the plant. 	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
LVIA16	<p>Revegetation for the project will consider the land use requirements of the National Airports Safeguarding Framework (NASF) (National Airports Safeguarding Advisory Group, n.d.) to minimise the risk of wildlife strikes at the Western Sydney Airport.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
LVIA17	Carry out appropriate soil analysis and identify soil preparation requirements for landscaping treatments to inform the Urban Design and Landscaping Plan and vegetation management in accordance with Roads and Maritime's Batter Surface Stabilisation Guideline (2015b).	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
LVIA18	Species selected for landscaping will consider species that are resilient to future modelled climatic conditions and are suitable for establishment on road embankments.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
SLP05	The project will be designed with the aim of minimising impacts on existing utilities and services, in consultation with utility owners and/or providers of services where feasible and reasonable.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
SLP06	Utility owners and/or providers of services will be identified and consulted with before works start, to determine the requirements for access to, protection of, or relocation of services. Disruption to existing services will be minimised where feasible and local residents and businesses will be notified before any planned disruption.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
SLP08	Adjustments to facilities in Western Sydney Parklands (eg walking and cycling trails and Sydney International Shooting Centre access) will be carried out in consultation with the Western Sydney Parklands Trust.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SLP10	<p>Ongoing consultation regarding management of potential impacts will be carried out in accordance with the Community Communication Strategy with the following community facilities:</p> <ul style="list-style-type: none"> • Kemps Creek Sporting and Bowling Club • Kemps Creek Cougars Baseball Club • Science of the Soul Study Centre • Muhammadi Welfare Association of Australia • Schools such as Kemps Creek Public School and Christadelphian Heritage College, and Irfran College • Western Sydney Parklands • Sydney International Shooting Centre. 	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
AH03	<p>Impacts upon identified Aboriginal sites will be minimised where feasible in consultation with a suitably qualified and experienced archaeologist. Measures considered will include (but not be limited to):</p> <ul style="list-style-type: none"> • Designing and locating bridges (including bridge pylons), haulage routes and other access roads to minimise potential disturbance of soils where feasible • Focusing protection measures on the zone within 100 metres of creeks including consideration of opportunities to cover the original cultural deposits in temporary protective barriers such as geotextile fabric and a layer of clean fill. 	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
AH05	<p>Investigations will be carried out during detailed design to determine the feasibility of retaining cultural deposits between the pylons of bridges or elevated structures at the following sites:</p> <ul style="list-style-type: none"> • BCW • BCE • SCW T1 • SCW T2 • SCE. <p>This will include covering the original cultural deposits beneath temporary protective barriers, where feasible, such as geotextile fabric and a layer of clean fill material.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
NAH03	<p>Impacts on Non-Aboriginal heritage items will be avoided or minimised where reasonable and feasible. Where impacts are unavoidable, works will be carried out in accordance with the measures for individual Non-Aboriginal heritage items outlined in measures NAH04 to NAH12.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
NAH05 (amended)	<p>All extant elements of the radio telescopes and associated infrastructure, including rubbish mounds situated outside the construction footprint will be left intact.</p> <p>Ground penetrating radar, or other remote sensing survey techniques, will be carried out under the supervision of a suitably qualified and experienced archaeologist before any ground disturbance within the heritage curtilage of the Fleurs Radio Telescope Site contained within the construction footprint to identify any sub-surface cables:</p> <ul style="list-style-type: none"> • If additional sub-surface FST components are unexpectedly identified during ground penetrating radar survey which have not been discussed as part of the 	<p>This REMM has been revised to outline the management measures needed for the additional elements of Fleurs Radio-telescope site that are located within the construction footprint. Further detail is provided in Section 4.5 and Appendix C.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	<p>consistency assessment, then additional assessment and management would be required. This would include, but may not be limited to, archival survey and recording</p> <p>Measures will be included in the CHMP to describe how the heritage values of the site will be conserved and managed during construction</p> <p>Transport for NSW will engage a suitably qualified heritage consultant to prepare an archival photographic recording of the impacted areas of the property, in accordance with DPC (Heritage) Heritage NSW guidelines (Heritage Council of NSW 2006). The archival recording report will include but not be limited to:</p> <ul style="list-style-type: none"> • Detailed survey drawings and photographic archival recording of remaining above-ground elements of the Fleurs Radio-telescope site. This survey will detail the exact location and orientation of remnant fabric within the landscape, including fabric associated with the former location of FST antenna X3 and antenna X4, the concrete pad between antennas X3 and X4, and the former vehicle access track Survey drawings will be included in the archival recording report • Outcomes of the remote sensing survey undertaken by GHD in 2021 to provide a comprehensive record of the site (or as comprehensive as possible prior to excavation) • Details of sample cables collected including original exact location by description, co-ordinates and mapping. <p>Prior to construction TfNSW will consult with relevant interested organisations (such as CSIRO, Universities, amateur telescopic organisations, local heritage bodies and other special interest groups) to determine if there is interest in retaining sub-surface cabling (including details on the type and length cabling to be retained) or other structures identified</p>		

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	<p>during archival recording, remote sensing or any unexpected additional cables found during construction</p> <p>The M12 West and M12 Central Contractor will (with advice from TfNSW Overarching Archival Recording Contractor) be responsible for the following:</p> <ul style="list-style-type: none"> • Retrieval of a sample of each type of cable / compressed air hose along the cable alignment between antennas X3 and X4 with supervision by a heritage specialist. This will include retrieval of 1-2m (or a length directed by TfNSW following consultation with stakeholders) of each type of cable / compressed air hose including the relevant attachment. The selection of the types and length of cables / hose to be collected will include consideration of the following: <ul style="list-style-type: none"> ○ Physical review of the cables / hose types visible at South Creek 3 Antenna Complex, South Creek 4 Complex, and South Creek 5 Antenna Complex ○ Any additional information identified through remote sensing survey of the cable alignment ○ Discussion with archival recording or other relevant heritage specialists where required ○ Outcomes from the consultation undertaken by TfNSW with interested parties ○ Cable samples will be collected, with consideration given to potentially contaminated materials, such as asbestos and PCBs. Appropriate WHS measures will be implemented in accordance with the Contractor's WHS Plan ○ Cable samples will be tagged, including exact location by description and relevant coordinates of the cabling prior to its extraction 		

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	<ul style="list-style-type: none"> ○ Safe storage of cable samples until collection by interested parties. If samples are unclaimed by interested parties within three months, they will be appropriately disposed of at a licensed landfill by the contractor ● Where cabling is not impacted by construction works, it can remain in-situ, otherwise the contractor is responsible for appropriate disposal. <p>Concrete plinths:</p> <ul style="list-style-type: none"> ● Prior to construction, the contractor must establish an exclusion zone around the concrete plinths at South Creek 3 Antenna Complex (Central) and South Creek 5 Antenna Complex (West) to protect against inadvertent impacts during construction. ● If leaving the plinths in situ during construction is not practicable, they will be removed and stored temporarily with survey information providing details of their position relative to each other and orientation. The Contractor will then investigate opportunities for re-establishing the concrete plinths on site close to their original location and/or as part of the interpretative display for the Radio Telescope site. If re-established, the survey information collected prior to their removal must be used to ensure that the plinths are located in the same orientation and arrangement. ● Prior to removal of the concrete plinths, the contractor is to identify whether any of the plinths are used as state survey marks. The contractor must comply with the preservation of survey infrastructure requirements in 		

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	<p>TfNSW specification G71. It is noted TS7279 is located on one of the plinths at X3.</p> <p>Measures for M12 Central only:</p> <ul style="list-style-type: none"> • Prior to construction the contractor must establish an exclusion zone around the former location of antenna X3 at South Creek 3 Antenna Complex to protect against inadvertent impacts during construction. • Prior to construction the contractor must establish an exclusion zone around the metal shed at South Creek 3 Antenna Complex to protect against inadvertent impacts during construction. <p>The heritage interpretation framework for the project (NAH02) will include interpretation measures that will improve community awareness of the history of the Fleurs Radio Telescope as well as determine suitable locations for the presentation of information that are publicly accessible.</p>		
NAH08	<ul style="list-style-type: none"> • A suitably qualified heritage consultant will be engaged to prepare an archival photographic recording of the impacted area before its disturbance and/or removal, in accordance with DPC (Heritage) guidelines (Heritage Council of NSW 2006). The recording will include a detailed map showing the location of the features. • An interpretive framework developed for the project will include consideration of elements to enable the continued interpretation and understanding of the airstrip at Fleurs Aerodrome as a linear and continuous element. This will be carried out in consultation with Department of Defence and consider opportunities for involvement of veterans groups. 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	<ul style="list-style-type: none"> Relevant guidelines and associated safe working distances will be adhered to for remaining heritage structures as outlined in the Appendix K 		
NAH10	<ul style="list-style-type: none"> Management measures identified in the project UDLP (LVIA01) will be implemented during detailed design to minimise impacts on landscape and vistas Flooding management measures (F01 to F08) and surface water quality and hydrology management measures (SWH01 to SWH13) will be implemented to reduce broader impacts on the surrounding scenic landscape. 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV11	<p>The following structures have the potential to be within the safe working distances for sensitive structures (Group 3 from DIN 4150):</p> <ul style="list-style-type: none"> Item 1: McGarvie Smith Farm Item 2: Fleurs Radio Telescope Site Item 4: Upper Canal System Item 6: McMaster Field Station Item 7: Fleurs Aerodrome. <p>A detailed survey will be completed to determine the potential for vibration impacts and to define appropriate criteria for each heritage item. Vibration monitoring will be carried out when vibration intensive tasks are occurring within the minimum working distances to heritage structures. Where the monitoring identifies exceedances in the relevant criteria, or where impacts are identified, additional mitigation measures will be identified and implemented to appropriately manage impacts.</p>	<p>A Building condition and public utilities assessment report has been prepared. This identified structures within the minimum working distances for vibration where a building conditions survey will be required.</p> <p>Two heritage items (items 2 and 7) were identified within this area (comprising of a metal structure and concrete slabs). The survey recommends that additional investigations should be undertake to determine whether vibration monitoring is required.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
NV09	Building Condition Surveys will be offered in writing to property owners before construction where there is a potential for construction activities to cause structural or cosmetic damage. A comprehensive report will be prepared by a suitably qualified professional before the relevant works begin and will comprise a written and photographic condition.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV13	The likelihood of cumulative construction noise impacts will be considered during detailed design when detailed construction schedules of other projects are available. Construction works will be scheduled with the aim of minimising concurrent works near sensitive receivers where possible in consultation with managers of other nearby projects that are likely to result in a cumulative impact. This will include the coordination of respite between the various construction projects where receivers are likely to experience concurrent construction impacts where feasible. Coordination between project teams would be carried out throughout construction.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV14	Operational noise and vibration mitigation measures will be identified in an Operational Noise and Vibration Review (ONVR). Requirements for mitigation measures, including quieter noise pavements, noise barriers, and at-property treatments, will be reviewed as part of the ONVR and as the detailed design progresses. The implementation of treatments will be carried out in accordance with Transport for NSW Noise Mitigation guidelines (Roads and Maritime 2015). Owners of residences identified as eligible for noise treatment triggered by the project will be contacted by TfNSW and/or TfNSW's contractor.	An operational noise assessment carried out for the proposed changes is provided in Appendix D. This indicates that the proposed changes will result in a reduction in the number of receivers previously identified in the approval documents as eligible for mitigation measures.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
F01	Further flood investigations and hydrological and hydraulic modelling will be carried out during detailed design to ensure the flood immunity objectives and design criteria for the project are met. The modelling will be used to define the nature of both main stream flooding and major overland flow along the full length of the project corridor under pre- and post- project conditions and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow. The hydraulic model(s) will be based on two-dimensional hydraulic modelling software. The modelling will take into account any updated regional flood modelling and information available at the time.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
F04	Creek adjustments would be re-considered and/or further refined to minimise the impact on the creeks during detailed design.	Bridge designs for Kemps Creek and South Creek have been refined to minimise creek impacts as part of the detailed design. This has included realignment of bridge piers to minimise creek disturbance.	Yes
F05	Detailed construction staging plans will be developed during detailed design so that bridges and culverts are constructed in a way that minimises flood risk.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
F06	Measures to address potential impacts of culvert blockage on afflux will be further investigated during detailed design and may include the installation of debris deflectors, trash racks or similar on drainage inlets where reasonable and feasible.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
F09	The proposed bridges, culverts and changes to watercourses will be further refined during the detailed design to minimise potential flooding impacts.	Additional flood impact assessment, modelling and drainage design has been prepared as part of the detailed design. The findings of this modelling has influenced the detailed design for the bridges and culverts in order to minimise potential flooding impacts.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SWH03	<p>A water reuse strategy will be developed for both construction and operational phases of the project to reduce reliance on potable water. This strategy will be prepared during the detailed design stage and implemented throughout the project and will outline the construction and operational water requirements and potential water sources to supply the water demand in consultation with Sydney Water. Alternative water supply options to potable water will be investigated, with the aim of reusing water using recycled water where feasible.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
SWH07	<p>The performance water quality controls developed for the design as set out in the EIS and the amended water quality and hydrology controls outlined in this amendment report (including but not limited to temporary and permanent sediment basins) will be verified as the detailed design develops for the project to ensure the objectives of the project are achieved.</p> <p>In the instance that water quality (MUSIC) modelling carried out during detailed design it cannot be demonstrated that the water quality controls would be effective in mitigation potential impacts, additional mitigation measures would be identified and implemented, where possible.</p>	<p>Further assessment has compared MUSIC modelled M12 discharge and sampled background concentrations to the ANZECC guidelines trigger values South Creek and Kemps Creek. Results are discussed in Section 4.8.3.</p>	Yes
SWH08	<p>Further water quality assessment will be undertaken during detailed design to establish site specific discharge criteria for construction sediment basins.</p> <p>Based on this, the number, location and size of the basins will be further refined during the detailed design with consideration to the relevant NSW EPA Environment Protection Licence application requirements and the environmental values of the downstream receiving waterway.</p>	<p>Further water quality assessment was undertaken during detailed design to establish site specific discharge criteria for construction sediment basins. This is summarised in Section 4.8.3. The number, location and size of the basins has been rationalised to accommodate the proposed changes.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SWH09	<p>Practical measures to prevent water pollution and control, abate or mitigate impacts to the environment will be investigated at the detailed design stages of the project with the aim to make improvements to the currently proposed water quality controls. Such measures may include:</p> <ul style="list-style-type: none"> • Larger or high efficiency temporary basins • Alternative dry bioretention operational basins. 	<p>Practical measures to prevent water pollution and control, abate or mitigate impacts to the environment have been investigated. The design incorporates measures to mitigate water pollution including biofiltration basins, wetlands and spill containment measures.</p>	Yes
SWH10	<p>The use of water sensitive urban design measures will be considered during detailed design to meet water quality objectives.</p>	<p>A combination of swales, bioretention and water quality basin treatment trains have been developed to contribute towards meeting water quality objectives. This is summarised in Section 4.8.3.</p>	Yes
SWH12	<p>The following measures will be carried out to manage activities within watercourses or on waterfront land:</p> <ul style="list-style-type: none"> • Implementing practices to minimise disturbance of banks • Undertaking bank stabilisation and installing instream structures • Maintaining minimum flows to assist in maintaining the viability of aquatic communities and preventing barriers to fish passage • Constructing instream crossings during low flows and design so that drainage off crossing doesn't contribute sediment load to the stream • All drainage feature crossings (permanent and temporary watercourse crossings and stream diversions), drainage swales and depressions will be designed by a suitably qualified and experienced professional and will be designed and constructed in accordance with relevant guidelines. 	<p>Detailed design has reviewed structures and the construction methodology to identify where environmental protections are required and improvements can be made.</p> <p>Principle measures include:</p> <ul style="list-style-type: none"> • Design of rip-rap to prevent scour • Designing South and Kemps Creek bridges to minimise adjustments and piers in the creek. 	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SWH13	<p>A set of hydrologic and hydraulic models will be developed, which are to be used to define the nature of both main stream flooding and major overland flow along the full length of the project operational footprint under pre- and post-project conditions. The hydraulic model is to extend a sufficient distance upstream and downstream of the project operational footprint, to negate any boundary effects and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow. The hydraulic model(s) is to be based on the TUFLOW (or equivalent) two-dimensional (in plan) hydraulic modelling software.</p> <p>The models will be used to verify the nature and extent of impacts and to confirm the type of mitigation measures required, including potential mitigation measures identified throughout the EIS (see Table 5-9 in Appendix M of the EIS) and the amendment report and supplementary memo (see Table 5-6 in Appendix I of the amendment report).</p> <p>The models will also be used during detailed design to describe the interaction between the project and flows particularly with respect to culverts and to assist in refining the design for flows arriving at and travelling through culverts.</p> <p>If further modelling identifies impacts to private properties, TfNSW will consult with landowners regarding appropriate management measures to be implemented.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
GW01	<p>Groundwater monitoring will be carried out as part of the construction water quality monitoring program for the project. The groundwater monitoring will be based on the water quality monitoring methodology, water quality indicators and the monitoring locations presented in the Groundwater quality and hydrology assessment report (Appendix N of the EIS and Table 7-1 in the groundwater supplementary technical memorandum (Appendix J of amendment report)).</p> <p>Baseline groundwater monitoring will be carried out at least monthly for at least six months before construction. Monitoring will also be carried out at least monthly during construction and will continue for at least six months of operation to verify that there are no groundwater impacts, and that management measures are adequate.</p>	<p>Baseline groundwater monitoring has been carried out at 12 sites.</p> <p>This also includes wet weather events every six months where possible, as outlined in EIS.</p> <p>This is recorded monthly from July 2020 (to continue for 24 months).</p> <p>Supplementary groundwater level data has been collected from additional monitoring bores installed in the Clifton Avenue area as discussed in Section 4.8.3</p>	Yes
GW02	<p>Potential impacts on groundwater flows will be reconsidered as the detailed design for the project progresses, particularly in relation to the projects vertical alignment and extent of road cuttings. The aim of this will be to ensure that the groundwater controls proposed for the design as set out in this document would remain effective in mitigating groundwater impacts.</p> <p>In the instance that, during detailed design it cannot be demonstrated that the groundwater controls would be effective in mitigating potential impacts, or if observed groundwater inflow rates into the western cut or airport interchange northern and southern cuts are higher than estimated, additional measures will be implemented to minimise potential impacts on groundwater flows due to road cuttings or other sub-surface components of the project.</p>	<p>Baseline groundwater monitoring has been carried out. Additional bores have been installed in areas identified as having gaps in data.</p> <p>Overall, the groundwater impacts associated with the proposed changes to the project are considered to meet the minimal impact considerations of the NSW Aquifer Interference Policy and are consistent with the current project approvals.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
GW05 (new)	<p>Groundwater quality, levels and inflows will be monitored at Clifton Avenue (Cut 9) and the location of the Sydney Water culverts during construction and operation as outlined in the M12 Central consistency assessment report (GHD, 2021).</p> <p>The groundwater indicators to be monitored will be as per Section 7.2.5 of Appendix N of the EIS. Groundwater inflows are to be monitored at monthly intervals. As part of observing inflows at the identified cuts, the groundwater inflow rate is to be estimated and the areas where groundwater inflow is occurring noted.</p> <p>During construction, if groundwater inflow rates are observed from the cuts identified through the detailed design of the M12 Motorway – Central including Cut 9 and at the Sydney Water culvert excavations, the groundwater quality from the cut is to be sampled.</p> <p>Operational phase groundwater quality sampling, including the quality sampling of Cut 9 inflows and at the Sydney Water culvert excavations, is to occur at monthly intervals for at least six months.</p>	<p>This new requirement has been proposed as a result of potential additional impacts from the detailed design, however overall the impacts remained consistent with the approved project.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
GW07 (new)	<p>Prior to construction commencing, the Construction Contractor will use their earthworks methodology to estimate the potential groundwater inflows that are expected in the first year of construction in order to confirm the inflows expected and if the proposed mitigation measures are sufficient to manage higher inflows that are likely during early earthworks activity.</p> <p>The estimate of groundwater inflows is to be undertaken for Cut 9 and at the Sydney Water culvert excavations. The estimate is to include groundwater inflow from both the walls and base of the cuts, and will take into account the construction methodology and staging for each cut. In addition, the estimate will utilise the maximum observed groundwater levels (as sourced from M12 Central groundwater monitoring data).</p> <p>The Construction Contractor will assess the results of the estimated groundwater inflows to confirm whether evaporation will be sufficient to mitigate the potentially higher inflows likely to be expected during early earthwork activities. If evaporation is determined not to be a sufficient mitigation measure, the Construction Contractor will identify and implement additional mitigation measures and these will be documented in the Construction Contractor's CEMP and Construction Soil and Water Management Plan.</p>	<p>This new requirement has been proposed as a result of potential additional impacts from the detailed design, however overall the impacts remained consistent with the approved project.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SC01	<p>Construction within areas of moderate to high risk saline soils will be managed in accordance with the CSWMP. Specific measures will also include (but not be limited to):</p> <ul style="list-style-type: none"> • Ongoing groundwater monitoring of salinity as part of the water quality monitoring program • Identification and management of saline discharge sites • Progressive stabilisation and revegetation of exposed areas following disturbance as soon as is practicable • Testing to confirm the presence of saline soils in areas of high salinity potential prior to disturbance. • Soil salinity management will also be carried out in accordance with the NSW Department of Primary Industries (2014) Salinity Training Handbook 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
SC02	Testing will be carried out to confirm the presence of saline soils in areas of high salinity potential and to confirm the presence of ASS around creeks prior to disturbance.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
SC05	<p>Detailed site (contamination) investigations will be carried out in accordance with the NSW EPA (1995) Sampling Design Guidelines and other NSW EPA endorsed guidance including the NEPM (2013) guidelines within the following AEI locations to confirm the presence of contamination before the start of construction at these locations:</p> <ul style="list-style-type: none"> • AEI 17: Stockpiles within Hi-quality Quarry Group Head Office • Within AEI 19: the area of miscellaneous construction activities and stockpiles of building materials along Luddenham Road (Lot 1, DP228498). • Within AEI 7: Area of waste and imported fill Former Kari and Ghossayn solid waste landfill (Lot 17, Clifton Avenue). 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	<ul style="list-style-type: none"> • Within AEI21: Substantial volume of illegally dumped material along Range Road, Cecil Park • Within AEI 24: Stockpiles within the OzSource property • Within AEI 26: TreeServe (wood processing, stockpiles of woodchips, logs and fire wood). <p>Within the ‘potential areas of existing fill’ identified in the Soils and contamination assessment report (Appendix K) for the amended project.</p> <p>Additional soil and groundwater investigations will be required in the areas of additional cut around the airport interchange northern cut and airport interchange southern cut to further assess the potential impacts to the amended project.</p> <ul style="list-style-type: none"> • Within AEI 6: PGH Bricks and Pavers • Within AEI 9: Sydney Recycling Park/ Wanless Recycling and Former Kari & Ghossayn Pty Ltd (Solid Waste Landfill) • AEI 10: SUEZ Kemps Creek Resource Recovery Park. <p>Additional soil and groundwater investigations will be required in the areas of additional cut around the airport interchange northern cut and airport interchange southern cut to further assess the potential impacts to the amended project</p>		
SC06	<p>Further intrusive asbestos investigations throughout the construction footprint will be carried out to assess asbestos risks before the start of construction. The investigations are to include visual assessments and ground truthing along the length of the project.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SC07	<p>A hazardous building materials management plan will be prepared in accordance with relevant guidelines to manage the removal of known and unexpected hazardous building during demolition activities.</p> <p>Before demolishing structures and/or buildings, a hazardous building materials audit will also be carried out in accordance with Australian Standard (AS 2601-2001) The demolition of structures. Where hazardous building materials are present, they will be managed to reduce the potential for contamination in accordance with the POEO Act and the Protection of the Environment Operations (Waste) Regulation (2014).</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
SC10	<p>A detailed investigation will be carried out within the area next to the SUEZ Kemps Creek Resource Recovery Park to assess the extent of high-risk soil gas. A report will be prepared to document the outcomes of the investigation and outline measures to manage risks including nuisance odours to the surrounding area during excavation, and prevent the build-up of gases in buildings, basins, and sub-surface trenches and pits, and other enclosed spaces/depressions associated with the project during construction. These investigations will be carried out in accordance (where applicable) with the Guideline for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (NSW EPA 2012a) and Assessing Risks Posed by Hazardous Ground Gases to Buildings Report (C665) (Wilson et al. 2007). This will include undertaking gas monitoring.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
SC11	Should the further investigations determine that gas concentrations remain elevated near the project footprint, gas monitoring will be carried out during construction within the construction footprint next to the SUEZ Kemps Creek Resource Recovery Park. If excavations are to be carried out within enclosed structures, gas accumulation monitoring will be carried out before and during construction. On site gas monitoring will be carried out in accordance with the NSW EPA (2016a) Environmental Guidelines: Solid Waste Landfills.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
SU1	A sustainability management plan for the project will be developed and implemented during detailed design, to give effect to the sustainability strategy for the project. The management plan will detail measures to meet the sustainability objectives and targets and IS rating tool credit requirements.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
CC01	<p>Detailed design will incorporate appropriate adaptation measures for all climate change risks with an original risk rating of moderate or above. These will include but not be limited to:</p> <ul style="list-style-type: none"> • Consideration of the full range of potential temperature extremes on the project (particularly bridge structures) which may occur as a result of climate change and consider material capacity to withstand heat during material type selection to minimise the likelihood of infrastructure failures • Consideration of energy dissipation at culvert outlets when velocities exceed existing magnitudes • Consideration of the use of native species which are typically more fire tolerant and can more rapidly regenerate after fire events • Maintenance of fauna passage along main creek lines under bridges. 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
CC02	A climate change monitoring and adaptive management framework will be prepared and implemented for the project. The framework will incorporate performance monitoring criteria and measures, and the requirement for periodic review of the climate change risk assessment and framework against updated climate data to ensure currency.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
GG01	Targets to reduce GHG emissions during construction and operation will be included in the project's sustainability management plan.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
GG02	Updated GHG assessment based on the detailed design for the project and the final project when built will be carried out.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
GG03	Vegetation removal will be minimised where practicable.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
GG04	The procurement of goods and services will consider goods and services that: <ul style="list-style-type: none"> • Are from local suppliers • Make use of recycled materials or materials with a low embodied energy content. • Are energy efficient or have low embodied energy • Minimise the generation of waste. 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
CU01	Regular consultation will be carried out with nearby/adjoining projects and key stakeholders during the detailed design and construction phase to review potential cumulative impacts and integrate designs and construction methodologies (including traffic impacts and noise management), as far as practicable to minimise cumulative impacts.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

The proposed changes are consistent with the Statement of Commitments / environmental management measures incorporated as part of the Division 5.2 Approval.

5.3 Project objectives

The principle objectives of the M12 Motorway are detailed within Section 3.3.1 of the Project EIS and include:

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

The project specific objectives are outlined within Section 3.3.2 of the Project EIS and include:

- Provide sufficient road capacity to meet traffic demand generated by the planned western Sydney urban development
- Provide a high standard connection to the airport with capacity to meet future freight and passenger needs
- Provide a road which supports and integrates with the broader transport network
- Support the provision of an integrated regional and local public transport system
- Preserve the access function of Elizabeth Drive
- Provide active local transport within the east–west corridor
- Make provision for connection to the future Outer Sydney Orbital.

The proposed changes support the project objectives.

As such the proposed changes are consistent with the program and project objectives.

5.4 Consistency questions – the Division 5.2 Approval

Table 5-3 presents a set of questions that assist Transport to determine whether the proposed change can be considered consistent with the Division 5.2 Approval.

Table 5-3: Division 5.2 Approval consistency questions

Consistency question	Discussion	Yes/No
1 Is the proposed change likely to result in changes to the scope and impacts of the project to an extent that would be considered a radical transformation of the project as a whole, as to be, in reality, an entirely new project?	The proposed changes detailed in Section 2.1 of this report would not result in a significant change to the project as a whole. The impacts associated with the proposed changes would be managed in accordance with the management measures proposed in the AR submissions report.	No

Consistency question	Discussion	Yes/No
2 Would any conditions of approval need to be amended in light of the change?	The proposed changes would not impact on the ability to comply with any of the conditions of approval. A review of the proposed changes against the conditions of approval is provided in Section 5.1.	No
3 Would the statement of commitments or environmental management measures need to change?	The proposed changes would not impact on the ability to comply with any of environmental management measures identified in the AR submissions report. A review of the proposed changes against the environmental management measures is provided in Section 5.2.	No
4 Would the proposed change be 'generally in accordance with' the documents incorporated in Standard Condition A1 (or A2)?	As described in Table 5-1, the proposed change is considered generally in accordance with the approval documents listed in Condition A1.	Yes
5 Would the environmental impacts of the project as a whole be altered by the proposed change to the extent that the proposed change would not be consistent with the Approval?	The environmental assessment detailed in Section 4 has found that the impacts are consistent with those impacts identified in the approval documents. These impacts can therefore be managed through safeguards identified in the AR submissions report.	No
6 Considering the project as a whole, would the magnitude of the change be viewed as consistent with the project?	The magnitude of the proposed change is negligible in comparison to the project as a whole. The proposed changes are consistent with the program and project objectives detailed in Section 5.3.	Yes

6. Consistency assessment – EPBC Approval

6.1 Commonwealth Minister’s Conditions of Approval

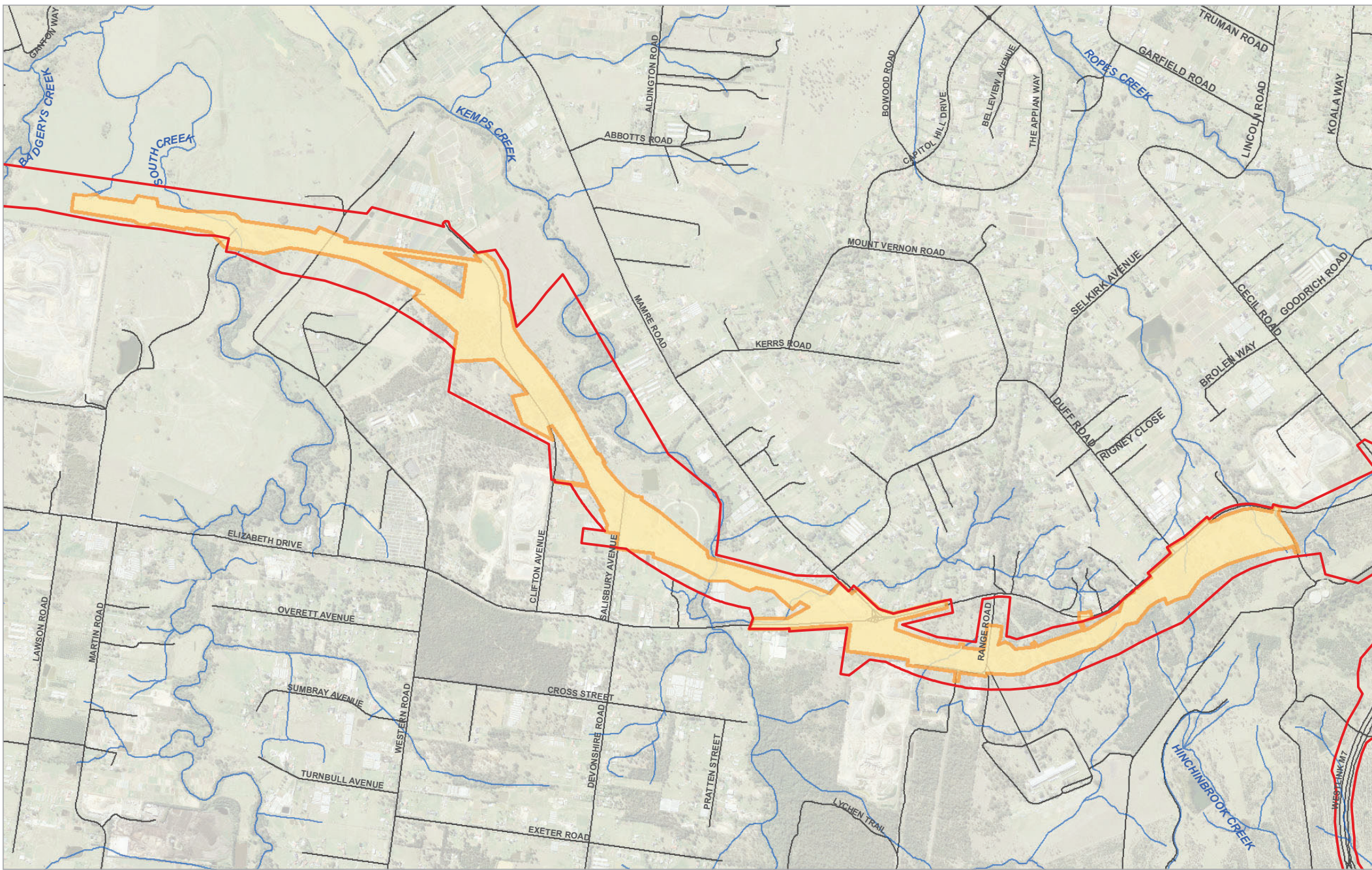
Table 6-1 below addresses those conditions of approval relevant to the proposed change in the context of the Commonwealth Approved Project. The amended construction boundary of the project compared to the EPBC boundary is shown in

Table 6-1: Consistency against relevant Commonwealth Minister’s conditions of approval for the project

No.	Condition of Approval	Discussion	Consistent
A2	The approval holder must submit to the Department a map(s) of the final construction footprint within six months of the final construction footprint being determined, and where the action is staged, a map of the final construction footprint for each stage, within six months of the final construction footprint for that stage being determined.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
A3	The approval holder must not clear protected matters outside the final construction footprint	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
A4	To minimise the impacts of the action on protected matters the approval holder must not clear more than the following specified amounts, or another specified amount determined in consultation with the Department in accordance with condition E4 of the State Infrastructure approval within the final construction footprint: <ul style="list-style-type: none"> a. 42.89 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest threatened ecological community; b. 0.44 hectares of Western Sydney Dry Rainforest and Moist Woodland on Shale threatened ecological community; c. 100 <i>Pultenaea parviflora</i> individuals comprising no more than 90 individuals from the Clifton Avenue population and no more than 10 individuals from the population north of the Western Sydney Parklands; 	A review of the construction footprint for the Central Package and construction methodology has been carried out. The proposed changes include an increase in the construction footprint. Appendix A details the changes in vegetation clearance compared to the approved upper clearing limits. Additional exclusion areas have been identified and included within the design. In addition, a number of ‘areas of vegetation to be retained’ have been identified which will be recommended to the construction contractor for retention, where feasible. These areas would require approval from Transport to clear. This has contributed to minimising impacts to protected matters.	Yes

No.	Condition of Approval	Discussion	Consistent
	<p>d. The number of <i>Pimelea Spicata</i> individuals identified in the additional surveys and as required by condition E8 of the State Infrastructure approval;</p> <p>e. 62.69 hectares of foraging habitat for Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>);</p> <p>f. 80.21 hectares of foraging habitat for Swift Parrot (<i>Lathamus discolor</i>).</p>	<p>The revised construction footprint includes several minor areas outside of the approved EPBC referral boundary. A map showing the final construction footprint will have to be submitted to the EPBC assessment officer.</p>	
A5	<p>For the protection of protected matters the approval holder must:</p> <p>a. Implement conditions A24 of Part A, Schedule 2 and C4, CS, C8, C9 and C10 of Part C, Schedule 2 of the State Infrastructure approval, where they relate to monitoring, managing, avoiding, mitigating, recording, or reporting on, impacts to protected matters.</p> <p>b. Implement biodiversity conditions E2 to E10 of Part E, Schedule 2 of the State Infrastructure approval where they relate to monitoring, managing, avoiding, mitigating, offsetting, recording, or reporting on, impacts to protected matters.</p> <p>c. Notify the Department in writing within 2 business days of formally proposing any change to the conditions of the State Infrastructure approval for which conditions Sa or Sb apply, and within 5 business days of becoming aware of the NSW Government proposing a change.</p> <p>d. Notify the Department in writing of any change to the State Infrastructure approval for which conditions Sa and Sb apply, within 5 business days of a change to the State Infrastructure approval being finalised.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

The proposed change can be accommodated within the EPBC conditions of approval.



- LEGEND**
- 100% detailed design construction footprint (August 2021)
 - EPBC Project Corridor
 - Roads
 - Watercourse

Paper Size ISO A3
 0 100 200 300 400
 Meters



Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56



Transport for NSW
 M12 Motorway Central Package
 Consistency Assessment

Project No. 21-12514239
 Revision No. -
 Date 30/08/2021

Comparison of the detailed design footprint and the EPBC referral corridor

FIGURE 6-1

©21/11/25/14239/GIS/Map#riverables21_12514239_Z064_Conistency_ExhibitedProject_EPBCBoundary_noflood.mxd
 Print date: 30 Aug 2021 - 10:59
 Whilst every care has been taken to prepare this map, GHD (and Nearnap) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: EPBC Corridor - JAAV, General Topography and Aerial Imagery - Sixmaps 2021 © Department of Customer Service 2020. Created by: elbertson

6.2 EPBC Approval consistency questions

Table 6-2 presents a set of questions that assist Transport to determine whether the proposed change can be considered consistent with an EPBC Approval.

Table 6-2: EPBC Approval consistency questions

Consistency question	Discussion	Yes / No
1 Would any conditions of the EPBC Approval need to be varied in light of the change?	No. Conditions relevant to the proposed change are identified in Section 6.1. None of these conditions would need to be varied as a result of the proposed change.	No
2 Would an approved action management plan required by a condition of approval need to be varied as a result of the proposed change?	No. There is no approved action management plan required by the EPBC Approval.	No
3 Would the proposed change constitute a 'new project' under the EPBC Act?	No. Section 4 of this report identifies the likely impacts associated with the proposed changes. The proposed changes would not constitute a 'new project' under the EPBC Act.	No

7. Conclusion

Based on the consistency assessment in this report, the proposed change is considered:

- Consistent with the Division 5.2 Approval
- ~~Not consistent with the Division 5.2 Approval. A modification to the project approval must be prepared and submitted for approval by the Minister.
[Note: if the change would solely be an administrative change to a condition of approval then the modification can be submitted in letter format.]~~
- Consistent with the EPBC Approval
- ~~Not consistent with the EPBC Approval. A written request to vary the condition/s of approval / approved action management plan must be prepared and submitted for approval by the Minister for the Environment / A new EPBC referral is required.~~
- ~~A radical transformation of the project and as such a new project should be developed with new and separate planning approvals obtained as necessary.~~

8. Other considerations


8.1 Permits, licenses and other approvals

There are no additional approval requirements or changes to any permits, licenses or other approvals as a result of the proposed change.

9. Certification

Author

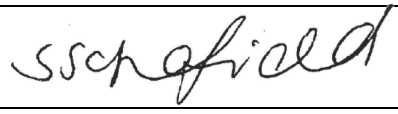

This consistency assessment provides a true and fair review of the proposed change for the M12 Motorway central section project.

Name	John McManus	Signature	
Position	Technical Director	Date	19 October 2021
Organisation	GHD		

Transport for NSW

The proposed change, subject to the implementation of all the environmental requirements of the project, is consistent with the Division 5.2 Approval.


The proposed change, subject to the implementation of all the environmental requirements of the project, is consistent with the EPBC Approval.

Name	Shannon Schofield	Name	Easwaran Veeragathipillai
Signature		Signature	
Position	Senior Environment and Sustainability Officer	Position	M12 Central Project /Delivery Manager
Date	19/10/2021	Date	19 October 2021

I have examined the proposed changes by reference to the Division 5.2 Approval in accordance with Section 5.25(2) of the EP&A Act and I have examined the proposed changes by reference to the EPBC Approval. I consider that the proposal is consistent with the Division 5.2 Approval and EPBC Approval.

I agree with the recommendations of the Transport Environment and Sustainability Officer and approve of the carrying out the proposed change in accordance with those recommendations.

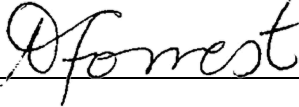
Name Suzette Graham

Signature 

Position A/Senior Manager Environment and Sustainability (M12/M7)

Date 19 October 2021

Name Deanne Forrest

Signature 

Position M12 Project Director

Date 20/10/2021

10. References

- ANZECC & ARMCANZ (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra
- DPI (2013) *Industries Policy and Guidelines for Fish Habitat Conservation and Management*. NSW Department of Primary Industries, June 2013.
- GHD (2021a). M12 Motorway – *Central Package Detailed Design Report – Flooding and Hydrology* (M12CDD-GHDA-ALL-SD-RPT-000100).
- GHD (2021b) M12 Motorway – *Central Package Detailed Design Report – Stormwater Drainage Report* (M12DD-GHDA-ALL-SD-RPT-000001)
- GHD (2021c) M12 Motorway – *Central Package Detailed Design Report – Design Development Plan* (M12CDD-GHDA-ALL-DN-PLN-000002).
- GHD (2021d) M12 Motorway – *Central Package Detailed Design Report – Waterway Report* (M12CDD-GHDA-ALL-SD-RPT-000003)
- GHD (2021e) M12 Motorway – *Central Package Detailed Design Report – Construction Wetland Design Report* (M12CDD-GHDA-ALL-SD-RPT-000010)
- Landcom (2004). *Managing Urban Stormwater: Soils and Construction. Volume 1*. NSW Government, Sydney
- Roads and Maritime Services (2019) *M12 Motorway, Environmental impact statement*
- SEEC (2021a) M12 Motorway - *Central Package Detailed Design, The Erosion and Sediment Management Report*, prepared on behalf of Transport for NSW
- SEEC (2021b) *M12 Motorway - Central Package Detailed Design, The Impact Assessment of Sediment Control Basin Discharges to Waterways*, prepared on behalf of Transport for NSW
- Transport for NSW (2020a). *Guideline for Assessing the Impacts of Treated Water Discharge from Water Quality Treatment Controls*. NSW Government, Sydney (Draft)
- Transport for NSW (2020b). *M12 Motorway, Amendment Report Submissions Report*
- Transport for NSW (2020c). *M12 Motorway, Amendment Report*
- Transport for NSW (2020d). *M12 Motorway, Submissions Report*
- Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report – Amendment*.
- Wallace Heritage Consulting (2018). *A Heritage Survey of the Fleurs Radio Telescope Field Site, Badgerys Creek, NSW*. Prepared for Jacobs Arcadis Joint Venture, p. vi.

Appendix A

Biodiversity impact assessment

Technical Memorandum

Issued by	Maddy Young, Kirsten Crosby – Ecologist, GHD
Subject	M12 Motorway Central Section Consistency Assessment – Biodiversity Technical Memorandum
Client	Transport for New South Wales
Project	M12 Motorway Central Section
Date	October 2021
Document reference	M12CDD-GHDA-ALL-EV-MEM-000007

1. Background

The new M12 Motorway will provide direct access to the Western Sydney International Airport at Badgerys Creek and connect to Sydney’s motorway network. The Motorway’s east-west alignment consists of 16-kilometres of dual carriageway between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham.

The Motorway will be built as a four-lane divided road and designed to be readily widened to six lanes to meet future demand. It will be designed to 110 km/h and posted at 100 km/h. The Motorway will provide increased road capacity and reduce congestion and travel times in line with future needs. It will also improve the movement of freight in and out of Western Sydney while serving the Western Sydney Priority Growth Area and the Western Sydney Employment Area.

The M12 is being delivered in three sections. This memorandum covers the central section of the M12 shown within the red area marked in Figure 1.



Figure 1 M12 central section extents

Within the central section, the project comprises:

- A four-lane dual-carriageway motorway, designed to facilitate widening to six lanes in the future
- Seven bridge locations as detailed below:
 - BR06 – M12 twin bridges over South Creek
 - BR07 – Clifton Avenue bridge over M12
 - BR08 – M12 twin bridges over Kemps Creek
 - BR09 – M12 twin bridges over Elizabeth Drive
 - BR10 – M12 twin bridges over Range Road

- BR11 – Water Tower Access Road bridge over M12
- Private property access bridge to Sydney University land
- Miscellaneous structures, including retaining walls, ITS gantries, sign supports, noise barriers and culverts
- Road drainage, comprising pits, pipes, channels and water quality facilities
- Culverts to convey existing or diverted watercourses
- Separate shared user path, including connections to existing networks
- Relocation and/or protection of existing utilities
- ITS infrastructure to support future smart motorways operation
- Signage, line marking, safety barriers and related road furniture
- Urban design, including landscaping and public art.

2. Project approvals

The project (SSI-9364) has been approved under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID:2018/8286). The project received approval from the NSW Minister for Planning and Public Spaces on 23 April 2021 and conditions of approval (CoA) were subsequently issued. The project received approval from the Minister for Commonwealth Department of Agriculture, Water and the Environment on 3 June 2021 and conditions were subsequently issued. The project's environmental impacts and commitments were presented in the following Approval Documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental Impact Statement* (the EIS)
- Transport for NSW (2020, August) *M12 Motorway, Amendment Report* (the amendment report)
- Transport for NSW (2020, August) *M12 Motorway, Submissions Report* (the submissions report).
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report* (the AR submissions report)
- Transport for NSW (2021, March) *M12 Motorway Amendment Report Submissions Report - Amendment*.

3. Purpose of this assessment

The purpose of this biodiversity consistency assessment is to:

- Describe the proposed change relative to the Division 5.2 Approval and the EPBC Act Approval
- Assess the environmental impacts associated with the proposed change relative to the Division 5.2 Approval and the EPBC Act Approval
- Determine if the proposed change is consistent with the Division 5.2 Approval or whether further approval is required either for a modification application or a new project
- Determine if the proposed change is consistent with the EPBC Act Approval or whether a variation to the conditions of approval or a new referral is required.

4. Description of the proposed changes

A review of the detailed design for both operation and construction of the project, including minor boundary changes, has identified a number of changes that would alter the approved biodiversity assessment. The principle design changes assessed are:

- **Shortening of South Creek Bridge (BR06)** The length of the bridge has been reduced to 12 x 33 m spans with an overall bridge length of 396 m. The refined bridge structure includes a design where bridge piers are positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 9 of the eastbound carriageway and Pier 10 of the westbound carriageway have been positioned at the edge of the creek and not within the low flow portion.
- **Shortening of Kemps Creek Bridge (BR08)** - The length of the bridge has been reduced to 5 x 30 m spans, with an overall bridge length of 150 m. The refined bridge structure includes a design where bridge piers are positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 3 on both carriageways is located within the creek, although the piers are positioned towards the creek bank and not within the low flow portion.
- **Change to Range Road Bridge (BR10) structure** - The Range Road Bridge design has been refined from a three span to a single span with vertical reinforced earth (RE) wall abutments. This would result in additional earthworks and no longer provide spill through abutment.
- **Repositioning of Water Tower Access Road alignment and bridge (BR11)** - The road and bridge have been moved around 250 m to the east to increase the distance between the bridge and the neighbouring TransGrid 330 kV exclusion zone. The type of bridge structure and vertical clearances have not changed.

During construction the following changes have been considered:

- **Other changes to the construction boundary** – Other changes have resulted from the need for an additional maintenance track, drainage refinements, adjustments required for the updated deposited plans, property adjustments, new exclusions zones and the removal of former compound site AF14 from the construction methodology. These changes resulted in minor changes to the construction boundary, increasing and decreasing it in places and therefore altering the impacts from vegetation clearance. These changes are shown on Figure 2.

5. Assessment methodology

5.1 Consistency assessment against the Approval documents

This assessment has reviewed the approval documents listed in section 2 for biodiversity impacts and offset calculations. Field surveys were carried out for the consistency assessment in June 2021 within the new areas of the detailed design construction footprint as follows:

- An additional area of WSPT property just west of Duff Road.
- A new maintenance track within WSPT land between Range Road and Duff Road. This is needed to provide access to drainage infrastructure and the fauna overpass.
- Transverse culvert at the western end of the project. The additional space is required to accommodate the scour protection needed for the culvert.
- New areas from changes in the deposited plans
- New areas from the property adjustment plans

The field surveys comprised:

- Vegetation mapping
- Searches for threatened flora.
- Terrestrial fauna habitat assessment

- Searches for the Cumberland Plain Land Snail (*Meridolum corneovirens*) in areas of suitable habitat.

The field surveys are described in further detail below in section 5.2

5.2 Field surveys

A desktop assessment and field surveys were undertaken to confirm the accuracy and currency of the vegetation mapping supplied by Arcadis for the EIS, *M12 Motorway Amendment Report - Appendix A Biodiversity supplementary technical report* (October 2020), and *M12 Motorway Amendment Report – Submissions Report* (December 2020). The field surveys were undertaken to confirm the extent, type and condition of threatened species and ecological communities to be impacted within the entire M12 central section. Areas outside the AR submissions report construction boundary were surveyed in June 2021.

Vegetation mapping of the site was ground-truthed in the field via systematic walked transects across the proposal site. Necessary adjustments were made by hand on aerial photographs of the proposal site with reference to a handheld Global Positioning System (GPS) unit. Native vegetation was divided into vegetation zones which represented a distinct Plant Community Type (PCT) and broad condition state. PCTs were identified based on vegetation structure, species composition, soil type and landscape position and with reference to the *BioNet Vegetation Classification* (OEH 2021c).

Targeted surveys were undertaken for threatened flora species that were predicted to occur at the site during the desktop review given known distributions, previous records in the locality and habitat requirements for each species. Targeted flora searches were completed by walking parallel transects spaced 10 m apart across the proposal site, with reference to Cropper (1993) and threatened plant survey guidelines (DPIE 2020a).

Fauna habitat assessments were undertaken throughout the site, including active searches for potential shelter, basking, roosting, nesting and/or foraging sites. Specific habitat features and resources such as water bodies, food trees, hollow-bearing trees, rock outcrops or overhangs, the density of understorey vegetation, the composition of ground cover, leaf litter and ground debris and soil type were noted.

Habitat assessments included searches for signs of fauna activity or occupancy including:

- Trees with bird nests or other potential fauna roosts.
- Burrows, dens and warrens.
- Distinctive scats or latrine sites, owl white wash and regurgitated pellets under roost sites.
- Tracks or animal remains.
- Evidence of activity such as feeding scars, scratches and diggings.

The locations and quantitative descriptions of significant habitat features were captured with a handheld GPS unit and photographed.

Active searches of woody debris and other ground litter around the base of trees were conducted throughout the site targeting the Cumberland Plain Land Snail. Potential shelter sites such as old fence posts found lying on the ground were carefully turned and inspected.

The field surveys did not result in any changes to the vegetation mapping in the EIS (RMS 2019), AR (TfNSW 2020a) and AR submissions report, or any updated threatened species findings within the proposed construction boundary.

6. Existing Environment

This section provides a comparison of landscape features and values, native vegetation and fauna habitat, threatened species and aquatic habitat of the construction footprint as described in section 6.2.2 of the AR submissions report and the refined construction footprint shown in Figure 2. No change in the vegetation mapping, or threatened species findings presented in the EIS (RMS 2019), AR (TfNSW 2020a) and AR

submissions report have been made a result of the field surveys, the changes in areas described in section 7 are a result of the change in construction boundary for the 100% detailed design.

6.1 Plant Community Types

Seven PCTs were identified in the construction footprint described in the AR submissions report. No additional PCTs were identified in the 100% detailed design construction footprint. There are some minor differences in the areas of five PCTs within the 100% detailed design construction footprint compared with the construction footprint as described in the AR submissions report. There are small increases in the areas of PCTs 724, 849, 850 and 1800 and a small decrease in the area of PCT 883 within the 100% detailed design construction footprint when compared with the construction footprint as described in the AR submissions report. The net increase of 0.26 hectares of native vegetation to be cleared is a result of the change in construction boundary and not a result of a change in vegetation mapping. The areas of each PCT within M12 Central AR submissions report and 100% detailed design construction footprint are listed in Table 7.1 and section 7.2.1 of this report.

6.2 Vegetation zones

Fifteen vegetation zones were identified within the seven PCTs in the AR submissions report construction footprint (TfNSW 2020c). The areas of each vegetation zone within M12 Central AR submissions report and 100% detailed design construction footprint are listed in Table 7-1 and section 7.2.1 of this report.

6.3 Threatened ecological communities

Six of the PCTs in the construction footprint as described in the amendment report were found to meet the criteria for five threatened ecological communities (TECs) listed under the Threatened Species Conservation Act (TSC Act). One PCT (PCT 883) was excluded from further assessment as it did not meet the description of the associated TEC as defined under the TSC Act. No additional TECs were identified in the 100% detailed design construction footprint. The 100% detailed design construction footprint contains some minor differences in areas in comparison to the construction footprint as described in the amendment report for three TECs.

Four of the PCTs in the AR submissions report construction footprint were found to meet the criteria for two TECs listed under the EPBC Act. Three of the PCTs that meet the criteria for a TEC listed under the EPBC Act were identified in the 100% detailed design construction footprint. The 100% detailed design construction footprint contains some minor differences in areas in comparison to the construction footprint as described in the AR submissions report for one TEC listed under the EPBC Act: Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (Table 7-4). The increase of 0.12 ha of this TEC within the refined construction footprint is located in additional the areas in the Western Sydney Parklands to the west of the M7 Motorway (Figure 3).

The areas of each TEC listed under the TSC Act and EPBC Act within M12 Central AR submissions report and 100% detailed design construction footprint are listed in Table 7.1 and section 7.2.1 of this report.

6.4 Fauna habitat types

Vegetation communities within the construction footprint as described in the EIS were consolidated into four broader fauna habitats based on general similarities in vegetation type, geology, landscape setting, habitat connectivity and fauna habitat values. Table 7-5 in section 7.2.1 compares fauna habitat in the construction footprint as described in the AR submissions report and the 100% detailed design construction footprint.

6.5 Threatened species

There are minor changes to the extent of fauna species polygon for the Southern Myotis (*Myotis Macropus*) in the M12 Central 100% detailed design construction footprint, compared with the central portion of the construction footprint as per the AR submissions report. The changes are presented in Table 7-7 and section 7.2.3 of this report.

6.6 Aquatic habitat

No additional areas of aquatic habitat were identified in the M12 Central 100% detailed design construction footprint.

6.7 Matters of National Environmental Significance

No additional MNES have been identified in the M12 Central 100% detailed design construction footprint. Section 7.2.5 provides further discussion of impacts to MNES within the construction footprint as described in the AR submissions report and the 100% detailed design construction footprint.

6.8 Additional areas within the construction footprint

6.8.1 WSPT property just west of Duff Road.

The additional area of WSPT land comprises a patch of moderate condition PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion. The canopy species included Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*Eucalyptus tereticornis*). The midstorey consisted of Hickory wattle (*Acacia implexa*), Australian indigo (*Indigofera australis*), Parramatta wattle (*Acacia parramattensis*), Blackthorn (*Bursaria spinosa*) and *Melaleuca decora*. The groundcover was mostly exotic and included Rhodes Grass (*Chloris gayana*), Fireweed (*Senecio madagascariensis*) and Cobblers Pegs (*Biden pilosa*). The north western portion of this area comprises biodiversity certified land and does not require additional assessment.

6.8.2 New maintenance track within WSPT land between Range Road and Duff Road.

The new maintenance track within WSPT land is located on an existing mountain bike track. The track is currently surrounded by moderate condition PCT 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (Photo 1). The vegetation adjoining the existing mountain bike track comprises two juvenile Grey Box (*Eucalyptus moluccana*), one juvenile Forest Red Gum (*Eucalyptus tereticornis*) and one juvenile Spotted Gum (*Corymbia maculata*). The midstorey was patchy and consisted of Parramatta wattle (*Acacia parramattensis*) and Blackthorn (*Bursaria spinosa*), with a weedy understorey dominated by African lovegrass (*Eragrostis curvula*).

The northern portion of this area comprises biodiversity certified land and does not require additional assessment. Six mature trees (one Grey Box (*Eucalyptus moluccana*) and five Forest Red Gum (*Eucalyptus tereticornis*) on the southern side of Elizabeth Drive fall within the biodiversity certified land within the detailed design construction footprint (Photo 2).



Photo 1 Location of new maintenance track within WSPT land along existing mountain bike trail



Photo 2 Mature trees on Elizabeth Drive

6.8.3 Transverse culvert at the western end of the project

The land within the new areas of the detailed design construction footprint at the Transverse culvert contains exotic pasture grass. One large Rough-barked apple (*Angophora floribunda*) was recorded outside of the boundary near the transverse culvert at the western end of the project (Photo 3). The tree contained multiple hollows and had a Diameter at Breast Height (DBH) of approximately 1 m.



Photo 3 Hollow bearing tree adjoining the Transverse culvert construction footprint

6.8.4 Construction boundary changes due to updated property adjustment plans

Minor alterations of the boundary occurred for the property adjustment plans. The changes were mostly related to driveways and were designed to avoid impacts to native vegetation. The driveways were located in existing hardstand areas or areas of exotic agricultural land. A large proportion of the boundary changes in the central portion of the 100% detailed design construction boundary occurred as a result of the property negotiation process and acquisition of land by TfNSW.

6.9 Field surveys

Field surveys confirmed the extent, type and condition of threatened species and ecological communities to be impacted by the M12 Motorway (Central) project. No changes to the vegetation mapping supplied by Arcadis for the EIS (TfNSW 2020a) or the amendment report (TfNSW 2020b) were required.

7. Assessment of potential impacts

7.1 Areas not requiring further assessment

Certified areas within the Growth Centres SEPP, which have already been subject to assessment as part of the certification of this area, have been excluded from impact assessment calculations under the Framework for Biodiversity Assessment (FBA). The areas of each PCT identified in the certified areas within the 100% detailed design construction footprint are listed in Table 7-1.

Table 7-1 Plant Community Types mapped within certified land

PCT Name	TSC Act Status	EPBC Act status*	Area within total M12 AR submissions report construction footprint within certified areas (ha)	Area within M12 Central AR submissions report construction footprint within certified areas (ha)	Area within M12 Central 100% detailed design construction footprint within certified areas (ha)	Change in area within certified areas (ha) of M12 Central
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)	CEEC	CEEC	0.66	0.66	0.26	-0.40
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (PCT 850)	CEEC	CEEC	10.04	9.95	7.44	-2.51
Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley (PCT 1800)	EEC	EEC	0.01	0.01	0	-0.01
			10.71	10.62	7.70	-2.92

7.2 Areas requiring assessment

7.2.1 Direct impacts to native vegetation

The M12 Central 100% detailed design construction footprint, excluding certified areas, contains about 32.81 hectares of native vegetation. This is an increase of about 0.26 ha of direct impacts to native vegetation within the M12 Central AR submissions report construction footprint. The areas of each PCT that would be directly impacted by the M12 Central 100% detailed design are presented in Table 7-3.

Table 7-2 Change in areas of PCTs within the M12 Central construction footprint

PCT No.	PCT Name	Area within the total M12 construction footprint as per the AR submissions report excluding certified areas (ha)	Area within the M12 Central construction footprint as per the AR submissions report excluding certified areas (ha)	Area within M12 Central 100% detailed design construction footprint excluding certified areas (ha)	Area (ha) of change within M12 Central excluding certified areas
724	Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	6.91	6.91	7.11	+0.2
830	Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	0.44	0	0	0
835	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	3.18	0.52	0.52	0
849	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	6.34	4.13	4.18	+0.05
850	Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition)	60.52	19.79	19.89	+0.1
883	Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion	0.57	0.57	0.45	-0.12
1800	Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	2.82	0.63	0.66	+0.03
Total		80.78	32.55	32.81	+0.26

The areas of each vegetation zone that would be directly impacted by the M12 Central 100% detailed design are presented in Table 7-3.

Table 7-3 Direct Impacts to native vegetation zones within the central portion of the M12 construction footprint excluding biodiversity certified land and exclusion zones

PCT Name	Vegetation zone code	Area (ha) within the total AR submissions report footprint (TfNSW 2020c)	Area (ha) within the central portion of the AR submissions report footprint (TfNSW 2020c)	Area (ha) within the central portion of the 100% design footprint	Total change in area (ha) from the central portion of the AR submissions report footprint
724 - Broad-leaved Ironbark - Grey Box - <i>Melaleuca decora</i> grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	724 - Moderate/Good_High	3.50	3.50	3.55	+0.05
	724 - Moderate/Good_Medium	2.96	2.96	3.11	+0.15
	724 - Moderate/Good_Poor	0.45	0.45	0.45	0
830 - Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	830 - Moderate/Good_Poor	0.44	0	0	0
835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	835 - Moderate/Good_Poor	3.18	0.52	0.52	0
849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	849 - Moderate/Good_Medium	3.64	3.04	3.09	+0.05
	849 - Moderate/Good_Poor	2.22	1.09	1.09	0
	849 - Moderate/Good_Poor (Derived Shrubland)	0.48	0	0	0
850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition)	850 - Moderate/Good_High	3.29	0	0	0
	850 - Moderate/Good_Medium	13.33	4.95	4.99	+0.04
	850 - Moderate/Good_Other (Revegetation)	24.58	14.84	14.90	+0.06
	850 - Moderate/Good_Poor	1.25	0	0	0
	850 - Low	18.07	0	0	0
883 -Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion	883 - Poor	0.57	0.57	0.45	-0.12
1800 - Swamp Oak open forest on river flats of the	1800 - Moderate/Good_Poor	2.82	0.63	0.66	+0.03

PCT Name	Vegetation zone code	Area (ha) within the total AR submissions report footprint (TfNSW 2020c)	Area (ha) within the central portion of the AR submissions report footprint (TfNSW 2020c)	Area (ha) within the central portion of the 100% design footprint	Total change in area (ha) from the central portion of the AR submissions report footprint
Cumberland Plain and Hunter valley					
Total		80.78	32.55	32.81	+0.26

All areas of native vegetation to be removed, except for PCT 883, fall within the definitions of TECs listed under the BC Act and/or the EPBC Act. The areas of each TEC that would be directly impacted as a result of the M12 Central 100% detailed design are listed in Table 7-4.

Table 7-4 Direct Impacts to threatened ecological communities within the central portion of the M12 construction footprint excluding biodiversity certified land and exclusion zones

TEC	Status	PCT(s)	Area (ha) within the total AR submissions report footprint (Arcadis 2021, TfNSW 2020c)	Area (ha) within the central portion of the AR submissions report footprint (TfNSW 2020c)	Area (ha) within the central portion of the 100% design footprint	Total change in area (ha) from the central portion of the AR submissions report footprint
TECs listed under the EPBC Act						
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	CEEC		42.89	25.10	25.22	+0.12
Total area of TECs listed under the EPBC Act						25.22
TECs listed under the BC Act						
Cumberland Plain Woodland in the Sydney Basin Bioregion	CEEC	850, 849	66.86	23.92	24.07	+0.15
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	835	3.18	0.52	0.52	0
Moist Shale Woodland in the Sydney Basin Bioregion	EEC	830	0.44	0	0	0
Shale Gravel Transition Forest in the Sydney Basin Bioregion	EEC	724	6.91	6.91	7.11	+0.20
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	1800	2.82	0.63	0.66	+0.03
Total area of TECs listed under the BC Act			80.21	31.98	32.36	+0.38

Table 7-5 compares fauna habitat in the construction footprint as described in the AR submissions report and the 100% detailed design construction footprint.

Table 7-5 Fauna habitat identified in the construction footprint

Habitat type	Habitat description	Area within the total M12 AR submissions report construction footprint excluding certified areas (ha)	Area within the M12 Central AR submissions report construction footprint excluding certified areas (ha)	Area within M12 Central 100% detailed design construction footprint excluding certified areas (ha)	Area of change in M12 Central excluding certified areas (ha)
Woodland	All mature and regenerating grassy, shrubby and heathy woodland vegetation within the study area not associated with riparian corridors on alluvial flats (PCTs 724, 830, 849, 850 and 883)	56.71	31.4	31.63	+0.23
Riparian forest	All mature and regenerating forest/woodland vegetation associated with drainage lines on alluvial flats (PCTs 835 and 1800)	6.00	1.15	1.18	+0.03
Grassland	All native and exotic grasslands, pastures and parklands. Scattered trees and landscape plants may also be present (No associated PCTs)	274.46	55.88	54.03	-1.85
Wetlands/ Watercourse	All naturally occurring and constructed permanent or ephemeral dams, ponds, creeks and drainage channels (No associated PCTs)	5.01	0.22	0.22	0
Total		342.18	88.65	87.06	-1.59

7.2.2 Indirect impacts to native vegetation

Indirect impacts to native vegetation were calculated for areas within 30 m of the construction footprint. Only vegetation that was categorised as a 'Non-viable edge' or 'New edge' was included in the indirect impact calculations. Indirect impacts to native vegetation associated with the AR submissions report and 100% detailed design footprints are shown in Table 7-6. The change in construction footprint has resulted in a decrease of 0.34 ha of native vegetation that would be indirectly impacted for the M12 Central 100% detailed design footprint when compared with the central portion of the AR submissions report footprint. A total area of native vegetation that would be indirectly impacted of 4.70 ha.

Table 7-6 Indirect Impacts to native vegetation within the central portion of the M12 construction footprint excluding biodiversity certified land and exclusion zones

PCT	Condition	Area (ha) within the total AR submissions report footprint (Arcadis 2021, TfNSW 2020c)	Area (ha) within the central portion of the AR submissions report footprint (TfNSW 2020c)	Area (ha) within the central portion of the 100% design footprint	Total change in area (ha) from the central portion of the AR submissions report footprint
Western Sydney Parklands					
Non-viable fragments					
850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition)	Moderate/Good_Medium	0.11	0.04	0	-0.04
	Moderate/Good_Other (Revegetation)	0.03	0.04	0	-0.04
New edges					
850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition)	Moderate/Good_Medium	3.44	0.55	0.42	-0.13
	Moderate/Good_Other (Revegetation)	5.92	3.96	3.83	-0.13
East of Clifton Avenue					
724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion	Moderate/Good_High	0.45	0.45	0.45	0
Total		13.30	5.04	4.70	-0.34

7.2.3 Removal of threatened fauna habitat

The areas of potential habitat within the M12 Central 100% detailed design construction footprint have increased for all of the subject species when compared to the central portion of the AR submissions report, except the Cumberland Plain Land Snail and White Bellied Sea Eagle which have remained the same. The increase in Southern Myotis habitat is a result of the additional hollow-bearing trees identified in the tree surveys by Cadence (2021). Areas of potential habitat were calculated for species credit species and the Grey-headed Flying-fox, a listed threatened species under the EPBC Act. In the BAR (Appendix E of the EIS), a conservative approach was adopted to calculate the area of potential habitat for threatened fauna species. For the purpose of targeted seasonal surveys potential habitat was defined as PCTs listed as associated vegetation types and habitat resources for each threatened species in the Threatened

Biodiversity Profile Data Collection, maintained in the NSW BioNet Atlas database (DPIE 2020). This method was used to calculate the areas of potential habitat for threatened fauna species within the 100% detailed design and central portion of the AR submissions report construction footprint. The results are summarised in Table 7-7.

Table 7-7 Potential habitat for threatened fauna in the M12 Central Construction footprint

Species	Listing under the BC Act	Listing under the EPBC Act	Associated PCT	Area (ha) within the total AR submissions report footprint (Arcadis 2021, TfNSW 2020c)	M12 Central AR submissions report footprint (ha)	M12 Central 100% design footprint (ha)	Total change from the central portion of the AR submissions report footprint (ha)
Cumberland Plain Land Snail	Endangered		835	5.10	0.52	0.52	0
Southern Myotis (breeding habitat)	Vulnerable		Hollow-bearing trees (breeding habitat)	1.05	0.51 18 hollow-bearing trees	0.67 20 hollow-bearing trees	+0.16 ha + 2 hollow bearing trees
Swift Parrot	Endangered	Critically Endangered	724, 830, 835, 849, 850, 883, 1800	80.78	32.55	32.81	+0.26
Grey-headed Flying-fox (foraging habitat)	Vulnerable	Vulnerable	835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Yellow-bellied Sheath-tail-bat	Vulnerable		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Eastern Coastal Free-tailed Bat	Vulnerable		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Greater Broad-nosed Bat	Vulnerable		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Large Bent-winged Bat (foraging habitat)	Vulnerable		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Little Bent-winged Bat (foraging habitat)	Vulnerable		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
Eastern False Pipistrelle	Vulnerable		835, 849, 850, 1800	72.86	25.07	25.25	+0.18
White-Bellied Sea-Eagle (breeding habitat)	Vulnerable		Nest site (breeding habitat)	One White-bellied Sea-Eagle nest.	No impact. Nest located outside of construct	No impact. Nest located outside of construc	No change

Species	Listing under the BC Act	Listing under the EPBC Act	Associated PCT	Area (ha) within the total AR submissions report footprint (Arcadis 2021, TfNSW 2020c)	M12 Central AR submissions report footprint (ha)	M12 Central 100% design footprint (ha)	Total change from the central portion of the AR submissions report footprint (ha)
					ion footprint.	tion footprint	

7.2.4 Impact to threatened flora species

The project would result in direct impacts on two threatened plant species, *Pultenaea parviflora*, and *Dillwynia tenuifolia*. The threatened flora species had previously been recorded in the AR submissions report construction footprint (TfNSW 2020c).

Table 7-8 Number of threatened plants impacted within the central portion of the M12 construction footprints excluding threatened plants located in biodiversity certified land and exclusion zones

Species	Number of individuals within the total M12 AR submissions report construction footprint (TfNSW 2020c)	Number of individuals within the M12 Central AR submissions report construction footprint (TfNSW 2020c)	Number of individuals within the M12 Central 100% design construction footprint	Total change from M12 Central AR submissions report footprint
<i>Dillwynia tenuifolia</i>	244	244	244	0
<i>Pultenaea parviflora</i>	Up to 100 individuals	93	93	0

7.2.5 Matters of National Environmental Significance

Six MNES were identified in the AR submissions report, four of the identified MNES are impacted by the M12 Central 100% detailed design. A comparison of MNES impacted by the central portion of the AR submissions report and the M12 Central 100% detailed design area shown in Table 7-9).

Table 7-9 Comparison of MNES for the construction footprint as per the amendment report and the refined construction footprint excluding certified areas and exclusions zones

MNES	Number or area (ha) within total M12 AR submissions report construction footprint	Number or area (ha) within M12 Central AR submissions report construction footprint	Number or area (ha) within M12 Central 100% detailed design construction footprint	Change in M12 Central excluding certified areas (ha)
Threatened Ecological Communities (area)				
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	42.89 ha	25.10	25.22	+0.12
Western Sydney Dry Rainforest and Moist Woodland on Shale	0.44 ha	0	0	0

MNES	Number or area (ha) within total M12 AR submissions report construction footprint	Number or area (ha) within M12 Central AR submissions report construction footprint	Number or area (ha) within M12 Central 100% detailed design construction footprint	Change in M12 Central excluding certified areas (ha)
Threatened flora (individuals)				
<i>Pultenaea parviflora</i>	Up to 100 individuals	93	93	0
<i>Pimelea spicata</i>	0	0	0	0
Threatened fauna (area of habitat)				
Grey-headed Flying-fox	62.69 ha (foraging)	25.07	25.25	+0.18
Swift Parrot	80.78 (foraging)	32.55	32.81	+0.26

7.3 Additional impact from the new areas within the construction footprint

Direct impacts at some of the key new areas within the 100 % detailed design construction footprint are described in section 7.3.1, are summarised in Table 7-10 and shown on Figure 2. Additional details for key areas are shown in Figure 3. The changes in these key areas do not account for all the changes within the M12 Central 100% detailed design construction footprint however, have been identified as key areas where there were increases to vegetation required to be cleared.

Table 7-10 Summary of direct impacts in the new areas within the 100% detailed design construction footprint

Location	PCT	BC Act listing	EPBC Act listing	Area within certified land (ha)	Area excluding certified land (ha)
WSPT west of Duff Road	850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a CEEC	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed as a CEEC	0.01 ha	0.03 ha
Maintenance track in WSPT land	850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a CEEC	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest listed as a CEEC	0.02 ha	0.04 ha
Total					0.07 ha

7.3.1 Direct and indirect impacts from the new areas within the construction footprint

WSPT property just west of Duff Road.

The changes to the detailed design boundary in WSPT land west of Duff Road would result in direct impacts to 0.03 ha of 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion. The removal of the vegetation in WSPT land will not create a 'Non-viable edge' or 'New edge'. Indirect impacts to the adjoining retained vegetation will be avoided through the tree protection measure described in section 8.1 and the REMMS presented in Section 7 of the AR submissions report. 0.01 ha of 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion is located within biodiversity certified land and does not require further assessment.

New maintenance track within WSPT land between Range Road and Duff Road.

The new maintenance track with WSPT land would result in direct impacts to 0.04 ha of 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion. The removal of the vegetation for the maintenance track will widen an existing path in WSPT land and will not create a 'Non-viable edge' or 'New edge'. Indirect impacts to the adjoining retained vegetation will be avoided through the implementation of the REMMS presented in Section 7 of the AR submissions report.

0.02 ha of 850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion and the mature trees on the southern side of Elizabeth drive are located within biodiversity certified land and do not require further assessment. The mature trees on Elizabeth drive will not be removed, some minor trimming of branches may occur to facilitate connection to the existing powerlines.

Transverse culvert at the western end of the project

No additional direct impacts to native vegetation will occur as a result of the new construction area for the transverse culvert at the western end of the project. The hollow-bearing tree recorded near the construction boundary will not be impacted (mitigation measures are described in Section 9).

Property adjustment plans (PAP's)

A review of the property adjustment plans (including driveway adjustments) showed that the property adjustments would not result in additional direct impacts to native vegetation.

Updates to the boundaries to match the final deposited plans (cadastral boundary)

The changes in the deposited plans that occurred as a result of the property acquisition and negotiation process with TfNSW resulted in additional impacts to native vegetation which have been captured in the overall vegetation impact calculations.

7.4 Changes to the design of Kemps Creek and South Creek bridges

The refined design of South Creek twin bridges (BR06) and Kemps Creek twin bridges (BR08) considered the impacts of locating piers within the channels of the creeks or the alternative of realigning creek channels. Given the angle of the road with respect to the creek channels and the length of the bridge spans, piers in the channel or creek realignment would be required.

REMM B15 requires further biodiversity assessment to be carried out as follows:

“Bridge pier locations within instream (main waterway channel) or on creek banks will be avoided during detailed design at the South Creek, Cosgroves Creek, Badgerys Creek and Kemps Creek crossings. Where avoidance is not possible, further biodiversity assessment will be required.”

In addition, creek adjustment impacts are considered in REMM F04. This measure states that *“Creek adjustments would be re-considered and/or further refined to minimise the impact on the creeks during detailed design.”*

The preferred design for each bridge comprised the following:

- South Creek Bridge (BR06). The refined bridge structure includes bridge piers positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 9 of the eastbound carriageway and Pier 10 of the westbound carriageway have been positioned at the edge of the creek and not within the low flow portion.
- Kemps Creek Bridge (BR08) - The refined bridge structure includes bridge piers positioned within the creek channel. This would reduce impacts to the existing creek by removing the need to re-align the creek. Pier 3 on both carriageways is located within the creek, although the piers are positioned towards the creek bank and not within the low flow portion.

During construction of the bridges fish passage would be maintained and the creek channels would be rehabilitated at the completion of active construction work in accordance with the landscape plans for the project.

Pier locations have been designed to minimise the number of piers in the creeks and have been positioned in order to limit changes to flow velocity and scouring. The design has met the requirement of REMM F04 by reviewing the design and avoiding the need for creek realignment. Fish passage would be maintained throughout operation of the project.

8. Environmental management measures

8.1 Tree protection

Protection measures will be required to reduce the potential for indirect impacts on the retained trees adjoining the construction footprint on the southern side of Elizabeth Drive. Section 7 of the AR submissions report presents the revised environmental management measures (REMMS). The management measures described in LVIA 15 should be included in the Construction Flora fauna management plan and should apply for all land where vegetation is to be retained.

8.2 Environmental management measures

The REMMS presented in the AR submissions report, remain pertinent to the detailed design and no amendments to these have been identified as needed. The existing measures to avoid, minimise or manage the project's impacts on biodiversity are detailed in Section 7 of the AR submissions report.

8.3 Areas of retained vegetation

GHD has identified opportunities for retention of vegetation (shown as 'Areas of retained vegetation' on Figure 2) within the construction corridor in line with the mitigation measures outlined in Section 7.1.6 of the Environmental Impact Statement (RMS 2019). These areas are summarised in Table 8-1. A total of 3.49 ha of retained vegetation has been identified within the M12 Central 100% detailed design construction footprint. The area of retained native vegetation has not been deducted from the total area of vegetation directly impacted within the central section of the M12 construction footprint as they represent potential opportunities for the construction contractor to avoid and minimise impacts (Tables 1-7). One hollow-bearing tree and 0.01 ha of Southern Myotis habitat are also located within the 'Area of retained vegetation', these areas have not been deducted from the total area of habitat impacted by the M12 central 100% detailed design shown in and Table 7-2 and Table 7-3. Offsets that would not need to be acquired if the 'Areas of retained vegetation' are not impacted are presented in Table 8-2. The offset calculations shown in Table 8.2 have not been deducted from the offsets presented in section 9.

Table 8-1. Areas of native vegetation with the 'Areas of retained vegetation' within the central portion of the M12 construction footprint

PCT	Vegetation zone	Area (ha) within biodiversity certified land in M12 central 100% design footprint	Area (ha) within non biodiversity certified land in M12 central 100% design footprint
835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	835 - Moderate/Good_Poor	0	0.15
849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	849 - Moderate/Good_Medium	0.02	0.90
	849 - Moderate/Good_Poor	0.10	0
850 - Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	850 - Moderate/Good_Medium	0,30	0.89
	850 - Moderate/Good_Other (Revegetation)	0.07	1.39
1800 - Swamp Oak open forest on river flats of the Cumberland Plain and Hunter valley	1800 - Moderate/Good_Poor	0	0.16
Total		0.48	3.49

Table 8-2. Ecosystem credits associated with the 'Areas of retained vegetation'

PCT (offset code)	Total M12 Project impact (ha) in AR submissions report	Ecosystem credits required for the total M12 project	Total area (ha) within non biocertified land within 'Areas of retained vegetation'	Proportional area associated with 'Areas of retained vegetation'	Ecosystem credits associated with 'Areas of retained vegetation'
835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (HN526)	3.18	105	0.15	4.72%	5.0
849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (HN528)	6.34	210	0.9	14.20%	29.8
850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition) (HN529)	60.52	1908	2.28	3.77%	71.9
1800 Swamp Oak open forest on river flats of the Cumberland Plain and Hunter valley (HN674)	2.82	75	0.16	5.67%	4.3

PCT (offset code)	Total M12 Project impact (ha) in AR submissions report	Ecosystem credits required for the total M12 project	Total area (ha) within non biocertified land within 'Areas of retained vegetation'	Proportional area associated with 'Areas of retained vegetation'	Ecosystem credits associated with 'Areas of retained vegetation'
Total	80.78	2685	3.49		110.9

9. Offsets associated with the detailed design of the M12 Motorway, Central Package

Additional field data from the consistency assessment surveys was consolidated with the existing data, and adjustments made to include the new areas. Table 9-1, Table 9-2, Table 9-3, Table 9-4 and Table 9-5 outline the ecosystem and species credits required to offset the direct and indirect impacts to native vegetation and threatened species resulting from the M12 Central Package. The credits were calculated based on the impacts of the M12 central section as a percentage of the total impacts of the entire M12 project. The total impact has been taken from the AR submissions report. Ecosystem credits were not calculated for one (883) in the amendment report as it did not meet the description of the associated TEC and as such did not require offset as per subsection 3.3.1.3 of the FBA (TfNSW 2020a; OEH 2014).

Table 9-1 Ecosystem credits associated with the direct impacts to native vegetation for the M12 central section

PCT (offset code)	Total M12 Project impact (ha) in AR submissi ons report	M12 Central impact (ha) in AR submissi ons report	Impact (ha) from M12 central 100% design package	Proportio nal impacts from M12 Central AR submissi ons report	Proportio nal impacts from the 100 % design package	Total M12 project ecosyste m credits	Ecosyste m credits required for M12 Central AR submissi ons report	Ecosyste m credits required for M12 central 100% design package	Change in ecosystem credits required for M12 Central from AR submissio ns report to 100% detailed design
724 Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (HN512)	6.91	6.91	7.11	100%	102.89%	372	372	382.8	+10.8
830 Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (HN524)	0.44	0	0	0	0%	15	0	0	0
835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (HN526)	3.18	0.52	0.52	16.35%	16.35%	105	17.2	17.2	0
849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (HN528)	6.34	4.13	4.18	65.14%	65.93%	210	136.8	138.5	+1.7
850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition) (HN529)	60.52	19.79	19.89	32.7%	32.87%	1908	623.9	627.1	+3.2
1800 Swamp Oak open forest on river flats of the Cumberland Plain and Hunter valley (HN674)	2.82	0.63	0.66	22.34%	23.40%	75	16.8	17.6	+0.8
Total	80.21	30.98	32.36			2685	1166.7	1183.2	+16.5

Table 9-2 Ecosystem credit associated with direct impacts to native vegetation listed under the EPBC Act

PCT (offset code)	Total M12 Project impact (ha) in AR submissions report (TfNSW 2020c)	M12 Central impact (ha) in AR submissions report	Impact (ha) from M12 central 100% design package	Proportion al impacts from M12 Central AR submissions report	Proportion al impacts from the 100 % design package	Total M12 project ecosystem credits	Ecosystem credits required for M12 Central AR submissions report	Ecosystem credits required for M12 central 100% design package	Change in ecosystem credits required for M12 Central from AR submissions report to 100% detailed design
724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (HN512)	6.91	4.86	4.89	70.33%	70.77%	276	194.1	195.3	+1.2
849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (HN528)	6.34	1	1	15.77%	15.77%	65	10.3	10.3	0.0
850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	60.52	19.23	19.33	31.77%	31.93%	1659	527.1	529.7	+2.6
Total		25.1	25.22				731.5	735.3	+3.8

Table 9-3 Ecosystem credits associated with the indirect impacts to native vegetation for the M12 central section

PCT (offset code)	Total M12 Project impact (ha) in AR submissions report	M12 Central impact (ha) in AR submissions report	Impact (ha) from M12 central 100% design package	Proportional impacts from M12 Central AR submissions report	Proportional impacts from the 100 % design package	Total M12 project ecosystem credits	Ecosystem credits required for M12 Central AR submissions report	Ecosystem credits required for M12 central 100% design package	Change in ecosystem credits required for M12 Central from AR submissions report to 100% detailed design
850 Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion (includes revegetation within Western Sydney Parklands and derived grasslands in Low condition) (HN529)	11.67	4.59	4.25	39.33%	36.42%	133	52.3	48.4	-3.9
724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion (HN512)	0.45	0.45	0.45	100%	100%	6	6	6	0
Total		5.04	4.70			139	58.3	54.4	-3.9

Table 9-4 Species credits required for vegetation removal in the M12 central section

Species	Loss of habitat (ha) or individuals within total M12 Project AR submissions report	Loss of habitat (ha) or individuals within M12 Central AR submissions report	Loss of habitat (ha) or individuals for the 100% design package (ha)	Proportional impacts from the M12 Central AR submissions report (TfNSW)	Proportional impacts from the 100% design package	Total Species credits required for M12 project AR submissions report	Species credits required for M12 Central AR submissions report	Species credit required for the M12 Central 100% design package	Change in species credits required for M12 Central from AR submissions report to 100% detailed design
<i>Dillwynia tenuifolia</i>	244 individuals	244 individuals	244 individuals	100%	100%	4392	4392	4392	0

Species	Loss of habitat (ha) or individuals within total M12 Project AR submissions report	Loss of habitat (ha) or individuals within M12 Central AR submissions report	Loss of habitat (ha) or individuals for the 100% design package (ha)	Proportional impacts from the M12 Central AR submissions report (TfNSW)	Proportional impacts from the 100% design package	Total Species credits required for M12 project AR submissions report	Species credits required for M12 Central AR submissions report	Species credit required for the M12 Central 100% design package	Change in species credits required for M12 Central from AR submissions report to 100% detailed design
<i>Pultenaea parviflora</i> Sydney Bush-pea	Up to 100 individuals	93 individuals	93 individuals	93%	93%	1500	1395	1395	0
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail	5.10	0.52	0.52	10.2%	10.2%	66	6.7	6.7	0
<i>Myotis macropus</i> Southern Myotis	1.05	0.51	0.67	48.6%	63.81%	23	11.2	14.7	+3.5
Total						5981	5804.9	5808.4	+3.5

Table 9-5 Summary of Credit offset requirements for the M12 Central 100% detailed design package

	Direct impacts All impacts (including EPBC listed impacts)	Direct impacts EPBC listed impacts only	Indirect impacts All impacts (including EPBC listed impacts)	Indirect impacts EPBC listed impacts only	All impacts (including EPBC listed impacts)	EPBC listed impacts only
PCT 724 / HN512	382.8	195.3	6	6	388.8	201.3
PCT 830 / HN524	0	0	0	0	0	0
PCT 835 / HN526	17.2	N/A	0	N/A	17.2	N/A
PCT 849 / HN528	138.5	10.3	0	0	138.5	10.3
PCT 850 / HN529	627.1	529.7	48.4	48.4	675.5	578.1
PCT 1800 / HN674	17.6	0	0	0	17.6	0
Total ecosystem credits	1183.2	735.3	54.4	54.4	1237.6	789.7
<i>Dillwynia tenuifolia</i>	4392	N/A	0	N/A	4392	N/A
<i>Pultenaea parviflora</i> Sydney Bush-pea	1395	1395	0	0	1395	1395

	Direct impacts All impacts (including EPBC listed impacts)	Direct impacts EPBC listed impacts only	Indirect impacts All impacts (including EPBC listed impacts)	Indirect impacts EPBC listed impacts only	All impacts (including EPBC listed impacts)	EPBC listed impacts only
<i>Meridolum corneovirens</i> Cumberland Plain Land Snail	6.7	N/A	0	N/A	6.7	N/A
<i>Myotis macropus</i> Southern Myotis	14.7	N/A	0	N/A	14.7	N/A
Total species credits	5808.4	1395	0	0	5808.4	1395

10. Assessment of detailed design against conditions of approval and commitments

10.1 NSW approvals

Figure 2 assesses the M12 Central detailed design construction footprint against the project's Revised Environmental Management Measures (REMMs) as outlined in Section 7 of the AR submissions report.

Table 10-1 Assessment of the detailed design for the M12 central section against relevant biodiversity REMMs in the M12 central section project area

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
B03	Native vegetation, threatened species and threatened species habitat removal will be minimised where practicable through detailed design. This will include avoiding the nest and surrounds of the White-bellied Sea-Eagle, where practicable.	A review of the construction footprint and construction methodology has been carried out. Exclusion areas have been expanded (Figure 2). In addition, a number of 'areas of vegetation to be retained' have been identified which will be recommended to the construction contractor for retention, where feasible. These areas would require approval from TfNSW to clear in the specifications. The nest of the White-bellied Sea-Eagle is not impacted by the M12 Central 100% detailed design.	Yes
B10	Removal of riparian vegetation at creek crossings will be minimised and vegetation connectivity across the riparian zone will be maintained where possible.	Investigation during the design process identified locations where connectivity could be maintained or improved through providing fauna structures and habitat replacement. Patches of vegetation at South Creek and Kemps Creek have been identified as 'Areas of retained vegetation' and comprise potential opportunities for the construction contractor to avoid and minimise impacts to the vegetation. The bridges have been designed to provide alternate breeding habitat for the Southern Myotis, and roosting habitat for the Eastern Bentwing Bat and Little Bentwing Bat	Yes
B13	Creek adjustments will be investigated and removed or minimised during detailed design where feasible. Proposed creek adjustments will be designed such that they result in minimal changes to flow velocities.	Creek adjustments have been minimised at Kemps Creek and South Creek. Pier locations have been designed to: <ul style="list-style-type: none"> – Minimise the number of piers in the creeks: – Limit changes to flow velocity and scouring etc. – Avoid the need to realign the creeks 	Yes
B14	Creek corridors will be revegetated with locally native riparian vegetation, in accordance with the requirements of the Policy and guidelines for fish habitat conservation and management (DPI, 2013) and in consideration of the Guidelines for instream works on waterfront land (DPI, 2012b). The creek channels will be rehabilitated to preconstruction conditions or better.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
B15	Bridge pier locations within instream (main waterway channel) or on creek banks will be avoided during detailed design at the South Creek, Cosgroves Creek, Badgerys Creek and Kemps Creek crossings. Where	The design team reviewed the pier locations at South Creek and Kemps Creek and have been able to refine the design to minimise the number of piers in the creeks and limit changes to flow velocity, scouring and creek	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	avoidance is not possible, further biodiversity assessment will be required.	adjustments. However, due to the length of the spans, piers are still required within the creeks. Further detail of the biodiversity assessment is provided in section 7.4.	
B17	Permanent and temporary waterway crossings will be designed and constructed to maintain fish passage in accordance with <i>Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (Fairfull and Witheridge, 2003). Crossing types should be matched to waterway type as per Table 1 in Fairfull and Witheridge (2003)	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
B21	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
B22	Changes to existing surface water flows will be minimised through detailed design.	<p>The potential impacts of design change on flooding behaviour and the scour potential within receiving drainage lines has been considered during the detailed design of the project. The design has included a number of measures to manage and minimise changes to existing surface water flows, including:</p> <ul style="list-style-type: none"> – Water sensitive design measures such as swales, wetlands and biofiltration basins – Culverts have been designed with scour protection, where required and to be large enough to allow for blockages. No additional structures such as debris deflectors, trash racks or similar on drainage inlets have been identified as necessary. <p>The design checks have indicated that the finalised drainage design for the project can be developed to ensure performance is consistent with the commitments made in the Approval documents.</p>	Yes
B23	Connectivity measures will be implemented in accordance with <i>Wildlife Connectivity Guidelines for Road Projects</i> (Transport for NSW, under preparation). Fencing will be located to reduce roadkill of fauna species and funnel animals to creek crossings where safe passage will be available. Detailed design is to retain fauna passage at all four main creek lines (Cosgroves, South, Kemps and Badgerys Creeks).	The proposed changes to the project would not impact on the ability to comply with this requirement. Detailed design has retained fauna passage at both South Creek and Kemps Creek within the central section	Yes
B24	Exclusion zones will be set up at the limit of clearing in accordance with <i>Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects</i> (RTA, 2011) (Guide 2: Exclusion zones). Exclusion zones will be set up to protect potential indirect impacts to threatened flora in accordance with the areas identified in the EIS and the amendment report (including Figure 1-2 of Appendix A of the amendment report).	Detailed design has maintained approved exclusion zones and additional exclusion areas have been provided in the detailed design, including additional areas at Clifton Avenue and on the northern side of the alignment within Western Sydney Parklands (Figure 2).	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
B28	<p>Shading impacts will be minimised through detailed design of bridge and culvert structures.</p> <p>The need for artificial lighting during construction and operation will be minimised through detailed design where feasible, including directing lighting away from vegetated areas where practicable.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

Table 10-2 assesses the M12 Central detailed design construction footprint against the project's NSW conditions of approval issued on 23 April 2021.

Table 10-2 Consistency against relevant Minister's conditions of approval for the project

No.	Condition of Approval	Discussion	Consistent
E2	The clearing of native vegetation must be minimised with the objective of reducing impacts to threatened ecological communities and threatened species habitat.	<p>Vegetation clearance has been recalculated to incorporate the boundary changes and the additional exclusion areas</p> <p>This has identified a net increase of 0.26 ha of native vegetation to be impacted for the M12 Central 100 % detailed design boundary when compared to the central portion of AR submissions report construction footprint, with the total area of vegetation to be impacted now being 32.81 ha within M12 Central.</p>	Yes
E4	The Proponent may review and update the ecosystem and species credit requirements in Table 1, Table 2 and Table 3 to reflect the final construction footprint and resulting extent and type of plant community types to be cleared and the extent of threatened species habitat impacted by the construction of the CSSI (excluding certified areas). Where the construction of the CSSI is staged, the Proponent may review and update the ecosystem and species credit requirements in Table 1, Table 2 and Table 3 for each stage of the CSSI. Amendments to the ecosystem and species credit requirements must be undertaken in consultation with EES and DAWE and submitted to the Planning Secretary for approval within six (6) months of determining the final construction footprint and, where the CSSI is staged, within six (6) months of determining the final construction footprint for each stage.	<p>Table 9-1, Table 9-2, Table 9-3, Table 9-4 and Table 9-5 outline the ecosystem and species credits required to offset the direct and indirect impacts to native vegetation and threatened species resulting from the M12 central section . The credits were calculated based on the impacts of the M12 central section as a percentage of the total impacts of the entire M12 project. The total impact has been taken from the AR submissions report.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p> <p>'Areas of retained vegetation' have been identified within the M12 Central construction footprint. These areas will provide the contractor with potential opportunities to review impacts to native vegetation and updates credit calculations based on the final clearing amounts.</p>	Yes
E5	<p>The review and update of credit requirements must be undertaken by:</p> <p>(a) using the vegetation mapping in the EIS, M12 Motorway Amendment Report - Appendix A Biodiversity supplementary technical report (October 2020), and M12 Motorway Amendment</p>	The review of the credit requirements was undertaken using the mapping in the EIS (RMS 2019), AR (TfNSW 2020a), AR submissions report and the field surveys described in Section 9. The credit	Yes

No.	Condition of Approval	Discussion	Consistent
	Report – Submissions Report (December 2020); and/or (b) completing verification surveys to confirm the extent, type and condition of threatened species and ecological communities to be impacted.	requirements are presented in Section 9.	
E6	Where verification surveys are required, they must be undertaken in consultation with EES. Any additional surveys must be undertaken at the time of year when groundcover is most likely to be predominantly native. If verification surveys are not possible at a time when groundcover is most likely to be native, the assumed presence of any relevant species and ecosystems may be applied to conservatively evaluate impacts and associated credit requirements.	Field surveys have been completed (Section 5.2) and the credit requirements have been updated (Section 9)	Yes
E11	The Proponent must minimise impacts to Key Fish Habitat (KFH) as defined in Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013 update). Residual impacts to KFH must be offset at a ratio of 2:1 habitat offset requirement in accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013 update) and in consultation with DPI Fisheries.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E14	A minimum width of three (3) metres and a minimum height of 1.5 metres must be provided to maintain fauna passage below the Badgerys Creek, Cosgroves Creek, South Creek and Kemps Creek bridges. The three-metre wide passage must consist of a natural substrate or other surface type that will not hinder fauna movement.	The proposed changes to the bridge design of South Creek and Kemps Creek would not impact on the ability to comply with this requirement.	Yes

10.2 Consistency with the EPBC Act Approval

Table 10-3 assesses the M12 Central detailed design construction footprint against the project's Commonwealth conditions of approval issued 3 June 2021.

Table 10-3 Consistency against relevant Commonwealth Minister's conditions of approval for the project

No.	Condition of Approval	Discussion
2	The approval holder must submit to the Department a map(s) of the final construction footprint within six months of the final construction footprint being determined, and where the action is staged, a map of the final construction footprint for each stage, within six months of the final construction footprint for that stage being determined	Discussed in section 10.2.2
3	The approval holder must not clear protected matters outside the final construction footprint.	Discussed in section 10.2.2
4	To minimise the impacts of the action on protected matters the approval holder must not clear within the construction footprint more than: a. 42.89 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest threatened ecological community; b. 0.44 hectares of Western Sydney Dry Rainforest and Moist Woodland on Shale threatened ecological community;	A review of the construction footprint for the Central Package and construction methodology has been carried out. The proposed changes include an increase in the construction footprint. Section 10.2.1 lists the changes in vegetation clearance compared to the approved upper clearing limits. The clearing with the M12 Central 100% detailed design boundary does not exceed the upper clearing limits. Additional exclusion areas have been identified and included within the design. In addition, a

No.	Condition of Approval	Discussion
	<p>c. 100 <i>Pultenaea parviflora</i> individuals comprising no more than 90 individuals from the Clifton Avenue population and no more than 10 individuals from the population north of the Western Sydney Parklands;</p> <p>d. The number of <i>P. spicata</i> individuals identified in the additional surveys and as required by condition E8 of the State Infrastructure approval;</p> <p>e. 62.69 hectares of foraging habitat for Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>);</p> <p>f. 80.21 hectares of foraging habitat for Swift Parrot (<i>Lathamus discolor</i>).</p>	<p>number of 'areas of vegetation to be retained' have been identified which will be recommended to the construction contractor for retention, where feasible. These areas would require approval from TfNSW to clear.</p> <p>This has contributed to minimising impacts to protected matters.</p> <p>The 100% detailed design construction footprint impacts areas outside of the approved EPBC referral boundary. A map showing the proposed boundary changes will have to be submitted to the EPBC assessment officer.</p>
5b	<p>For the protection of protected matters the approval holder must:</p> <ul style="list-style-type: none"> implement biodiversity conditions E2 to E10 of Part E, Schedule 2 of the State Infrastructure approval where they relate to monitoring, managing, avoiding, mitigating, offsetting, recording, or reporting on, impacts to protected matters. 	Addressed in Table 10-2

10.2.1 Upper clearing limits for Matters of Environmental Significance

EPBC Act conditions of approval (DAWE 2021a) set upper limits of clearing for five Matters of Environmental Significance (MNES). The MNES listed in the conditions of approval included:

- two threatened communities:
 - Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest critically endangered ecological community
 - Western Sydney Dry Rainforest and Moist Woodland on Shale critically endangered ecological community
- one threatened flora species:
 - *Pultenaea parviflora* (vulnerable species)
- two threatened fauna species:
 - foraging habitat for the Grey-headed Flying-fox (vulnerable species)
 - foraging habitat for the Swift Parrot (endangered species).

The approved upper limits of clearing and the areas impacted by the 100% detailed design construction footprint are presented in Table 10-4. The proposed changes to the boundary of the 100% detailed design construction footprint are consistent with the EPBC Approval with impacted areas or numbers of individuals either equal or less than that calculated for the amendment report submissions report (AR submissions report) (TfNSW 2020c). As a result, a variation to the conditions of approval, a conditioned action management plan or a new referral is unlikely to be required for the M12 central section. TfNSW will need to manage their total clearing areas across the three stages of the M12 to ensure clearing limits are not exceeded

Table 10-4 Approved upper clearing limits for MNES and the area or number of individuals impacted by the 100% detailed design M12 Central Footprint

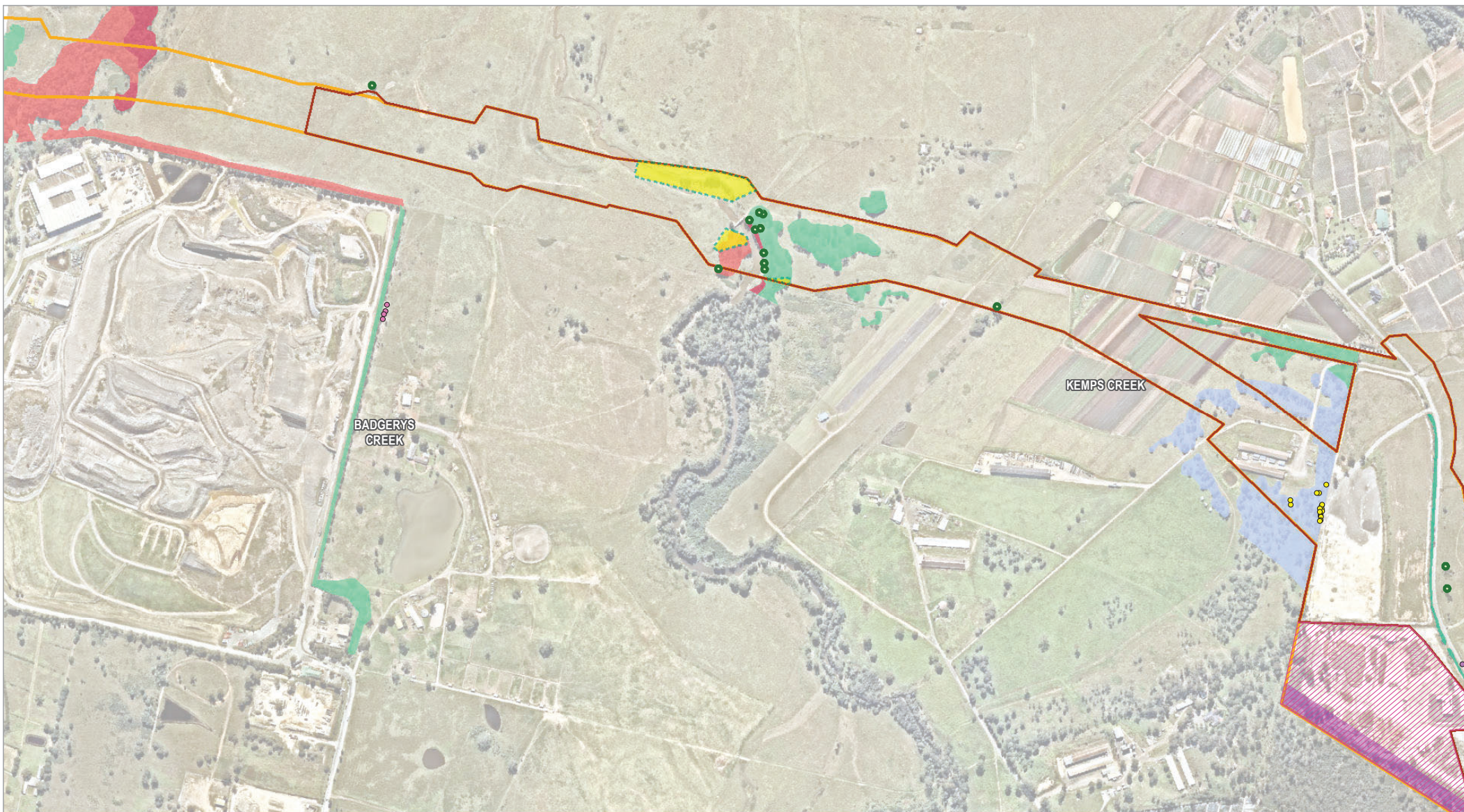
MNES	Maximum approved clearance for the entire M12 alignment	Area (ha) or number of individuals impacted by 100 % detailed design M12 Central footprint
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	42.89 ha	25.22 ha

MNES	Maximum approved clearance for the entire M12 alignment	Area (ha) or number of individuals impacted by 100 % detailed design M12 Central footprint
threatened ecological community CEEC		
Western Sydney Dry Rainforest and Moist Woodland on Shale threatened ecological community CEEC	0.44 ha	0 ha
Sydney Bush-pea (<i>Pultenaea parviflora</i>)	100 individuals	93
Grey-headed Flying Fox (<i>Pteropus poliocephalus</i>)	62.71 ha of foraging habitat	25.25 ha
Swift Parrot (<i>Lathamus discolor</i>)	80.21 ha of foraging habitat	32.81 ha

10.2.2 EPBC boundary

There are a number of areas of the 100% detailed design construction footprint that are outside the 'final construction footprint' referred to in the Commonwealth condition 2. The final construction footprint refers to the area shown in the map(s) submitted under condition 2, determined by the approval holder in accordance with a consistency assessment(s) or a modification assessment under the NSW Environmental Planning and Assessment Act 1979, where no new significant impacts to protected matters are identified. For the purposes of this assessment the 'final construction footprint' is the AR submissions report construction footprint (TfNSW 2020c).

Changes to the final construction footprint are outlined in the previous sections. Impacts in the areas outside the AR submissions report construction boundary are unlikely to result in a significant impact to MNES listed under the EPBC Act. A map showing the final construction footprint will have to be submitted to the EPBC assessment officer in line with protocols outlined in DAWE (2021b) in accordance with the project's Commonwealth conditions of approval issued 3 June 2021, CoA 2.



Plant Community Types (Arcadis 2020, GHD 2021)

- Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion
- Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley

Threatened Flora EIS (Arcadis, GHD 2021)

- Dillwynia tenuifolia
- Pultanea parviflora

Hollow Bearing Tree (CCS 2021, GHD 2021)

-

LEGEND

- Construction footprint - 100% (26/8/2021)
- Construction footprint - Amendment Report Submissions Report (December 2020)
- Exclusion Zones (M12 Central 100% detailed design, July 2021)
- Exclusions zones (Amendment Report Submissions Report, December 2020)
- Areas of retained vegetation

Paper Size ISO A3
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Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



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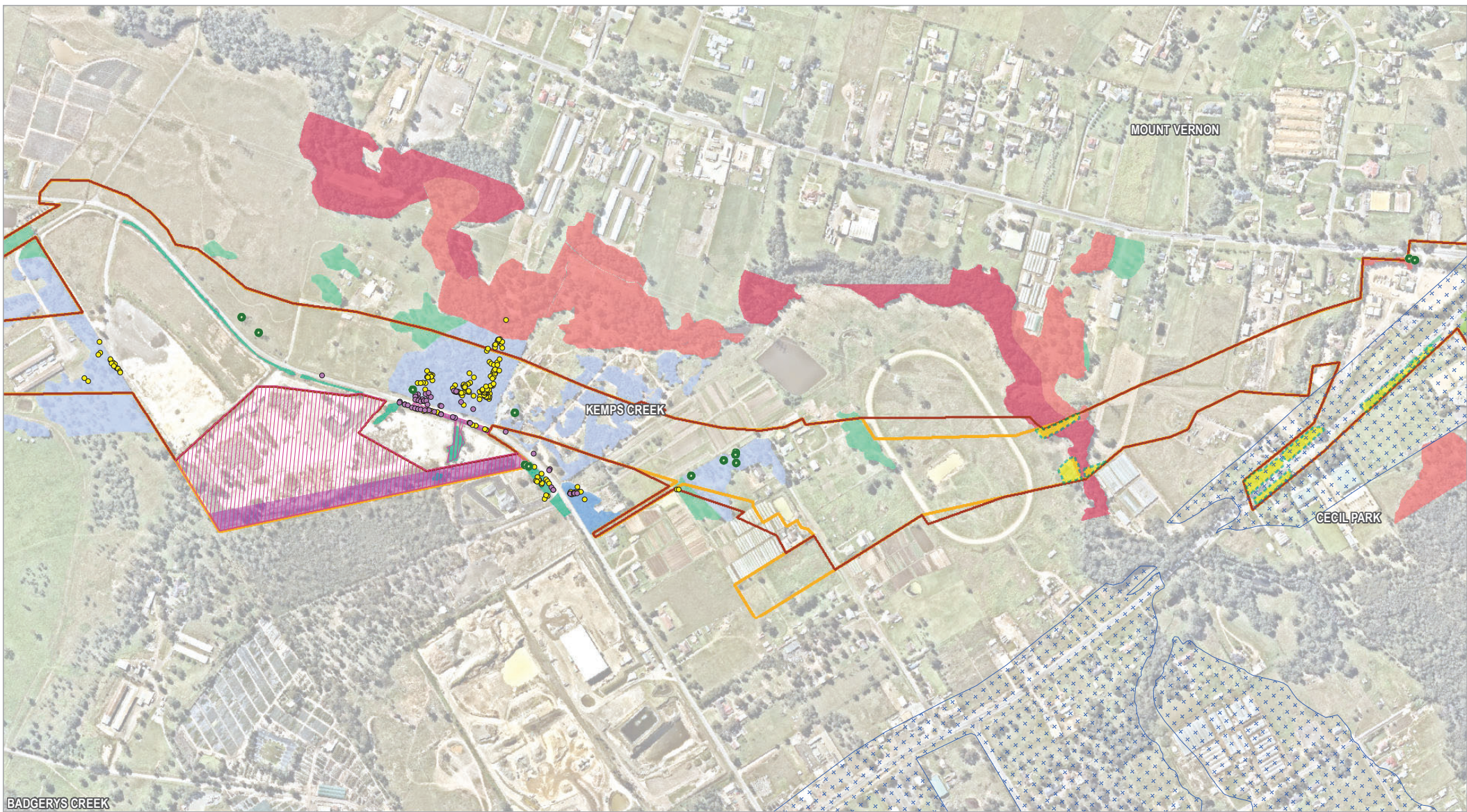
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Vegetation Clearing

FIGURE 2-1

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Plant Community Types (Arcadis 2020, GHD 2021)

- Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion
- Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion
- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion
- Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion
- Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley

Threatened Flora EIS (Arcadis, GHD 2021)

- *Dillwynia tenuifolia*
- *Pultenaea parviflora*

- Hollow Bearing Tree (CCS 2021, GHD 2021)

LEGEND

- Construction footprint - 100% (26/8/2021)
- Construction footprint - Amendment Report Submissions Report (December 2020)
- Biocertified Land: Existing Certified
- Exclusion Zones (M12 Central 100% detailed design, July 2021)
- Exclusions zones (Amendment Report Submissions Report, December 2020)
- Areas of retained vegetation

Paper Size ISO A3
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Metres

Map Projection: Transverse Mercator
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Grid: GDA2020 MGA Zone 56



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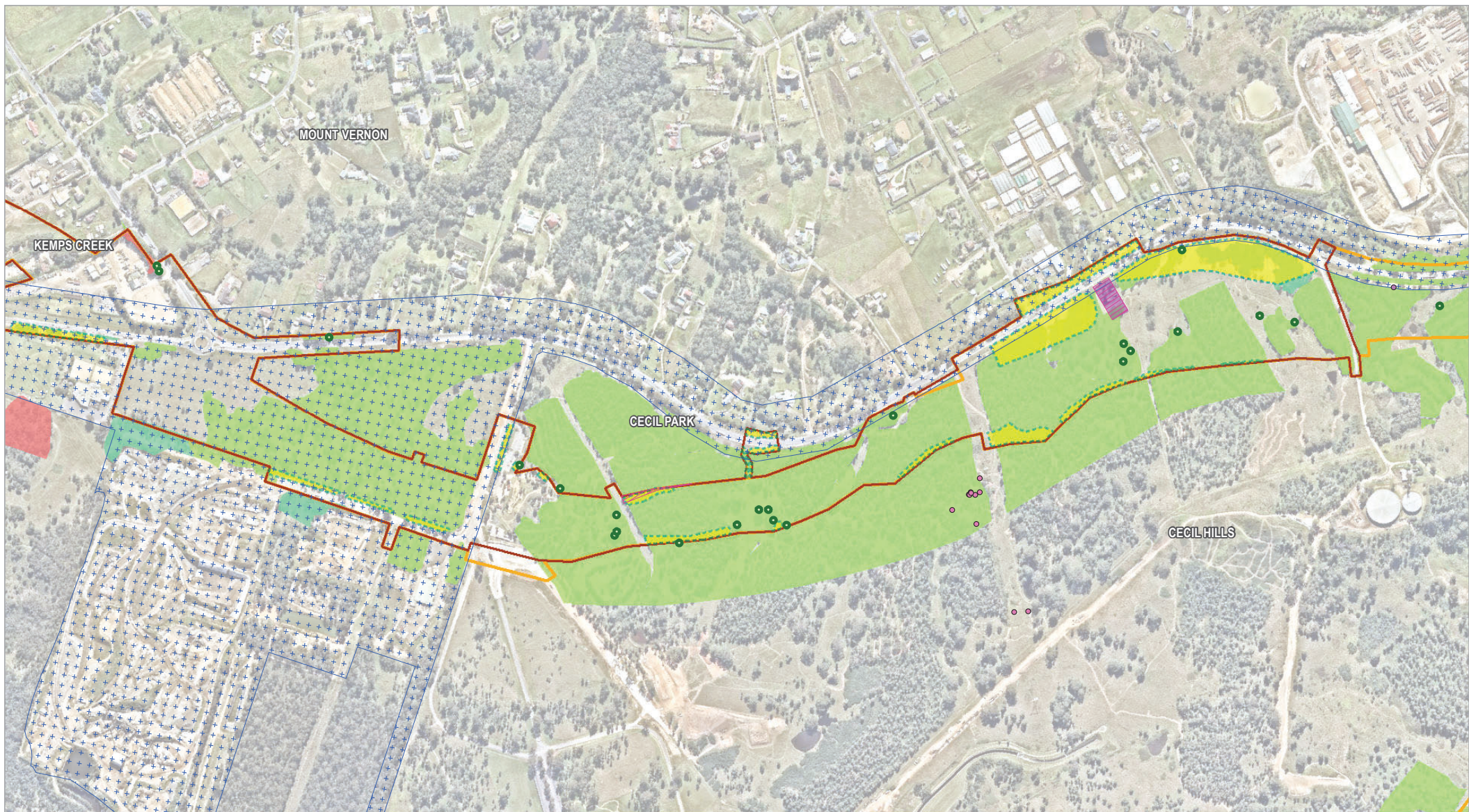
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FIGURE 2-2

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Plant Community Types (Arcadis 2020, GHD 2021)

Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion

Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion

Threatened Flora EIS (Arcadis, GHD 2021)

Grevillea juniperina
Pultenaea parviflora

Hollow Bearing Tree (CCS 2021, GHD 2021)

LEGEND

Construction footprint - 100% (26/8/2021)

Construction footprint - Amendment Report Submissions Report (December 2020)

Biocertified Land: Existing Certified

Exclusion Zones (M12 Central 100% detailed design, July 2021)

Exclusion zones (Amendment Report Submissions Report, December 2020)

Areas of retained vegetation

Paper Size ISO A3
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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



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M12 Motorway Central Package
Detailed Design

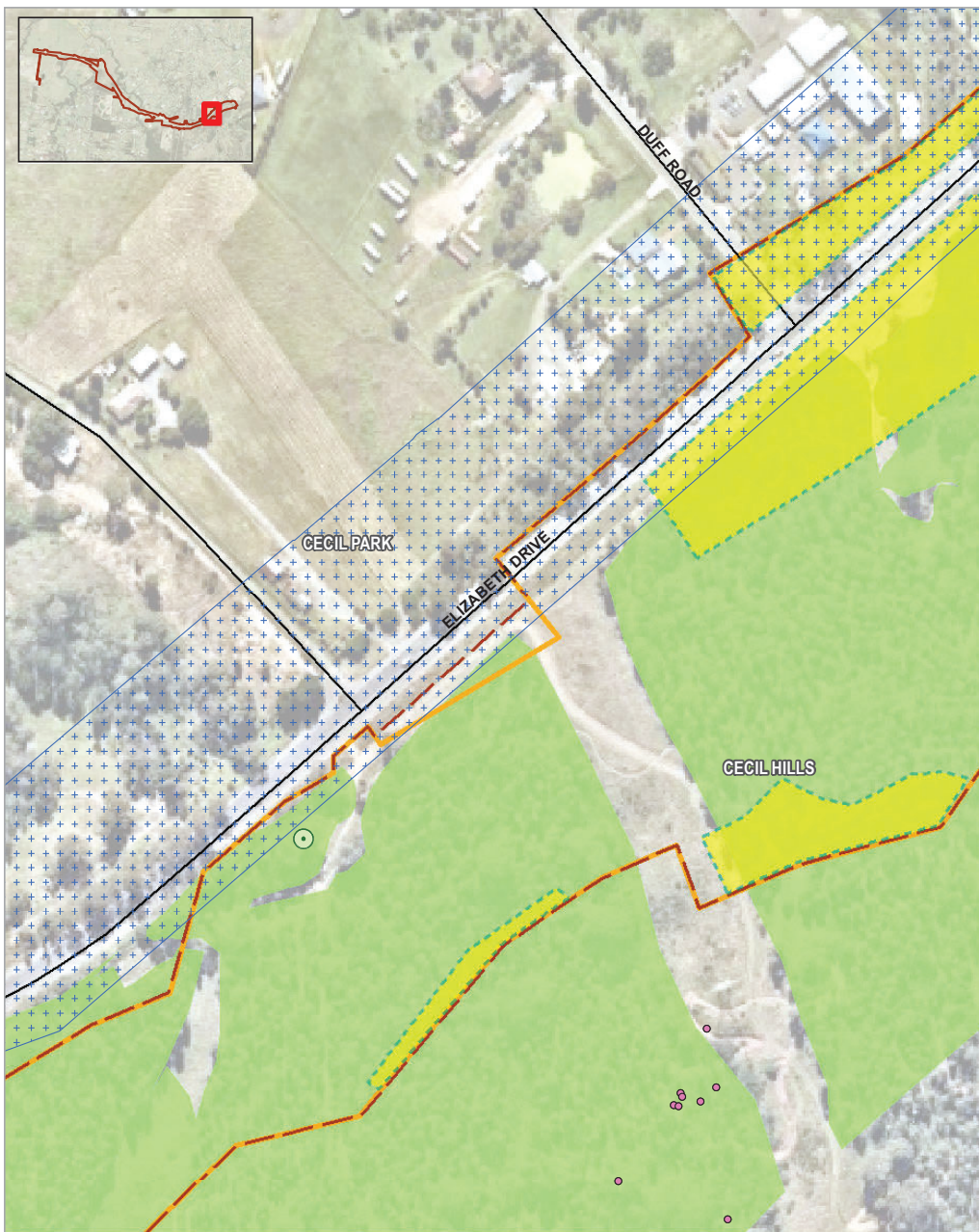
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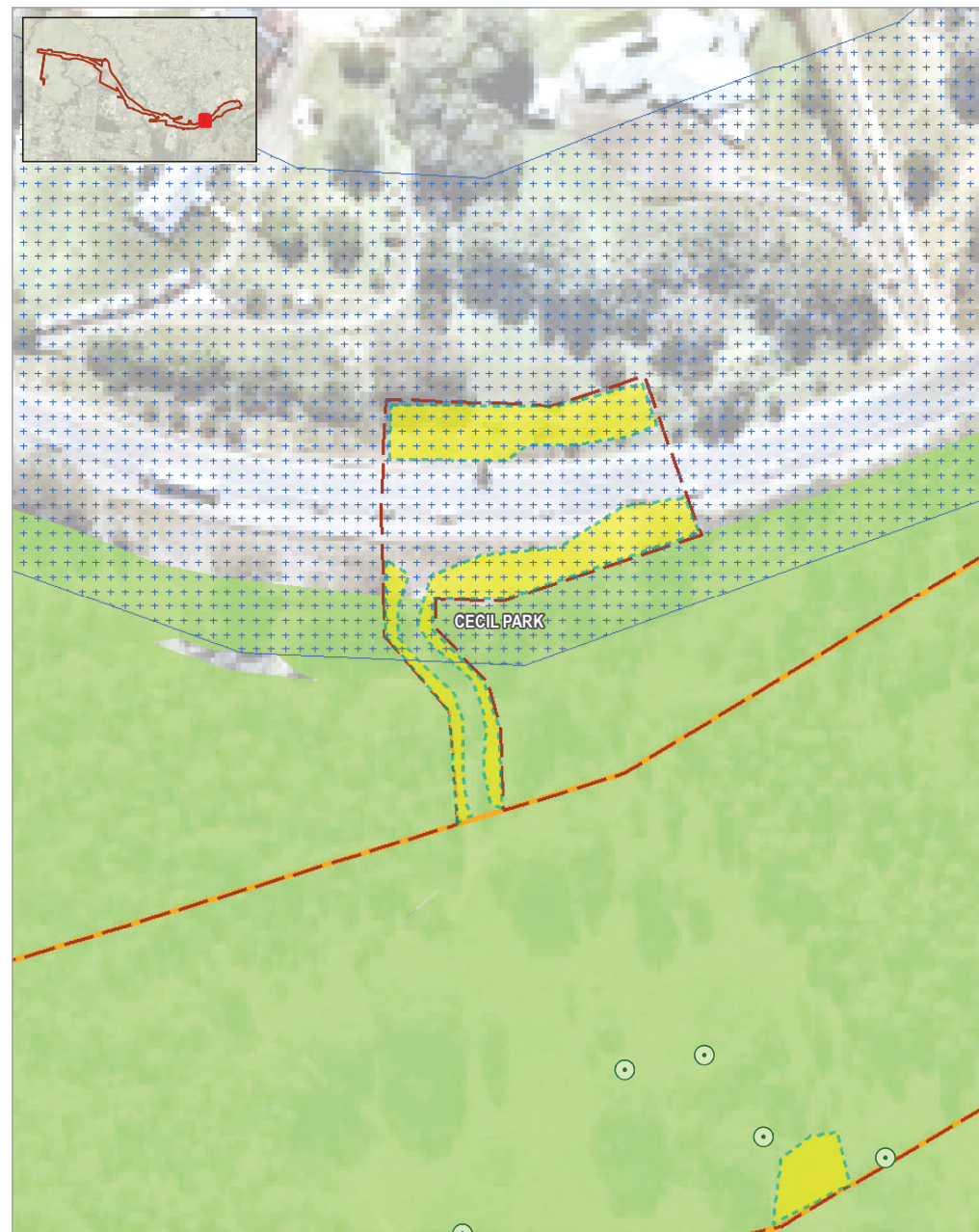
FIGURE 2-3

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WSPST land west of Duff Road



Maintenance track with WSPST land

LEGEND

Construction footprint - 100% (26/8/2021)

Construction footprint - Amendment Report Submissions Report (December 2020)

Biocertified Land: Existing Certified

Hollow Bearing Tree (CCS 2021, GHD 2021)

Threatened Flora EIS (Arcadis, GHD 2021)

Grevillea juniperina

Areas of retained vegetation

Plant Community Types (Arcadis 2020, GHD 2021)

Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion

Paper Size ISO A3



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



Transport for NSW
M12 Motorway Central Package
Detailed Design

Vegetation Clearing

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FIGURE 3

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11. References

DAWE, 2021a. Approval; The M12 Motorway Project between the M7 Motorway, Cecil Hills and The Northern Road, Luddenham, NSW (EPBC 2018/8286). Australian Government Department of Agriculture, Water and the Environment dated 3 June 2021.

DAWE, 2021b. *Guide to providing maps and boundary data for EPBC Act projects*. Department of Agriculture, Water and the Environment, Canberra, February.

RMS, 2019. *M12 Motorway Environmental Impact Statement Appendix E Biodiversity Assessment Report*. Sydney: prepared for Transport for New South Wales by Jacobs Arcadis Joint Venture.

RTA, 2011. *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*. Sydney: Roads and Traffic Authority.

Standards Australia (2007). *Australian Standard: pruning of amenity trees, AS 4373 – 2007*, Standards Australia, Sydney

Standards Australia (2009). *Australian Standard: protection of trees on development sites, AS 4970 – 2009*, Standards Australia, Sydney

TfNSW, 2020a. *M12 Motorway Amendment Report*. Sydney: prepared for Transport for New South Wales by Jacobs Arcadis Joint Venture. Dated October 2020.

TfNSW, 2020b. *M12 Motorway Submissions Report*. Sydney: prepared for Transport for New South Wales by Jacobs Arcadis Joint Venture. Dated October 2020.

TfNSW, 2020c. *M12 Motorway Amendment Report Submissions Report*. Sydney: prepared for Transport for New South Wales by Jacobs Arcadis Joint Venture. Dated December 2020.

TfNSW, 2021. *Re: The M12 Motorway Amendment Report Submissions Report – Amendment*. Memorandum prepared for Transport for New South Wales by Arcadis. Dated 8 March 2021.

Appendix B

Aboriginal heritage impact assessment



30 July 2021

Shannon Schofield
Environment Officer
Western Sydney Project Office
Transport for NSW
27 Argyle Street
Parramatta NSW 2150

Dear Shannon,

**RE. M12 Motorway Project (SSI-9364) Central Package
Consistency Assessment – EIS Boundary Adjustment Review
Aboriginal Cultural Heritage**

Introduction and project background

Transport for NSW (TfNSW) is seeking to construct and operate the M12 Motorway project (the project) between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham, with interchanges to connect to the existing road network and future Western Sydney International Airport (WSIA). The project was designated as Critical State Significant Infrastructure (CSSI) (SSI-9364), with approval being sought under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Secretary's Environmental Assessment Requirements (SEARs) were issued in October 2018 by the Department of Planning and Environment (now Department of Planning, Industry and Environment; DPIE) to guide preparation of an Environmental Impact Statement (EIS) for the project. Following completion and exhibition of the EIS in October-November 2019, a submissions report was prepared to address the issues raised during the exhibition period. A separate Amendment Report was prepared to address potential environmental impacts due to design changes and construction updates to the project since the exhibition of the EIS. The Amendment Report was subsequently placed on exhibition in October-November 2020, with a submissions report prepared in December 2020 to address issues raised during the Amendment Report exhibition period. An amendment to the amendment report submissions report was then issued in March 2021.

The project was approved by the Minister for Planning and Public Spaces in April 2021. TfNSW must carry out the CSSI in accordance with the conditions of approval and the following project documentation:

- (a) M12 Motorway Environmental Impact Statement (dated October 2019);
- (b) M12 Motorway Submissions Report (dated October 2020);
- (c) M12 Motorway Amendment Report (dated October 2020);
- (d) M12 Motorway Amendment Report - Submissions Report (dated December 2020); and
- (e) M12 Motorway Amendment Report - Submissions Report - Amendment (dated 8 March 2021).

Project documentation specific to Aboriginal cultural heritage includes:

- Jacobs Arcadis Joint Venture, October 2019. *M12 Motorway Environmental Impact Statement: Appendix I Aboriginal Cultural Heritage Assessment Report*. Report to Roads and Maritime Services.
- Jacobs Arcadis Joint Venture, October 2019. *M12 Motorway Environmental Impact Statement: Archaeological Assessment Report*. Prepared for Roads and Maritime Services.
- Jacobs Arcadis Joint Venture, October 2020. *M12 Motorway Amendment Report: Appendix E Aboriginal heritage supplementary technical memorandum*. Prepared for TfNSW.

Consistency assessment

Kelleher Nightingale Consulting Pty Ltd (KNC) was engaged to complete a consistency assessment for Aboriginal cultural heritage in relation to proposed adjustments to the approved project boundary. These comprise minor adjustments to both the construction boundary and the operational boundary as assessed in the existing project documentation and project approval.

The proposed adjustments are located in the central part of the project area, primarily related to changes and refinements to the construction and operational boundaries between Badgerys Creek in the west and the Cecil Park Reservoir access road in the east. The 100 percent M12 Central detailed design (July 2021) is shown on Figure 1. The boundary adjustment assessment areas were identified where the construction and operational boundary has changed since the finalisation of the project documentation described above and the issue of project approval, and now exceeds the (former) approved construction footprint.

Assessment process

Aboriginal heritage was assessed for the EIS and Amendment Report in the *M12 Motorway Environmental Impact Statement: Appendix I Aboriginal Cultural Heritage Assessment Report*, *M12 Motorway Environmental Impact Statement: Archaeological Assessment Report*, and *M12 Motorway Amendment Report: Appendix E Aboriginal heritage supplementary technical memorandum*.

All boundary adjustment areas fall within the 'detailed investigation area' previously assessed for Aboriginal cultural heritage during preparation of the EIS, Amendment Report and existing project documentation. Identified Aboriginal archaeological sites in the vicinity are shown in Figure 1. Sites at least partially within the 100 percent M12 Central detailed design (July 2021) include:

- BCE (part of South Creek Complex Aboriginal site complex)
- SCW T1 (part of South Creek Complex Aboriginal site complex)
- SCW T2 (part of South Creek Complex Aboriginal site complex)
- SCE (part of South Creek Complex Aboriginal site complex)
- KNW (part of Kemps Creek Complex Aboriginal site complex)
- KCW (part of Kemps Creek Complex Aboriginal site complex)
- KCE (part of Kemps Creek Complex Aboriginal site complex)
- RR and
- PCP8.

Sites are described in Chapter 7.5 of the EIS, and Chapter 6.5 of the Amendment Report. These sites are located wholly or partially within the existing project boundary as per the EIS and Amendment Report and will be impacted by the project. Minor additional impacts to the sites from the proposed boundary adjustments are considered to be consistent with the existing impacts identified in the EIS, Amendment Report and existing project documentation. As the impacts are considered to be consistent, the existing management requirements and recommendations for the sites should be maintained for the boundary adjustment areas.

The consistency assessment also undertook an updated search of the Aboriginal Heritage Information Management System (AHIMS) database to confirm the location and status of Aboriginal archaeological sites. Search results are attached as Appendix A. The AHIMS search findings are consistent with the findings of the EIS, Amendment Report and existing project documentation. The proposed boundary adjustments would not impact additional AHIMS sites.

Result

The boundary adjustment areas required for the 100 percent M12 Central detailed design (July 2021) are consistent with the findings of the M12 cultural heritage assessment report (as per the EIS, Amendment Report and existing project documentation). Existing management requirements and recommendations for the identified sites should be maintained for the boundary adjustment areas.

No further Aboriginal archaeological assessment is warranted.

If you have any questions, please do not hesitate to contact me on 02 9232 5373.

Yours sincerely,



Dr Matthew Kelleher
Director/Archaeologist
Kelleher Nightingale Consulting Pty Ltd

FIGURE REDACTED

Figure 1. M12 - Consistency Assessment EIS Boundary Adjustment review, central package

Appendix A – AHIMS Search Results

APPENDIX REDACTED

APPENDIX REDACTED

APPENDIX REDACTED

APPENDIX REDACTED

APPENDIX REDACTED

Appendix C

Non Aboriginal Heritage impact assessment

M12 Motorway Consistency Assessment

Non-Aboriginal Heritage Consistency
Assessment

Report to GHD on behalf of Transport
for NSW

October 2021



 artefact

Artefact Heritage
ABN 73 144 973 526
Suite 56, Jones Bay Wharf
26-32 Pirrama Road
Pyrmont NSW 2009
Australia

+61 2 9518 8411
office@artefact.net.au

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1.0 INTRODUCTION

1.1 Background

Transport for NSW (TfNSW) will construct and operate the M12 Motorway (the project), to provide direct access between the Western Sydney Airport at Badgerys Creek and Sydney's motorway network. The M12 Motorway will run between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham for a distance of about 16 kilometres and is expected to be opened to traffic prior to opening of the Western Sydney Airport.

The project will be a four-lane dual-carriageway motorway, including a new grade separated interchange with the Airport Access Road to provide connection to the Western Sydney International Airport.

This Non-Aboriginal Heritage Consistency Assessment is for the M12 Motorway – Central Package. An overview of the M12 Motorway – Central Package is illustrated in Figure 1. The detailed design for the M12 Motorway – Central Package has been completed (July 2021) and has resulted in changes in the proposed footprint, which require further environmental assessment. This Consistency Assessment is based on the 100% detail design submission.

The M12 is being delivered in three sections. This report largely covers the Central Section of the M12 shown within the red area marked in Figure 1. It is noted that some of the elements discussed in this assessment extend into the West Section of M12 (Fleurs Radio Telescope site), however, only the features discussed are predominantly located within M12 Central Section.

Figure 1: M12 Central Section extents



Within the Central Section, the project comprises:

- A four lane dual-carriageway motorway, designed to facilitate widening to six lanes in the future
- Seven bridge locations as detailed below:
- BR06 – M12 twin bridges over South Creek
- BR07 – Clifton Avenue bridge over M12
- BR08 – M12 twin bridges over Kemps Creek
- BR09 – M12 twin bridges over Elizabeth Drive
- BR10 – M12 twin bridges over Range Road
- BR11 – Water Tower Access Road bridge over M12
- Private property access bridge to Sydney University land
- Miscellaneous structures including retaining walls, ITS gantries, sign supports, noise barriers and culverts
- Road drainage, comprising pits, pipes, channels and water quality facilities
- Culverts to convey existing or diverted watercourses
- Separate shared user path, including connections to existing networks
- Relocation and/or protection of existing utilities
- ITS infrastructure to support future smart motorways operation

- Signage, line marking, safety barriers and related road furniture
- Urban design including landscaping and public art.

1.2 Project approvals

The project (SSI-9364) has been approved under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID:2018/8286). The project received approval from the NSW Minister for Planning and Public Spaces on 23 April 2021 and conditions of approval were subsequently issued. The project received approval from the Minister for Commonwealth Department of Agriculture, Water and the Environment Minister on 3 June 2021 and conditions were subsequently issued. The project's environmental impacts and commitments were presented in the following Approval Documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement* (the EIS)
- Transport for NSW (2020, August) *M12 Motorway, Amendment Report* (the Amendment Report)
- Transport for NSW (2020, August) *M12 Motorway, Submissions Report* (the Submissions Report).
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report* (the AR Submissions Report).
- Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*.

1.3 Purpose of this assessment

Artefact Heritage (Artefact) have been engaged by GHD to prepare a non-Aboriginal heritage consistency assessment for some M12 Central design changes. This report has been prepared to assess the consistency of heritage impacts and assessments between the AR Submissions Report boundary and changes in the boundary of the investigation area related to the M12 Motorway project works (July 2021 100% design).

In addition, this report investigates remnant features of the Fleurs Radio Telescope site that were not assessed in the M12 EIS Non-Aboriginal Heritage Technical Paper. The remnant features span both the M12 Central and M12 West project footprints but have all been assessed in this report. Additional information has been provided since the EIS, regarding the Fleurs Radio Telescope site, that as not available previously but facilitated this assessment. The identification of additional remnant features was supported by site inspections of the area.

Works and adverse heritage impacts are also assessed in accordance with relevant non-Aboriginal heritage conditions of approval and Revised Environmental Management Measures (REMMs) for the project.

Non-Aboriginal heritage consistency assessment for the M12 West project footprint adjustments are assessed in a separate report prepared by WSP.

1.4 The study area and description of proposed area changes

The study area for this report is primarily within the M12 Central as shown in Figure 3. The proposed boundary changes that have been assessed are only located within the M12 Central project footprint. However, additional detailed heritage assessment has been provided for the Fleurs Radio Telescope Site which is located across both M12 Central and M12 West. The detailed assessment consists of the following area:

- Fleurs Radio Telescope Site
 - Lot 21 DP258414: 885a Mamre Road, Kemps Creek

1.4.1 Fleurs Radio Telescope Site

The Fleurs Radio Telescope Site portion of the study area is located immediately north of Lot 1 DP74574 and the Kemps Creek Advanced Resource Recovery Park. It is characterised by a cleared, semi-rural property nestled between Kemps Creek to the east and South Creek to the west. It falls within the curtilage of the Penrith Local Environment Plan (LEP) 2010 heritage listed *Fleurs Radio Telescope Site* (item no. 1832).

The site is recorded on the LEP as having heritage significance at a local level. Remains of the Mills Cross, Shain Cross, Chris Cross and Fleurs Synthesis Telescope (FST) antennas, all of which played a major role in the development of Australia's radioastronomy industry, occupy land approximately 1 kilometre east of the study area. Later additions to the FST are present within the study area.

In addition to the local significance of the heritage item, the Statement of Significance included in the EIS identifies the significance of the Fleurs Radio Telescope at a State and National level.¹ This includes the association of the site to the national and international astronomy community and the connection to Australia's radioastronomy developments including the Square Kilometre Array.

Additional components associated with the Fleurs Radio Telescope Site (refer to Section 4.1) have been identified within the M12 Central portions of the project boundaries, following investigative research by Artefact. This includes a site inspection undertaken on 15 July 2021 which was to identify the fabric remains of the FST that were not assessed in the EIS non-Aboriginal Heritage Technical Paper (Figure 2). The site inspection included the identification of additional elements, such as concrete plinths and concrete pads.

1.4.2 Description of proposed area changes

The project as described in the Division 5.2 Approval and EPBC Approval, dated 3 June 2021, is outlined in detail in Chapter 5 of the EIS (Roads and Maritime, 2019). The amended project boundary is detailed in Chapter 2 of the Amendment Report (Transport for NSW, 2020a) and Chapter 1 of the AR Submissions Report (Transport for NSW, 2020).

The proposed changes to the footprint of the M12 Motorway – Central Package are shown in Figure 3 to Figure 5 below.

1.5 Limitations

This consistency assessment is limited to consideration of listed and potential unlisted heritage items identified in the EIS Non-Aboriginal Heritage Technical Paper and Amendment Reports, and a review of additional listed heritage items that may be impacted by the proposed boundary changes. This consistency assessment does not provide an assessment of Aboriginal heritage.

This consistency assessment is primarily limited to a desktop assessment only. Additional historical research and site inspections have not been undertaken in relation to the proposed boundary changes. Additional historical research and site inspection have only been undertaken to inform the assessment of the remnant features of the Fleurs Radio Telescope site that were not assessed in the M12 EIS Non-Aboriginal Heritage Technical Paper.

¹ NSW Government, "M12 Motorway Environmental Impact Statement, Appendix J Non-Aboriginal Heritage Assessment Report," 85–86.

1.6 Methodology

1.6.1 Grading of impacts

In order to consistently identify the potential impact of the proposed works, the terminology contained in Table 1 has been referenced throughout this document. This terminology, and corresponding definitions, are based on those contained within guidelines produced by the International Council on Monuments and Sites (ICOMOS).²

Table 1: Terminology for assessing the magnitude of heritage impact.

Grading	Definition
Major	<p>Actions that would have a long-term and substantial impact on the significance of a heritage item. Actions that would remove key historic building elements, key historic landscape features, or significant archaeological materials, thereby resulting in a change of historic character, or altering of a historical resource.</p> <p>These actions cannot be fully mitigated.</p>
Moderate	<p>Actions involving the modification of a heritage item, including altering the setting of a heritage item or landscape, partially removing archaeological resources, or the alteration of significant elements of fabric from historic structures.</p> <p>The impacts arising from such actions may be able to be partially mitigated.</p>
Minor	<p>Actions that would result in the slight alteration of heritage buildings, archaeological resources, or the setting of an historical item.</p> <p>The impacts arising from such actions can usually be mitigated.</p>
Negligible	<p>Actions that would result in very minor changes to heritage items.</p>
Neutral	<p>Actions that would have no heritage impact.</p>

² Including the document *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*, ICOMOS, January 2011.

Figure 2: Overlap of listed Fleurs Radio Telescope heritage item with the location of the additional Fleurs Radio Telescope elements

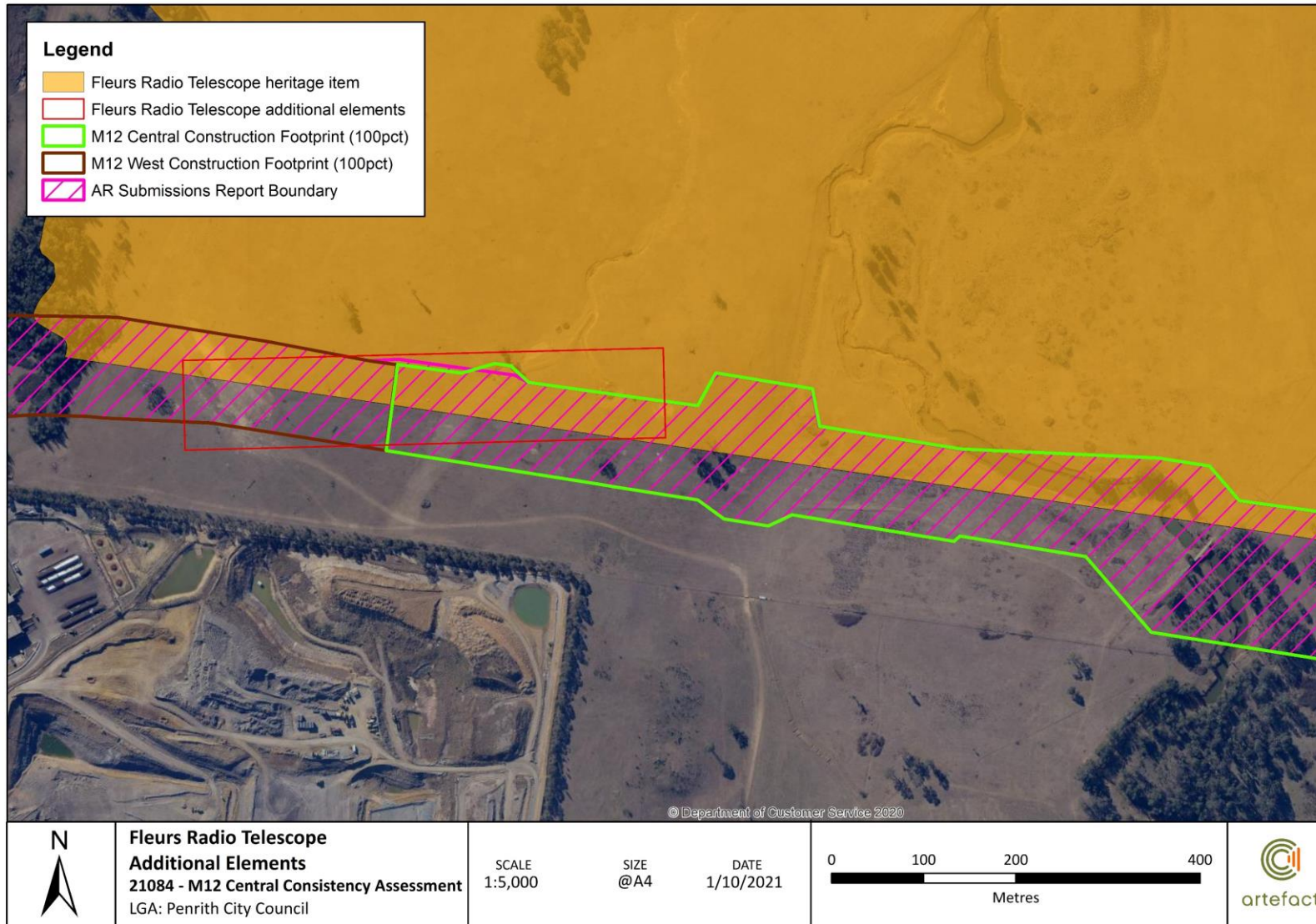


Figure 3. Overview of proposed changes to the M12 Central Package footprint in relation to identified heritage items

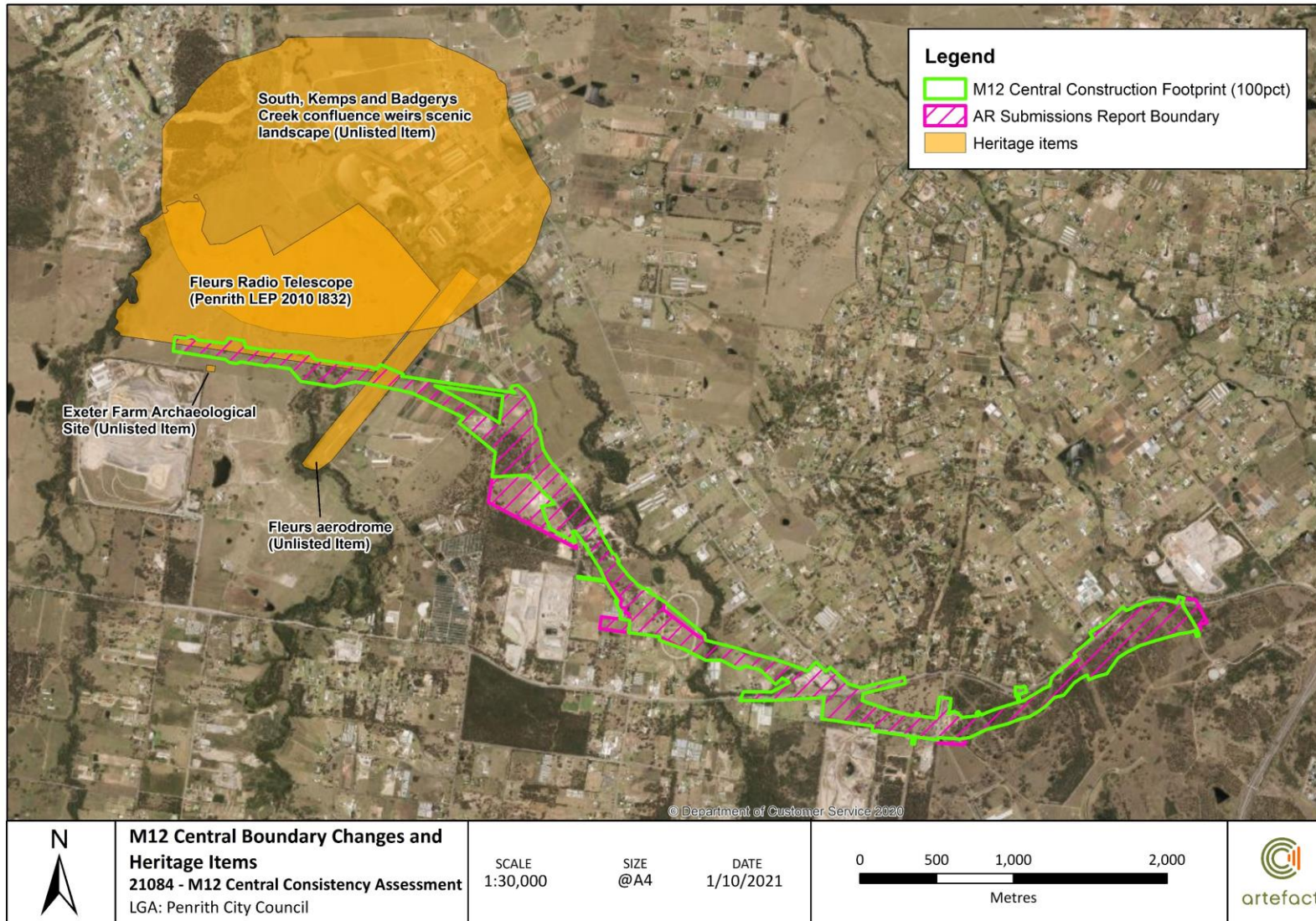


Figure 4. Overview of proposed changes to the M12 Central Package footprint (western section)

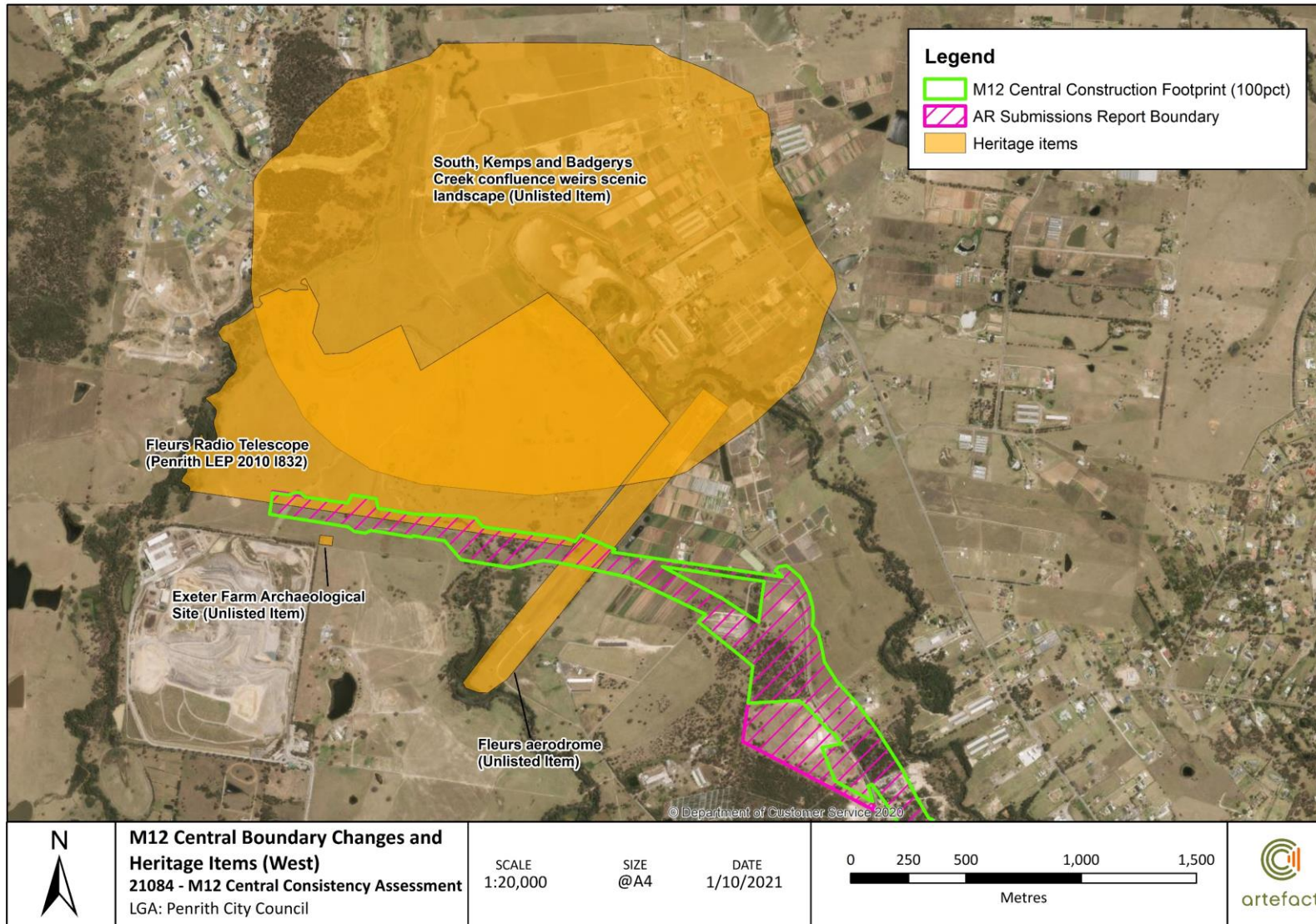
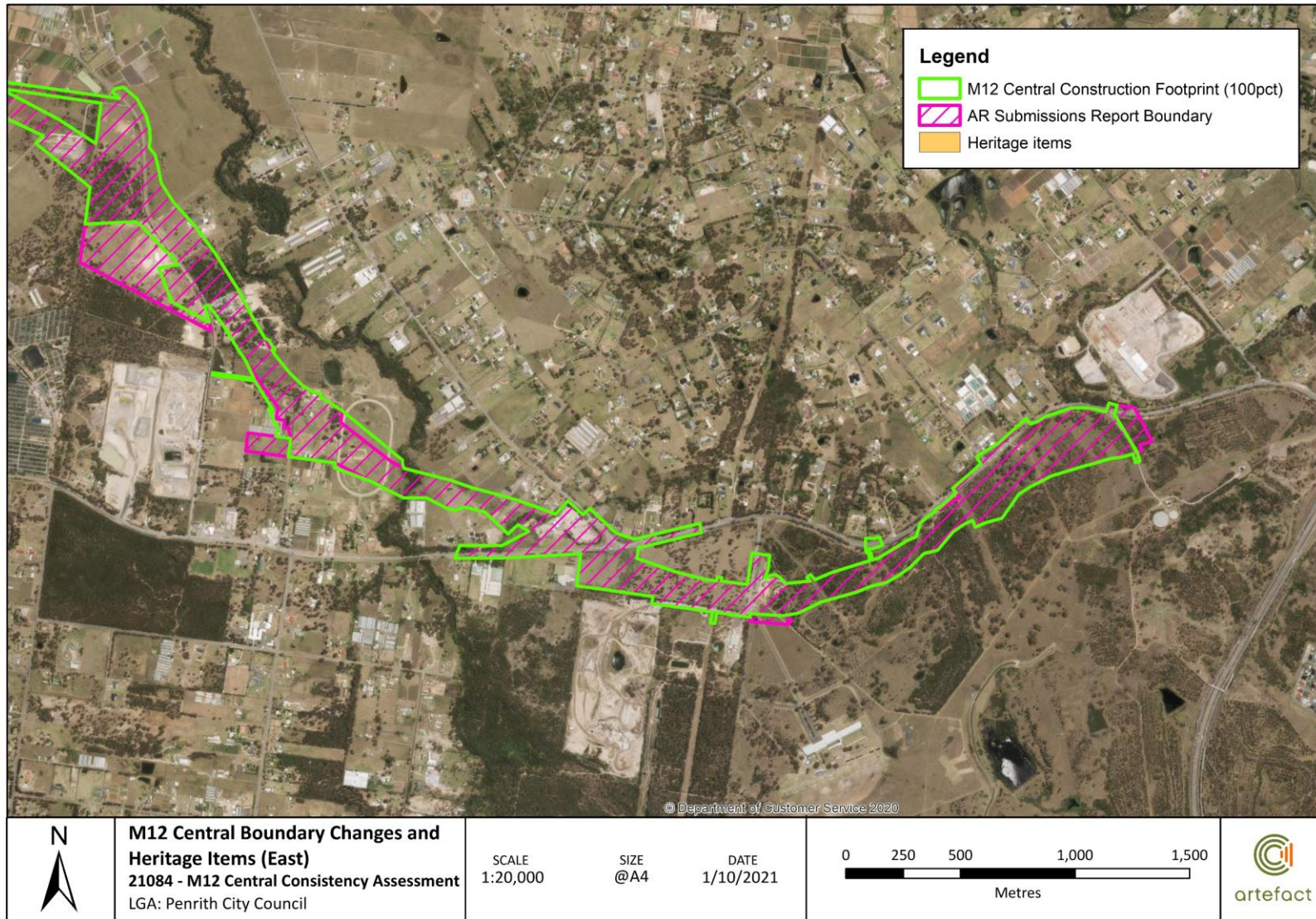


Figure 5. Overview of proposed changes to the M12 Central Package footprint (eastern section)



1.7 Previous heritage assessments for the project

Australian Government and Aurecon, 2016. *M12 Motorway: Strategic Route Options Analysis, Heritage Working Paper. Report to Roads and Maritime Services NSW, Sydney.*

The Australian Government and Aurecon Australasia Pty Ltd prepared a Strategic Route Options Analysis for the M12 Motorway project on behalf of TfNSW (then Roads and Maritime) in 2016. This document included a desktop study and field validation of Aboriginal and non-Aboriginal heritage prepared by Navin Officer Heritage Consultants.

Navin Officer Heritage Consultants identified various telescopes and dishes associated with the Fleurs Radio Telescope Site within, and bordering, the proposed M12 Motorway footprint. A significance assessment prepared for the Telescope Site concluded that it may have State and National heritage significance. Their significance assessment is provided in Table 3.

Wallis Heritage Consulting and Alice Gorman, 2018. *A Heritage Survey of the Fleurs Radio Telescope Field Site, Badgerys Creek, NSW. Prepared for Jacobs Arcadis Joint Venture.*

Alice Gorman (for Wallace Heritage Consulting) prepared a heritage survey of the Fleurs Radio Telescope Field Site on behalf of Jacobs Arcadis Joint Venture to contribute to the M12 Motorway project heritage impact assessment and EIS.

The heritage survey covered an area to the east of the current study area, in a portion of the Fleurs Radio Telescope Field Site located between Kemps Creek and South Creek. Surviving remains of the Mills Cross, Shain Cross, Chris Cross and FST were identified within the former radio telescope site. Most relevant to the current consistency assessment were the remains of a dish antenna and signal hut associated with the FST, which were identified on either side of South Creek. These were named the *South Creek 1* and *South Creek 2 Antenna Complexes*.

The survey report made the following conclusions about the heritage significance of the Fleurs Radio Telescope Site:

The site is considered to have State and potentially National significance demonstrating ground breaking scientific discoveries, leading to revisions of our understanding of the origins of the universe, and as evidence of locally designed instruments contributing to Australia's pre-eminence in the international development of radioastronomy. While the elements are in poor condition, they are rare surviving examples of cross antenna types. There is renewed interest in the history of radioastronomy due to Australia's key role in the Square Kilometre Array, to which the Fleurs antennas can be considered historical precursors. The elements are considered to have outstanding interpretive potential.³

The report concluded that all surviving evidence of the Mills Cross, Shain Cross and FST be avoided and preserved. It recommended that a Conservation Management Plan be prepared for the entire Fleurs Field Site and the University of Sydney seek advice about the process of nominating it on the State Heritage Register.

Biosis, 2019. *M12 Motorway Non-Aboriginal Archaeological Impact Assessment Report. Prepared for Roads and Maritime Services.*

Biosis prepared a Non-Aboriginal Archaeological Impact Assessment Report for the M12 Motorway project, on behalf of TfNSW (then Roads and Maritime) in 2019.

³ Wallace Heritage Consulting, 2018. *A Heritage Survey of the Fleurs Radio Telescope Field Site, Badgerys Creek, NSW*. Prepared for Jacobs Arcadis Joint Venture, p. vi.

The report identified two items of heritage significance located within the current study area – Item 2 and Item 10. Item 2 represents the Fleurs Radio Telescope Site. Item 10 represents the brick scatter identified by Aurecon in 2016.

Biosis carried out a second inspection of the brick scatter in 2018 and prepared a detailed analysis of the landscape including a row of Osage-orange trees bordering the potential archaeological site.

The following description of Item 10 was provided in the report:

Lightly grassed, ploughed fields, 50% ground surface visibility. Area of archaeological potential noted adjacent to a line of immature eucalypt trees forming a boundary with the adjacent Kemps Creek Advanced Resource Recovery Park. Handmade bricks, sandstone, glass, ceramic, metal and two musket balls were located adjacent to line of trees. Vehicle and foot survey. A hedge of bow-wood trees was also noted.⁴

1.8 Authors and acknowledgements

This report has been prepared by Adele Zubrzycka (Senior Heritage Consultant), Martina Muller (Historian), Jenny Winnett (Principal), Sarah-Jane Zammit (Senior Heritage Consultant), Sarah Ryan, (Heritage Consultant), and reviewed by Jayden van Beek (Senior Associate). Management input and review has been provided by Josh Symons (Technical Director).

1.9 Review

In August 2021 Dr Alice Gorman of Wallis Heritage Consulting (WHC) undertook a comprehensive review of a draft non-Aboriginal Heritage consistency assessment for the Fleurs additional components that was prepared by Artefact, dated July 2021.⁵ The review by Dr Gorman concluded that:

- The newly identified components associated with Fleurs Radio Telescope Site would not alter the impact assessment of the project as minor, which would be consistent with the EIS
- The mitigation measures outlined by Artefact, including photographic and archival recording of the site and infrastructure were appropriate
- It was highlighted that organisations may be interested in the collection of cable samples, as outlined by Artefact as a mitigation measure
- The recommended retention of the concrete plinths in situ was identified as an appropriate interpretation strategy
- The project and any impacts generated upon the Fleurs Radio Telescope Site should not impact upon the potential state or national listing of the site, nor detract from the significance of the heritage item, as concluded by Artefact
- Dr Gorman also referenced previous archaeological investigations that have been undertaken for the former Orroral Valley NASA satellite tracking station in the ACT where similar antennas had been removed. These previous investigations emphasised the significance of similar sub-surface

⁴ Biosis, 2019, *M12 Motorway Environmental Impact Statement*, report prepared for Roads and Maritime Services, p. 45.

⁵ Gorman, Alice C. "A Review of the Heritage Significance of the Fleurs Synthesis Telescope, Badgerys Creek, NSW". Draft report prepared for Roads and Maritime Services.

cables and remaining above ground fabric, with management of sub-surface cables including geophysical surveys.⁶

Based upon the aforementioned review of the draft heritage consistency assessment by Artefact, dated July 2021, the following updates have been included in this report including:

- Specific recommendations outlining the sampling, repository and discard policies of the cable samples. This includes additional consideration of the fact that multiple organisations may be interested in obtaining cable samples and that specifics should be outlined within the policy to avoid future confusion.

⁶ Gorman, A.C., 2012, *An archaeological investigation of the Orroral Valley NASA Tracking Station*, report to ACT Heritage.

2.0 STATUTORY CONTEXT

2.1 Project Approvals

The project (SSI-9364) has been approved under Division 5.2 of the EP&A Act. It is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID:2018/8286). The project received approval from the NSW Minister for Planning and Public Spaces on 23 April 2021 with conditions. The project also received approval from the Australian Minister for the Environment on 3 June 2021 with conditions. The project's environmental impacts and commitments were presented in the following Approval Documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement* (the EIS)
- Transport for NSW (2020, August) *M12 Motorway, Amendment Report* (the Amendment Report)
- Transport for NSW (2020, August) *M12 Motorway, Submissions Report* (the Submissions Report).
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report* (the AR Submissions Report).
- Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*.

2.2 Other legislation and instruments

The following legislation and instruments provide guidance and best practice standards for this assessment.

2.2.1 Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) is the primary piece of State legislation affording protection to heritage items (natural and cultural) in NSW. Under the Heritage Act, 'items of environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant. Significance is based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values.

The State Heritage Register (SHR) was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered by the Heritage NSW, Department of Premier and Cabinet (DPC) and includes a diverse range of over 1500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW.

There are no SHR listed items within the study area.

2.2.2 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process, including development of State Environmental Planning Policy and Local Environmental Plan (LEP) planning instruments.

The Fleurs Radio Telescope site is listed on the following heritage registers:

- Penrith LEP 2010 (Item I832)

- Western Sydney State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (Item I5)

Until 30 September 2020, the Fleurs Radio Telescope site was listed entirely on the Penrith LEP 2010 (Item I832). From 1 October 2020 the Fleurs Radio Telescope site was split between two planning instruments, with the portion generally east of South Creek remaining on the Penrith LEP 2010 (Item I832), whilst the portion that overlaps with the study area was removed from the Penrith LEP 2010 and listed on the Western Sydney State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (Item I5).

3.0 HISTORICAL CONTEXT – FLEURS RADIO TELESCOPE SITE

A historical context for Fleurs Radio Telescope site is provided below. A historical context for the remainder of the M12 Central Project footprint is provided in the EIS Non-Aboriginal Heritage Technical Paper.

3.1 Fleurs Aerodrome, Field Station and Radio Telescopes⁷

The Fleurs Estate, now encompassed by 2322 acres of freehold land, was put up for sale in 1934.⁸ In 1942, land east of South Creek was associated with an aerodrome constructed by the Royal Australian Air Force (RAAF) during World War II (WWII).

In 1953/4, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) acquired the property for use as a scientific field site for radioastronomy. Soon after, the Fleurs Radio Telescope was established on the now disused aerodrome site in response to the need for a large and flat space for radioastronomers Bernard Mills, W. N. (Chris) Christiansen and Charles (Alex) Shain to build a large enough antenna for Australia's developing research into radioastronomy.⁹

Mills Cross (1954)

The Mills Cross (a two-dimensional radio telescope shaped like a cross), developed by Bernard Mills, was constructed on the property between 1953 and 54 using chicken wire, timber and metal struts. The telescope was able to pick up radiowaves from the Milky Way and radio emissions from other galaxies.¹⁰ With the exception of a small hut, no other telescopes or structures were built at the site during this time (Figure 7 and Figure 12).

Shain Cross (1955)

In 1955, Alex Shain erected three telescopes at the Fleurs site to continue his research on Jupiter.¹¹ A year later, the Shain Cross (Figure 9) was constructed alongside the Mills Cross for the purpose of surveying galactic plane and Jupiter radio emissions.¹² The Shain Cross was encompassed by a series of dipoles which were strung between power-pole sized posts (as shown in Figure 8 and Figure 9).¹³

Chris Cross (1957-1988)

The Shain Cross was followed by the Chris Cross in 1957, which sat immediately south of the Mills Cross as shown in Figure 13. The Chris Cross was a large radio telescope designed for mapping solar emissions and producing a detailed two-dimensional map of the sun each day (Figure 10). Developed by W N (Chris) Christiansen, it represented the first grating solar array to be constructed in the world and operated from 1957 and 1988.¹⁴ The structure consisted of 32 parabolic dish antennas (5.8 meters in diameter each) constructed using tubular aluminium covered in chicken wire. These were manufactured in the CSIRO workshops and the east-west and north-south arms stretched over 378 metres.¹⁵

⁷ The majority of this historical background for the Fleurs property has been reproduced from: Wallace Heritage Consulting, 2018. *A Heritage Survey of the Fleurs Radio Telescope Field Site, Badgerys Creek, NSW*. Prepared for Jacobs Arcadis Joint Venture.

⁸ Nepean Times, Sat 10 Mar 1934, "Fleurs", p. 4.

⁹ Frater et al. 2013, p. 8

¹⁰ Frater et al. 2013, p. 11.

¹¹ Orchiston et al. 2015, p. 7.

¹² Orchiston 2004a, p. 158.

¹³ Orchiston and Slee, 2002.

¹⁴ Orchiston and Mathewson 2009, p. 11.

¹⁵ CSIRO, n. d. The flowering of Fleurs: an interesting interlude in Australian radio astronomy https://www.atnf.csiro.au/news/newsletter/jun02/Flowering_of_Fleurs.htm, accessed on 7 July 2021 and Tribune 1957, p. 7.

University of Sydney and the Fleurs Synthesis Telescope (1963-1988)

The Fleurs Radio Telescope Site was purchased by the University of Sydney in 1963. The site was then used by the School of Electrical Engineering, at this time led by Professor W N Christianson (who had developed the Chris Cross).¹⁶ Christiansen, his colleagues, and their students established six 13.7 metre stand-alone parabolic dishes (antennas) at the eastern and northern ends of the Chris Cross and to the north and west of the Cross throughout the 1970s.¹⁷

The Chris Cross subsequently became known as the FST (Figure 11) and was used to study supernova remnants, large radio galaxies and emission nebulae.¹⁸ By incorporating the additional dish antennas, it became the 'most powerful radiotelescope in the Southern Hemisphere at the time'.¹⁹ In the late 1970s, two additional 13.7 metre dishes were added to the Telescope,²⁰ which are the subject of this assessment (Antenna X3 and Antenna X4).

University of Western Sydney and the Australia Telescope National Facility (1988-1998)

In 1988, the FST, Shain Cross and Mills Cross were placed in the management of the University of Western Sydney and the site became known as the Australia Telescope National Facility (ATNF). However, by this time, the Fleurs Radio Telescope and its associated antennas and dishes had begun to deteriorate. Questions were soon raised about how the site and its equipment should be managed.²¹

In response, some antennae were demolished, while others were given away. Efforts were made to preserve the remaining antennae and dishes at the site in the 1990s by University of Western Sydney students.²² The overall demise of the property during this period can be seen by comparing aerial photographs taken in 1986 (Figure 24) and 1998 (Figure 27).

Abandonment (1998)

Despite these efforts, the equipment continued to deteriorate and by 2005 the majority of surviving antennas and dishes had been removed from the site, demolished, or abandoned *in situ*. Two of the 13.7m antenna dishes from the FST were removed from site, refurbished, and installed at CSIRO Marsfield, where they remain extant.

Figure 6: Two former FST antenna dishes at CSIRO Marsfield²³



¹⁶ Davies, 2009, p. 8.

¹⁷ Orchiston 2004a, p. 159.

¹⁸ CSIRO, n. d. The flowering of Fleurs: an interesting interlude in Australian radio astronomy

¹⁹ Gorman, A. 2018, p. 14.

²⁰ Frater and Goss, 2011, p. 222.

²¹ Orchiston 2004a, pp. 157, 160

²² Gorman, A. 2018, p. 22.

²³ NSW Six Maps.

Figure 7: The Mills Cross at the Fleurs field station on 25 October 1954, looking south²⁴

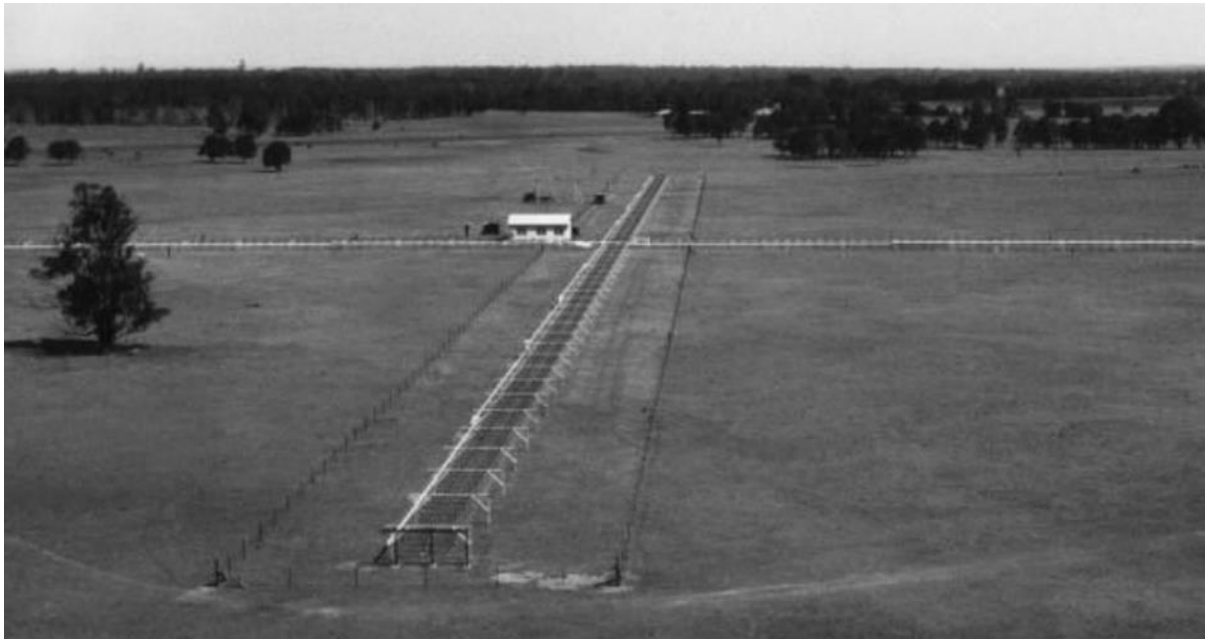


Figure 8: The Shain Cross looking south²⁵



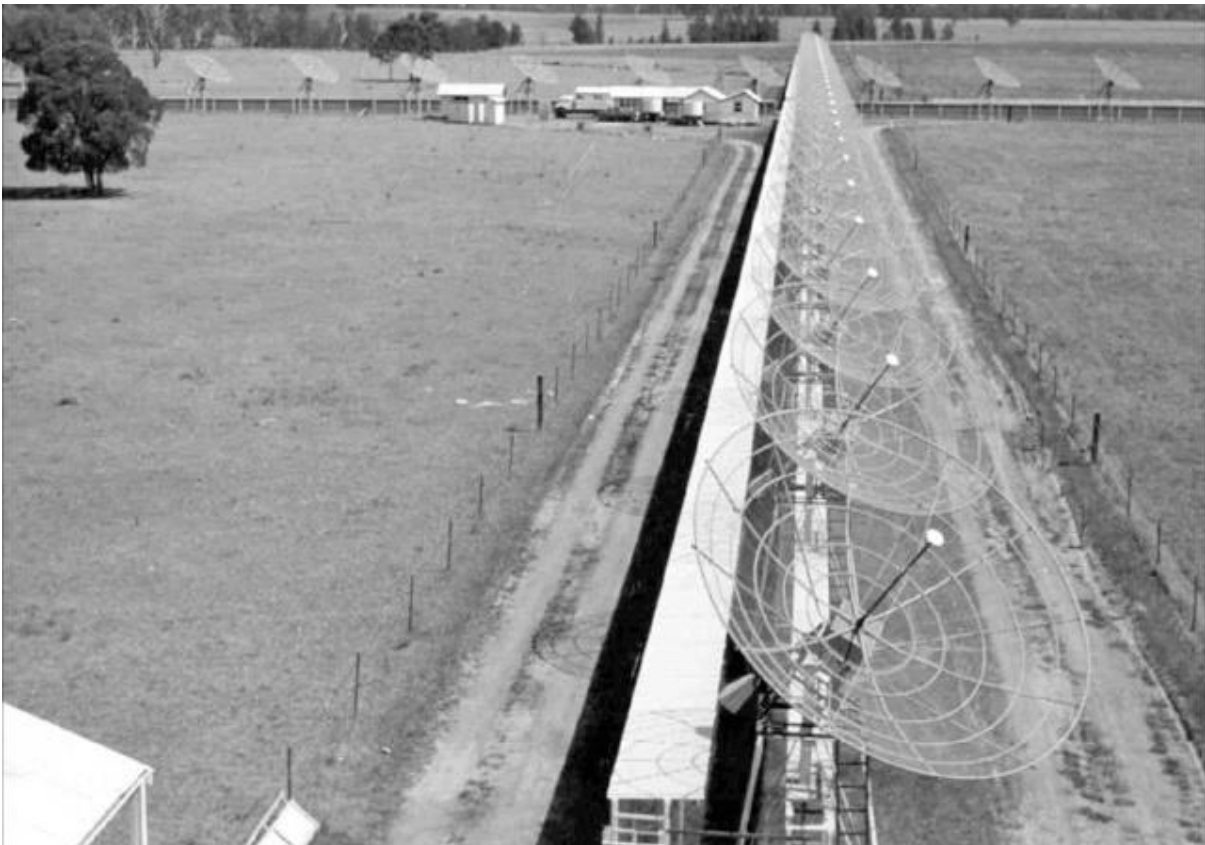
²⁴ CSIRO Radio Astronomy Image Archive: 3476-3.

²⁵ CASS RAIA B3868-19 in Gorman 2018, p. 11.

Figure 9: Suspended dipoles of the Shain Cross at the Fleurs field station²⁶



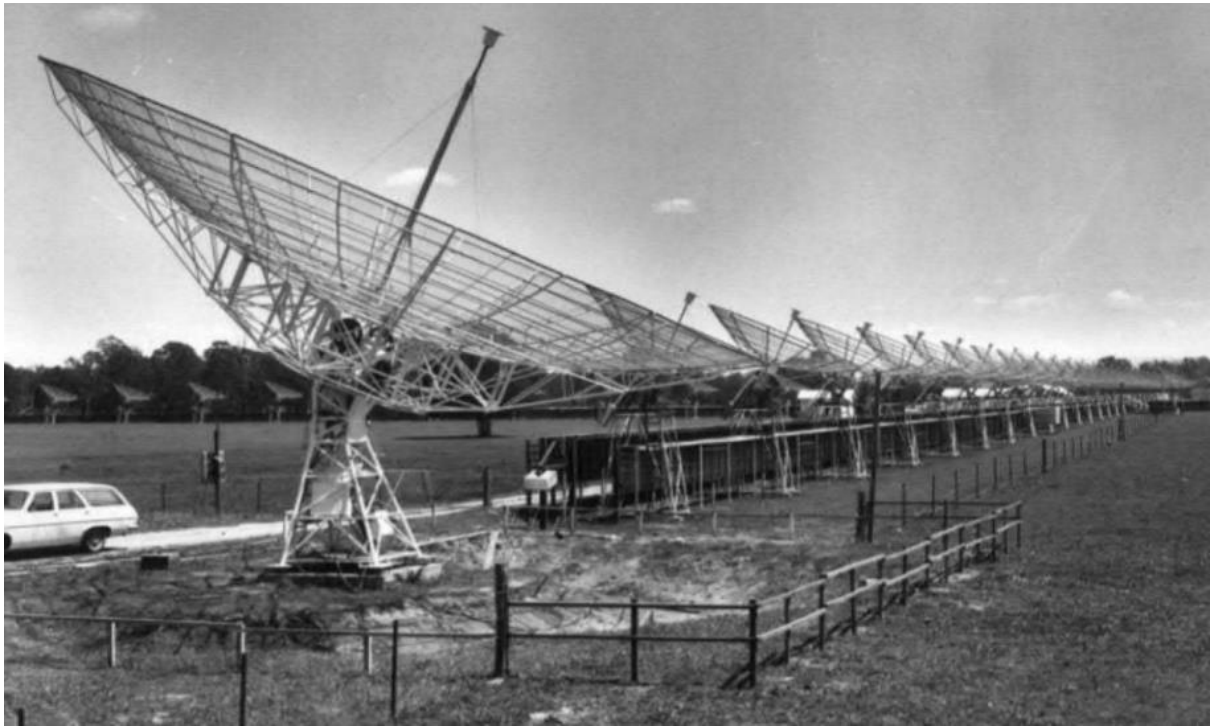
Figure 10: The Chris Cross taken from the eastern end of the EW arm looking west towards the central receiving and other huts and the NS arm²⁷



²⁶ Robertson, P, Cozens, G, Orchiston, W, Slee, B, Wendt, H. 2010. Early Australian Optical and Radio Observations of Centaurus A. Publications of the Astronomical Society of Australia. 27. 10.1071/AS09071.

²⁷ Stewart, R., Wendt, H., Orchiston, W., Wayne, Slee, B. 2011. A Retrospective View of Australian Solar Radio Astronomy 1945–1960, in *Highlighting the History of Astronomy in the Asia-Pacific Region*. DOI: 10.1007/978-1-4419-8161-5_22. ATNF Historic Photographic Archive

Figure 11: The newly developed FST in 1973²⁸



3.2 Area west of South Creek prior to Fleurs Synthesis Telescope

The portion of land west of South Creek and within the study area was not utilised as an aerodrome in the 1940s or the early years of the Fleurs Radio Telescope site's development. Instead, much of the area appears to have been used for cattle grazing. This is evidenced by aerial photographs taken in 1955, 1962, 1970 and 1975 (Figure 12, Figure 13, Figure 14 and Figure 15), all of which show it undeveloped and occupied by scattered trees.

However, between 1975 and 1978, the FST site had been extended to include new structures in the study area, as shown in the 1978 aerial photograph in Figure 24. These new structures formed part of an expansion scheme for the FST that took place from 1976 to 1986.

²⁸ ATNF, Historic Photographic Archive, 9097-11.

Figure 12: 1955 aerial photograph showing the undeveloped nature of land within the study area at this time. The FST Site is visible in the top right corner²⁹

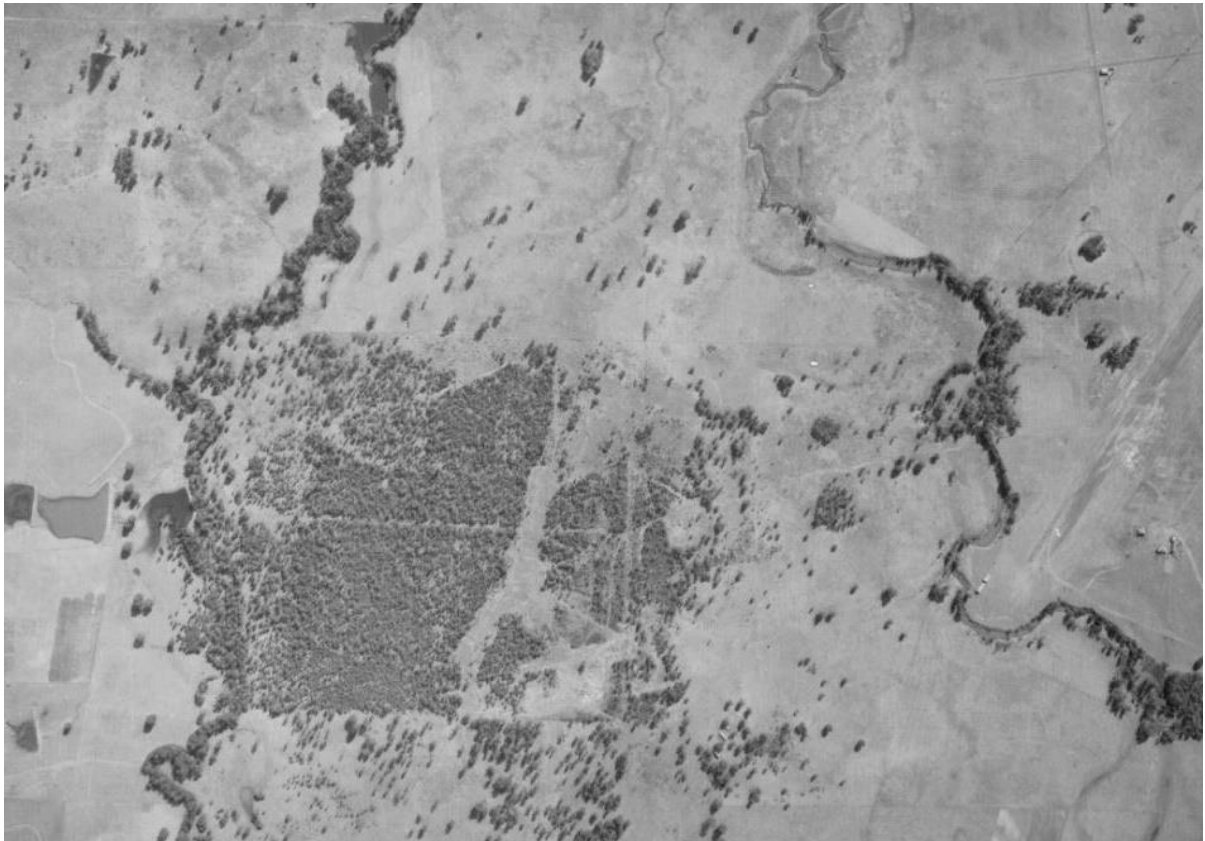


Figure 13: 1965 aerial photograph showing the undeveloped nature of land within the study area at this time. The FST Site is visible in the top right corner³⁰



²⁹ NSW Government Spatial Portal.

Figure 14: 1970 aerial photograph showing the undeveloped nature of land within the study area at this time. The FST Site is visible in the top right corner³¹



Figure 15: 1975 aerial photograph showing the undeveloped nature of land within the study area at this time. The FST Site is visible in the top right corner³²

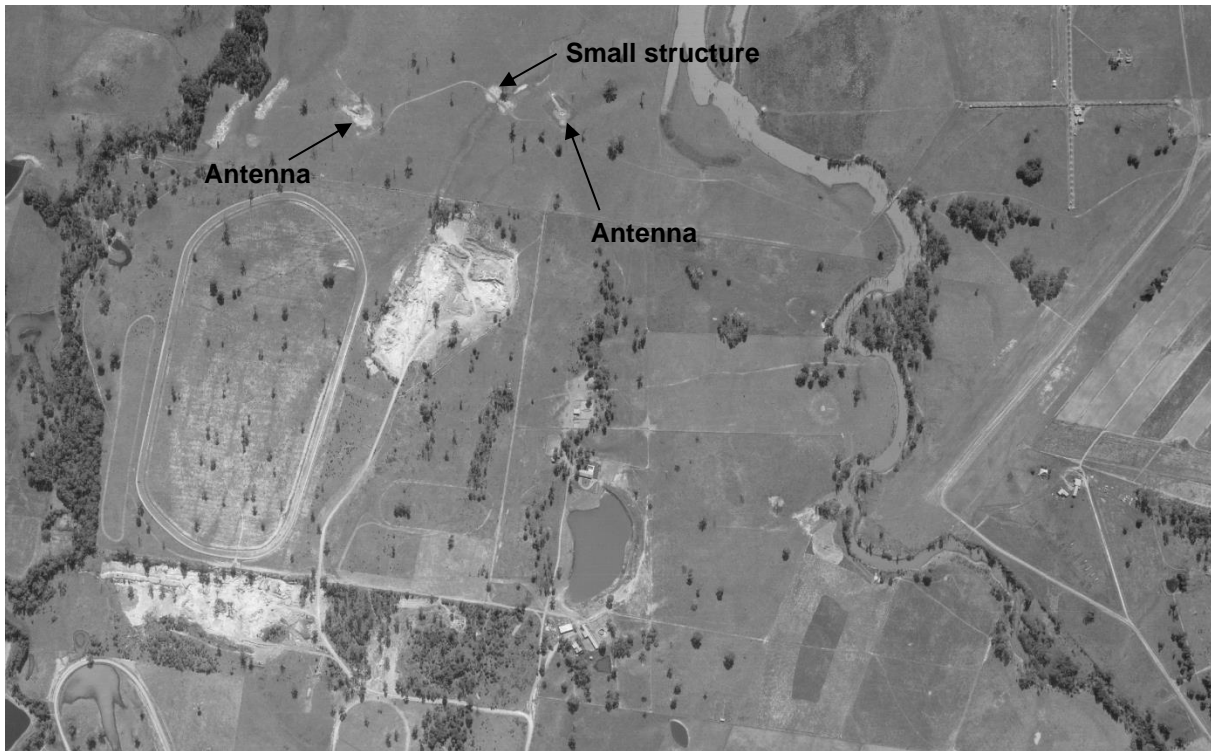


³⁰ NSW Government Spatial Portal.

³¹ NSW Government Spatial Portal.

³² NSW Government Spatial Portal.

Figure 16: 1978 aerial photograph showing two recently constructed antennas and a small structure within the Fleurs portion of the study area (indicated). The original portion of the FST Site is visible in the top right corner³³



3.3 Fleurs portion of the study area during Fleurs Synthesis Telescope use

After the University of Sydney had taken over the Fleurs Radio Telescope site in 1963, it had established the FST by converting the Chris Cross and constructing additional, standalone dish antennas.³⁴ By 1965, four new 13.7m diameter standalone parabolic dish antennas had been added to the Chris Cross and its vicinity (see Figure 17 – Figure 19).

Two antennas were located immediately adjacent to the north and east arms of the Chris Cross, respectively, and two further dish antennas were constructed a little further to the west (immediately east of South Creek) and north of the Chris Cross, respectively. These were later known as antennas X₁ and Y₁ (Chris Cross east and north), Y₂ (north antenna) and X₂ (west antenna) [see Figure 22]. None of these four 13.7m antennas were located in the study area.

Figure 19 shows three of these dish antennas in 1969, looking towards the study area which was still unoccupied.

In September 1976, Christiansen reported that construction of four new 13.7m diameter paraboloids was almost complete.³⁵ The location of the existing four dish antennas and proposed new antennas was noted in a diagram (Figure 20). One of the new antennas was to be located at Badgerys Creek, and quite some distance from Fleurs, while another one was to be located to the south of Chris Cross. Two of the proposed antennas were to be located east of South Creek.

Christiansen mentioned that “a decision on what are the most suitable positions for the new 13.7m paraboloids was made on the basis of a number of limiting considerations.”³⁶ One of these limiting

³³ NSW Government Spatial Portal.

³⁴ Alice C. Gorman, “A Heritage Survey of the Fleurs Radiotelescope Field Site, Badgerys Creek, NSW. Prepared for Jacobs Arcadis Joint Venture” (Wallis Heritage Consulting, March 5, 2018), 14. 20.

³⁵ W. N. Christiansen, “Extensions to the Fleurs Synthesis Telescope,” *Proceedings (Astronomical Society of Australia)* 3, no. 1 (September 1976): 35.

³⁶ Christiansen, “Extensions to the Fleurs Synthesis Telescope,” 35.

factors was that the antennas had “to be placed on someone else’s land” which was not necessarily level and was in one direction covered by water. This was likely the location of the two dishes further away. Another limiting factor was financing, which required the construction of the dish antennas in stages. The plan was to first add the two closest antennas on the western end of the east-west array (in the study area), followed by the one to the south and, finally, the antenna at Badgerys Creek. The team was also working on the development of a new digital receiving system to simplify the “problem” of providing the many large time-delays required when we extend the telescope to a diameter of more than 3.5 km.³⁷

The two new antennas west of South Creek and in the study area are visible in the 1978 aerial photograph (Figure 21) and were noted as having been erected by 1980.³⁸ ‘By 1980 they were known as X₃ (eastern antenna) and X₄ (western antenna) (refer Figure 22). By that time, the proposed locations for the two more remote additional new antennas (known as Z₁ and Z₂) had changed, with the new location shown in the diagram in Figure 22. The foundations for these two new antennas further afield, located outside the study area, had been poured by 1980.³⁹

In 1984, Jones *et al.* described the new arrangement of the East-West array of the FST, which had been extended to 1.585 km by the addition of the two new 13.7m paraboloids in the study area (X₃ and X₄) (Figure 23). By that time, a digital receiver had “been built to accommodate the extra delay and correlation requirements, low noise Field Effect Transistor (FET) preamplifiers have been installed on the large antennas, and a software package has been developed for processing observation data on a Virtual Address eXtension (VAX) 11/780.”⁴⁰

The two new dishes in the study area were now fully automated, with work in progress at that time to provide the same capability for the older large antennas to the east. Jones *et al.* (1984) described how Local Oscillator power was “transmitted to each antenna via a branched system of underground cables arranged to approximately equalise the path length to each antenna so that differential variations caused by temperature changes are minimised. Power amplifiers are included at certain locations to overcome cable attenuation.”⁴¹

It appears that the two dishes further away from the site (Z₁ and Z₂) were never constructed, as by 1986 the FST was described as containing a total of six 13.7m antennas in addition to the 32 smaller antennas of the older east-west array.⁴² By then, all antennas were fully computer controlled. This six-dish FST array was restricted to relatively compact objects but had “an enormous advantage over the full array in flexibility, improved potential accuracy of calibration and speed of scientific return.”⁴³

The 1986 aerial photograph (Figure 24 - Figure 25) shows the two antennas in the study area (X₃ and X₄), with trenches between the two likely indicating where the cabling had been laid. Small, box or shed-like structures to the east of the two antennas and halfway along the cabling trenches likely housed technical equipment such as amplifiers and/or associated hardware and cabling, or potentially served as signal boxes. They are not visible in the 1978 aerial (Figure 21), suggesting they were added to the late 1970s dishes as part of the automatization of the FST in the early 1980s. There may have been further associated smaller structures and underground cabling present within the study area.⁴⁴

³⁷ Christiansen, 35.

³⁸ R. H. Frater, R. G. Gough, and A. Watkinson, “The Synthesised Beamshapes for the Fleurs Extension,” *Proceedings (Astronomical Society of Australia)* 4, no. 1 (1980): 24.

³⁹ Frater, Gough, and Watkinson, 24.

⁴⁰ I. G. Jones *et al.*, “The FST - A 20 Arc Second Synthesis Telescope,” *Proceedings (Astronomical Society of Australia)* 5, no. 4 (1984): 574.

⁴¹ Jones *et al.*, 574.

⁴² Michael J. Batty *et al.*, “Astronomy with the Fleurs Six-Dish Array,” *Proceedings (Astronomical Society of Australia)* 6, no. 3 (1986): 346.

⁴³ Batty *et al.*, 347.

⁴⁴ Cf. Alice C. Gorman, “A Heritage Survey of the Fleurs Radiotelescope Field Site, Badgerys Creek, NSW. Prepared for Jacobs Arcadis Joint Venture” (Wallis Heritage Consulting, March 5, 2018), 72-75. Gorman identified extant signal boxes at ‘South Creek 1’ and ‘South Creek 2’.

The expanded and automated FST was only in use until 1988, when it was closed, and the site transferred to the Engineering Faculty at the University of Western Sydney.⁴⁵ The FST subsequently deteriorated, despite efforts to restore at least some of the equipment in 1990. Eight years later, in 1998, the site was closed down again. By then, the two antennas in the study area were still standing (Figure 27). By the end of 2004, all smaller antennas of the Chris Cross and the two antennas at the end of its eastern and northern arms had been bulldozed.⁴⁶

The 13.7m antennas from the study area were dismantled and removed in 2005, and subsequently restored and upgraded for reuse at the Australia Telescope National Facility headquarters at Marsfield.⁴⁷ In June 2005, O'Sullivan and Jacka reported that two dishes had been removed from the Fleurs site and were being refurbished at SES as part of the New Technology Demonstrator (NTD).⁴⁸ The refurbished antennas were expected to be ready for installation on site at Marsfield in July 2005, and available for experiments by October 2005. The relocated antennas appear on aerial photographs showing the Marsfield site from 2007.⁴⁹

O'Sullivan and Jacka's presentation given in June 2005 included photographs of X₄ prior to removal (Figure 28). Although there is no photograph of X₃ prior to removal, it is assumed that X₃ was the other antenna dish removed and relocated to Marsfield. This is based on the fact that both X₃ and X₄ were removed at the same time and installed at Marsfield at the same time. X₁ and Y₁ were removed from site a few years earlier, whilst X₂ and Y₂ remain on site.

Antenna dish X₄ was shown in O'Sullivan and Jacka's presentation standing in an excavated depression with its bases surrounded by water. Alice Gorman indeed reported in 2018 that two antennas had been relocated to Marsfield, noting that one of the removed antennas was excavated from a creek where it was surrounded by thick bulrushes, and one had the letter 'W' painted on the base, referring to its location to the west of the creek.⁵⁰

Gorman's 2018 survey of the M12 Motorway project footprint identified the remains of the last two 13.7m dish antennas that were left on the former FST site.⁵¹ One of these antennas was the north antenna (Y₂), identified as part of the *Shain Cross North Antenna* complex by Gorman.⁵² The second remnant antenna was located on the eastern side of South Creek (assigned *South Creek 2 Antenna Complex*) and comprised of an original parabolic dish associated with the FST as well as its associated concrete pads and cables (Figure 29). This antenna, like the north antenna constructed during the 1960s, and the dish and associated remnant structures were assessed as having high significance as one of the two only surviving examples of FST elements on the property.

To the west of the *South Creek 2 Antenna Complex*, Gorman identified the remains of a signal box, set of three plinths, cable trench (with exposed cables and associated cable fragments), and footing trench likely connected to an FST antenna, all associated with the FST (assigned *South Creek 1 Antenna Complex*) (refer Figure 29).⁵³ Gorman noted that the dish antenna had been removed, however, there is no indication that an antenna was located at this location. The signal box and cables identified at *South Creek 1 Antenna Complex* are likely to be located with the cable trench to

⁴⁵ Wayne Orchiston and Don Mathewson, "Chris Christiansen and the Chris Cross," *Journal of Astronomical History and Heritage* 12, no. 1 (2009): 28.

⁴⁶ *Ibid.*; cf. Google Earth Pro, Historical Imagery 2002-2004.

⁴⁷ Google Earth Pro, Historical Imagery 2004 (the two dish antennas in the study area are still evident) and 2006 (both dish antennas removed).

⁴⁸ John O'Sullivan and Colin Jacka, "The Australian NTD and XNTD Projects. Presented at the Astron FPA Workshop, 30 June 2005," 28, accessed July 20, 2021, https://www.astron.nl/fpaworkshop2005/Monday/OSullivan_FPA2005.pdf.

⁴⁹ Google Earth Pro, 2005 and 2007. The antennas are not visible in the 2005 aerial of the Marsfield site but are evident in 2007. No aerial image is available for 2006.

⁵⁰ Gorman, "A Heritage Survey of the Fleurs Radiotelescope Field Site, Badgerys Creek, NSW. Prepared for Jacobs Arcadis Joint Venture," 26.

⁵¹ Gorman, A (Wallace Heritage Consulting). 2018.

⁵² Gorman, "A Heritage Survey of the Fleurs Radiotelescope Field Site, Badgerys Creek, NSW. Prepared for Jacobs Arcadis Joint Venture," 24-25. 34-37. Fig. 18.

⁵³ Gorman, 26-27. 72.

X₃ and X₄. Gorman, who acknowledged that the antenna trench may also have been a small stock watering dam,⁵⁴ assessed the significance of the *South Creek 1 Antenna Complex* as low, primarily because the dish antenna was not present, and plinths had been removed from their original location.

While Gorman's assessment concluded that cables within the Fleurs Radio Telescope Site have high research potential, and noted that intact cables were present in other areas of the site.⁵⁵ The signal box is clearly visible for the first time in an aerial photograph dated 1986 (Figure 24), suggesting that it was part of the later, early 1980s phase of expansion and automation of the FST.

Figure 17: 1965 aerial photograph showing the four new 13.7m dishes constructed as part of the FST, as indicated by arrows. The study area remains undeveloped⁵⁶



⁵⁴ Gorman, 27.

⁵⁵ Gorman, A (Wallace Heritage Consulting). 2018.

⁵⁶ NSW Government Spatial Portal.

Figure 18: Undated view of the Chris Cross and Mills Cross from the north, showing three 13.7 m antennas, in the foreground and at the northern and eastern ends of the Chris Cross. The disused WWII air strip is visible in the background⁵⁷



⁵⁷ Orchiston, W. 2004. The Rise and Fall of The Chris Cross: A Pioneering Australian Radio Telescope, p. 160. ATNF Historic Photographic Archive 9097 35.

Figure 19: 1969 photograph showing the FST Site from the east looking west, showing two 13.7 m antennas at the northern (right) and eastern (front) end of the Chris Cross, and another one further to the west (background). The study area is still undeveloped⁵⁸



⁵⁸ R. H. Frater, W. M. Goss, and H. W. Wendt, "Chris Christiansen: Telescope Design and Earth-Rotational Synthesis," in *Four Pillars of Radio Astronomy: Mills, Christiansen, Wild, Bracewell*, Astronomers' Universe (Cham: Springer, 2017), 83 Fig. 4.22. CSIRO Radio Astronomy Historical Photographic Archives N9114-3.

Figure 20: Diagram published by W. N. Christiansen in September 1967, showing the existing 13.7m paraboloids as small circles, with larger circles indicating new paraboloids under construction and nearing completion. Two of those (outlined) were located in the study area and formed part of the planned extension of the FST by the University of Sydney⁵⁹

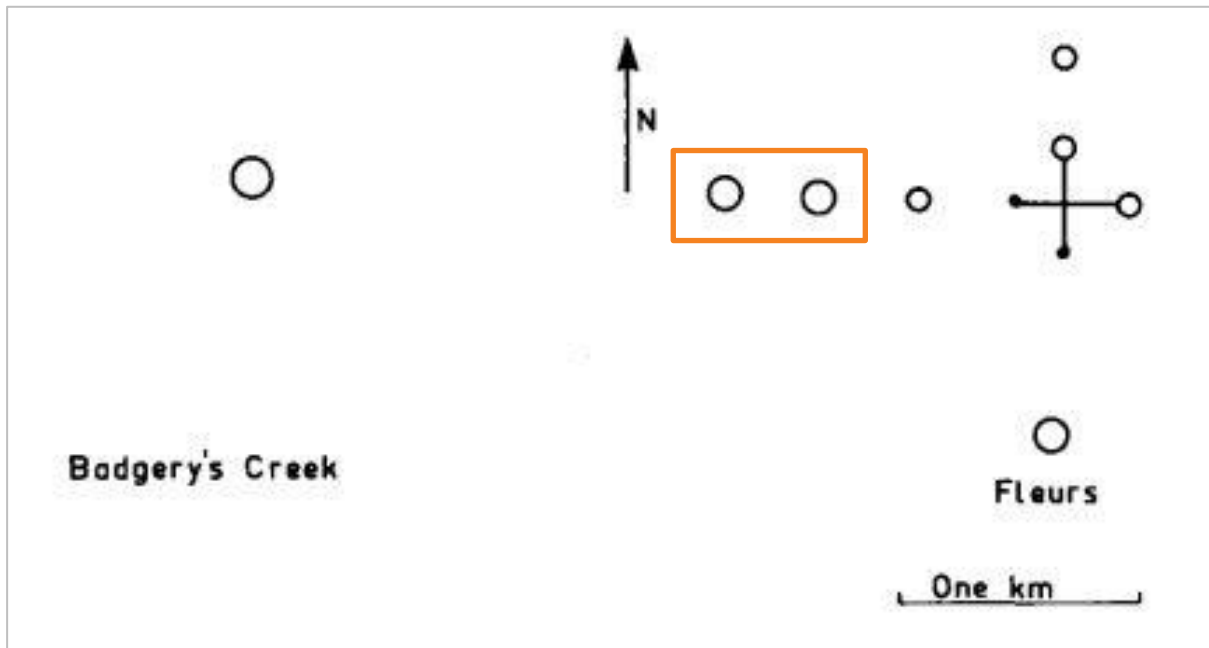
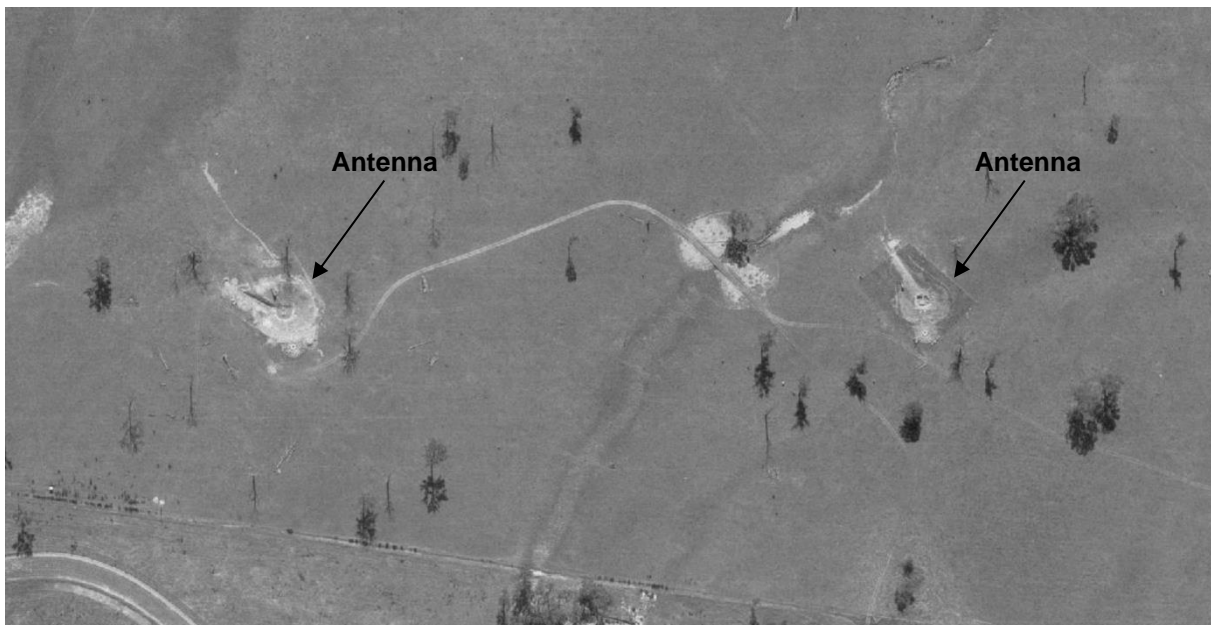


Figure 21: Detail of 1978 aerial photograph showing two recently constructed 13.7m antennas within the Flours portion of the study area (indicated). They were linked and accessed by a new path⁶⁰



⁵⁹ Christiansen, "Extensions to the Flours Synthesis Telescope," 35 Fig. 1.

⁶⁰ NSW Government Spatial Portal.

Figure 22: Diagram published by R. H. Frater *et al.* in 1980, showing the planned antenna configuration for the extended FST, with the 13.7m antennas named. Two of these, named X_3 and X_4 (outlined), were located in the study area⁶¹

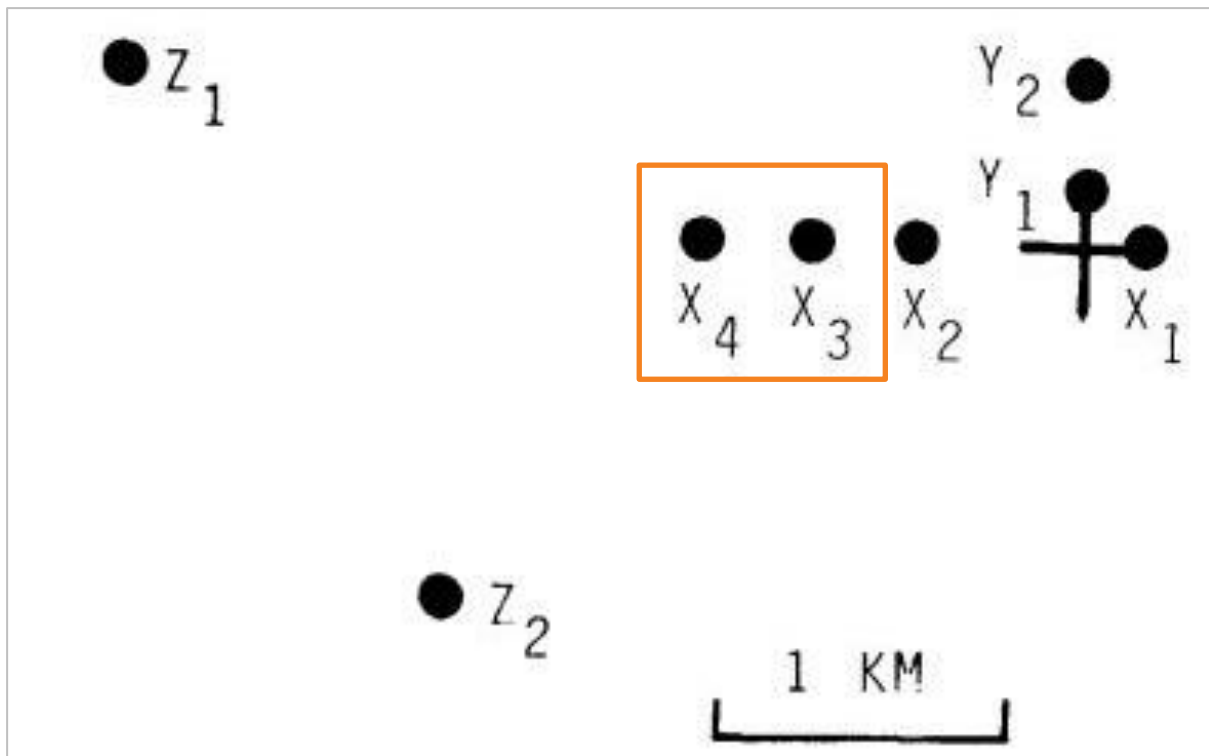
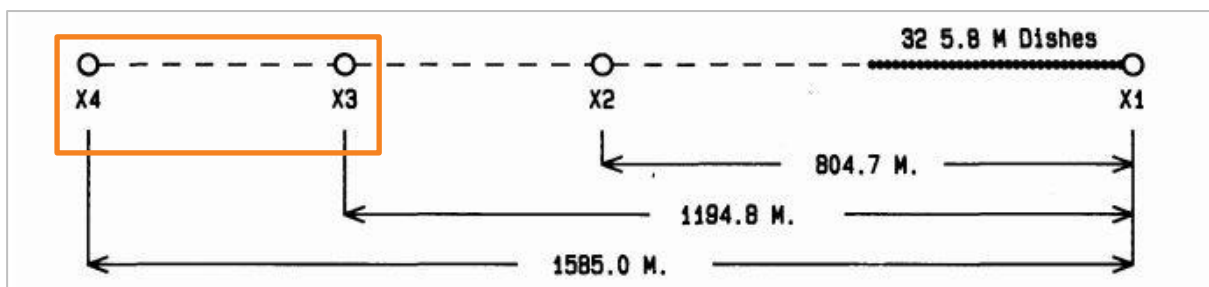


Figure 23: Diagram published by I. G. Jones *et al.* in 1984, showing the east-west array of the extended FST, with X_3 and X_4 (outlined) located in the study area. The distances between dish X_1 and the other 13.7m antennas are also noted⁶²



⁶¹ Frater, Gough, and Watkinson, "The Synthesised Beamshapes for the Fleurs Extension," 24 Fig. 1.

⁶² Jones et al., "The FST - A 20 Arc Second Synthesis Telescope," 575 Fig. 1.

Figure 24: 1986 aerial photograph showing the location of antennas X₃ and X₄ and associated small structure within the Fleurs portion of the study area (indicated) in relation to the original FST set up on the eastern side of the creek (at top right). They formed the east-west array of the expanded FST Site⁶³

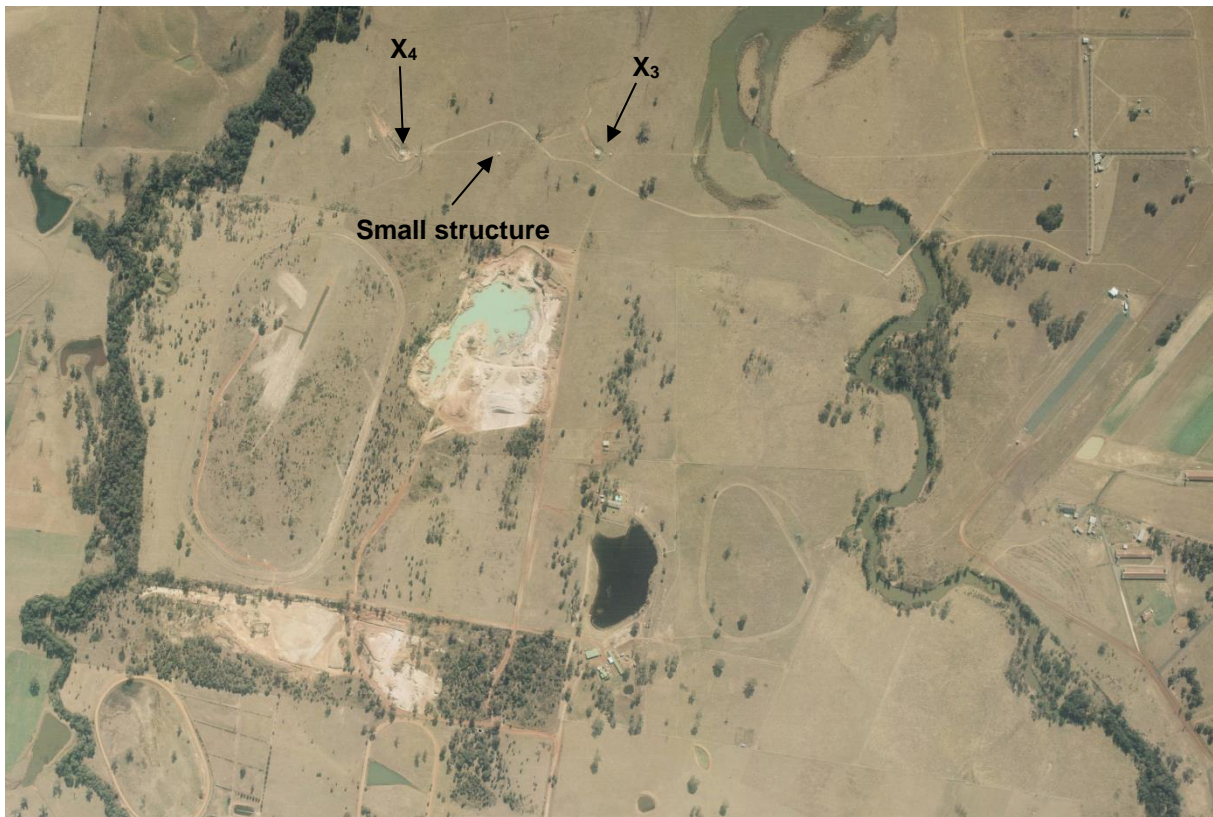
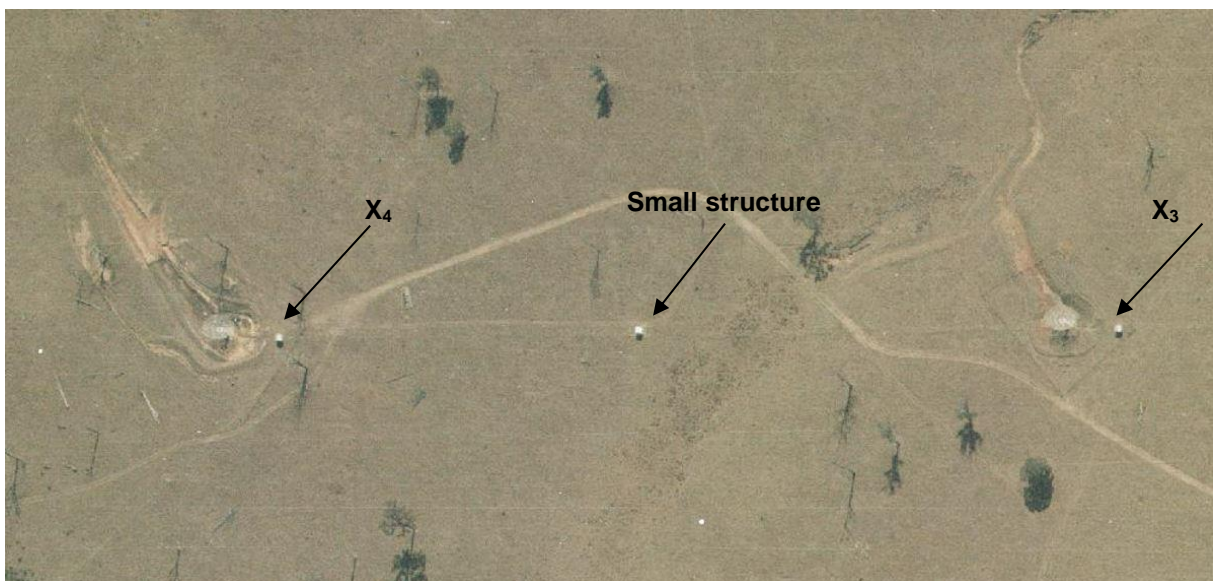


Figure 25: Detail from 1986 aerial photograph showing antennas X₃ and X₄ and associated small structure within the Fleurs portion of the study area (indicated). Additional small structures, such as signal boxes, and underground cabling may have been present in the area⁶⁴



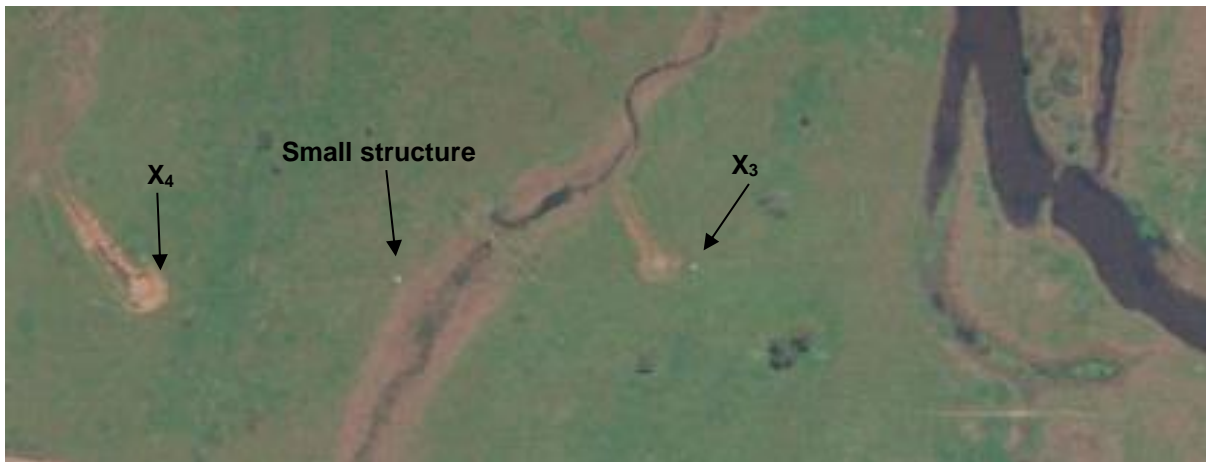
⁶³ NSW Government Spatial Portal.

⁶⁴ NSW Government Spatial Portal.

Figure 26: 1986 aerial photograph showing antenna X2 at the site identified by Gorman (2018) as South Creek 2 Antenna complex (on right) and signal box at South Creek 1 Antenna complex (on left), which is clearly visible for the first time in this aerial photograph⁶⁵



Figure 27: 1998 aerial photograph showing the deteriorating FST antennas and associated structure within the Fleurs portion of the study area are still present⁶⁶



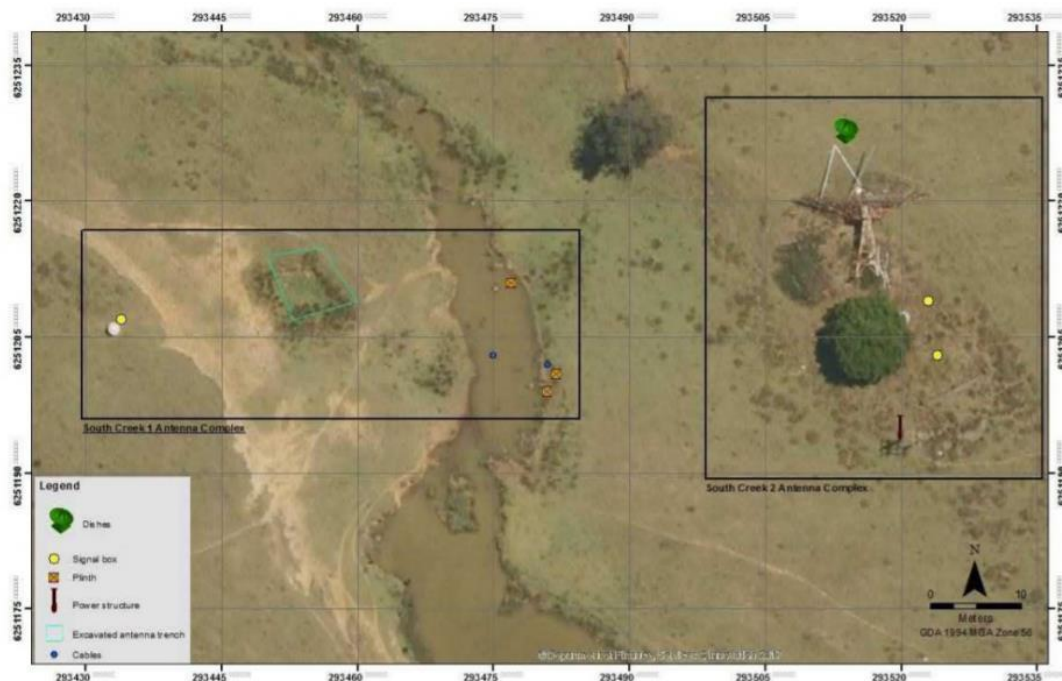
⁶⁵ NSW Government Spatial Portal.

⁶⁶ NSW Government Spatial Portal.

Figure 28: 2005 photographs showing one or both antennas in the study area prior to relocation to Marsfield. The antennas were located in depressions, with their bases surrounded by water. The nearby Kemps Creek Resource Recovery Park (landfill facility) is visible behind the antenna on the left⁶⁷



Figure 29: Map showing South Creek 1 and 2 Antenna Complexes (east of the study area) as identified by Gorman in 2018⁶⁸



⁶⁷ O'Sullivan and Jacka, "The Australian NTD and XNTD Projects. Presented at the Astron FPA Workshop, 30 June 2005."

⁶⁸ Gorman, A (Wallace Heritage Consulting). 2018, p. 29.

4.0 SITE CONTEXT

4.1 Fleurs Radio Telescope site – Fleurs Synthesis Telescope remains

A site inspection was conducted on 15 July 2021 by Jayden van Beek (Senior Associate) and Isabel Wheeler (Heritage Consultant) at the portion of the Fleurs Radio Telescope site that falls within the M12 footprint. The intention of the inspection was to identify the fabric remains of the FST that were not assessed in the EIS non-Aboriginal Heritage Technical Paper.

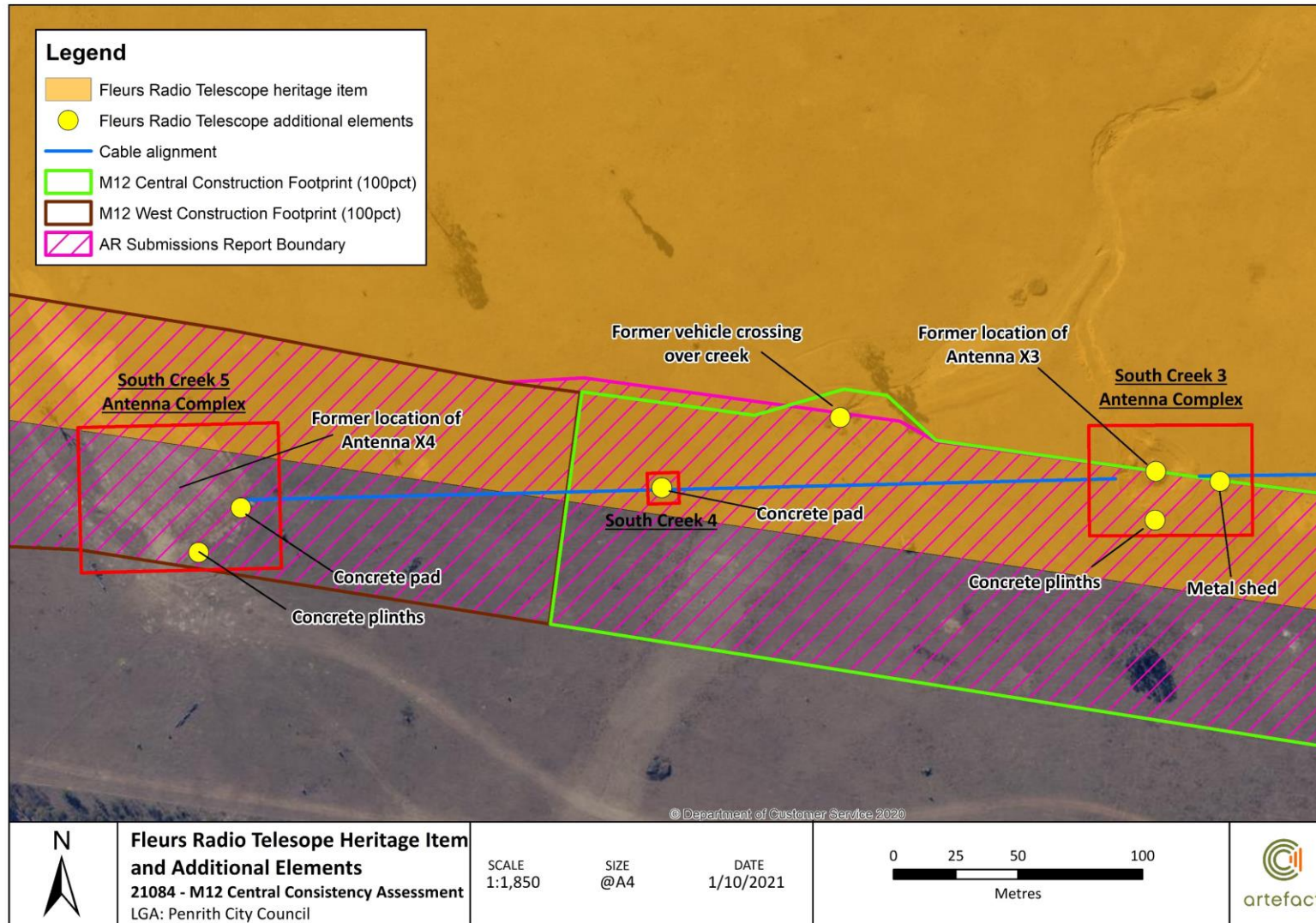
The site inspection on 15 July 2021 included pedestrian inspection of the FST remains in the study area (see Figure 30).

Item numbering follows the item numbering system from the EIS for the FST.

Table 2: Identified Fleurs Radio Telescope elements relevant to the current assessment

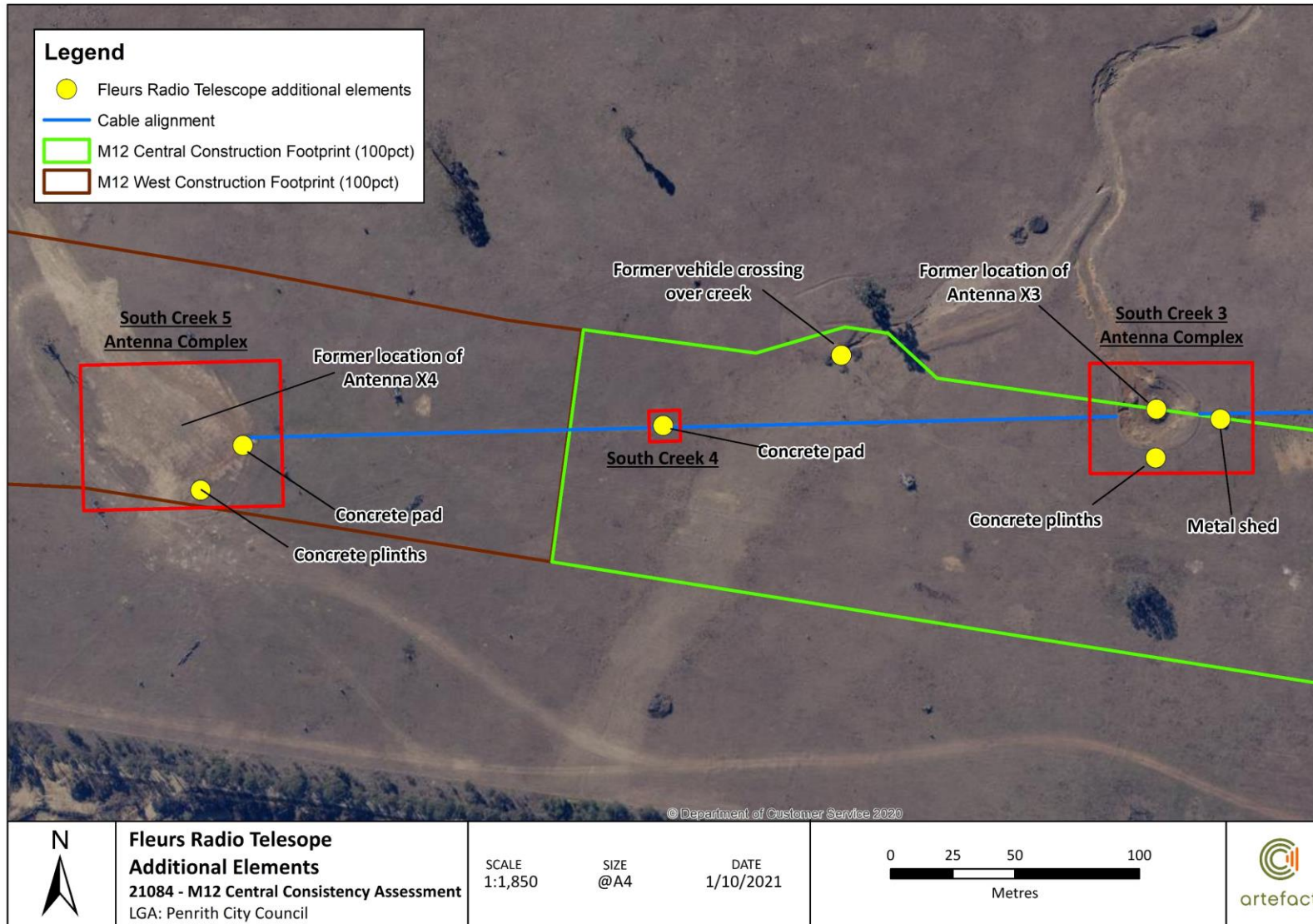
Document	Name	Identified Elements	Comments
EIS	South Creek 1 Antenna Complex	Signal box, three plinths, cable trench, antenna footing trench	The EIS suggests that SCAC1 was the site of an antenna that was subsequently moved to CSIRO Marsfield. However, aerial photographs and technical drawings of antenna locations do not indicate there was an antenna at this location. Antenna X ₁ was located east of the Chris Cross; Antenna X ₂ remains in a dilapidated state on site (EIS South Creek 2 Antenna Complex); Antenna X ₃ and X ₄ were not identified in the EIS and are assessed in this report (see South Creek 3 Antenna Complex and South Creek 4 Antenna Complex below)
EIS	South Creek 2 Antenna Complex	Antenna X ₂ , signal box, power structure, fenced enclosure	Antenna X ₂ collapsed
This report	South Creek 3 Antenna Complex	Former location of antenna X ₃ , metal shed, concrete plinths, cables	Antenna X ₃ removed, likely relocated to CSIRO Marsfield
This report	South Creek 4	Concrete pad, cables	Most equipment and housing shed have been removed
This report	South Creek 5 Antenna Complex	Former location of antenna X ₄ , concrete pad, concrete plinths, cables	Location of antenna X ₄ backfilled following the relocation of antenna X ₄ to Marsfield. Most equipment and hosing shed associated with concrete pad have been removed
EIS and this report	Undeground cables	Cables, compressed air hoses, power supply cables identified at concrete pads and within metal shed	Aerial photographs suggest underground cable trench linking antenna X ₂ , X ₃ and X ₄
This report	Former vehicle crossing over creek	Concrete culverts, deteriorated vehicle crossing	Aerial photographs suggest this creek crossing was used during installation of X ₃ and X ₄

Figure 30: FST elements assessed in this report, showing heritage curtilage of Fleurs Radio Telescope heritage item and the AR Submissions Report boundary



Document Path: D:\GIS\GIS_Mapping\21084 M12 Haul Road\MXD\Central_Package\2021.10.01\Fleurs_Heritage_Item_20211001.mxd

Figure 31: FST elements assessed in this report, showing the elements located within M12 Central



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4.1.1.1 South Creek 3 Antenna Complex

South Creek 3 Antenna Complex includes the location of antenna X₃ before it was removed in c.2004. The remains identified at South Creek 3 Antenna Complex include:

- Excavated 'basin' where X₃ was located
- Metal shed in poor condition, sitting on a concrete pad. Remaining equipment in generally poor condition includes power supply board, possible server rack, PVC conduits and associated cables / compressed air hoses
- Three aggregate concrete plinths

Former location of antenna X₃

Antenna X₃ was originally located in a small excavated basin. The last available photo of antenna X₄ before removal provides an indication of how X₃ would have appeared before removal. The photos of X₄ (Figure 32) shows the antenna surrounded by water and bulrush vegetation. Aerial images indicate the basin for antenna X₃ was similar in appearance and condition.

Figure 32: View of antenna X₄ in c.2004 before removal⁶⁹



Figure 33: View east across the former location of antenna X₃ in July 2021, metal shed in background



⁶⁹ O'Sullivan and Jacka, "The Australian NTD and XNTD Projects. Presented at the Astron FPA Workshop, 30 June 2005."

The excavated basin remains filled with water and bulrush vegetation. From the margins of the excavated basin, no visible remains of antenna X₃ were visible in the bulrush vegetation during the inspection.

The basin now functions as a 'dam' and potentially a source of water for livestock. Erosion around the basin is consistent with frequent access by livestock. Around the eroded margins of the basin the following material was identified:

- Several partially buried / broken white plastic PVC pipes, approximately 50mm diameter. One of the partially exposed PVC pipes is aligned with the metal shed and the cable alignment between X₂, X₃, and X₄
- Timber poles, unknown provenance / function
- Brick fragments

Overall, the function of the basin as a feature excavated for installation of X₃ is still legible. However, the basin is eroding/ changing shape over time due to natural erosion and livestock access. Timber and brick fragments around the margins of the basin may be associated with former fencing and general rubbish scattered across the area – these items are neither in their original contexts nor associated with any visible/ identifiable features.

Due to the removal of antenna X₃ and deteriorating nature of the basin, the overall condition of the former location of X₃ is **poor**.

Metal shed

A partially collapsed metal shed is located approximately 10 metres east of the former location of X₃. Due to the collapsed nature of the shed it was not safe to enter during the site inspection. Inspection through the door opening observed dilapidated remains of power supply infrastructure, cable and compressed air hose entry points, and the possible remains of a collapsed computer server rack.

Several PVC conduits are located in one corner of the shed, housing numerous black cables and compressed air hoses which drape over the side of the PVC conduits and litter the floor under collapsed roof sheeting. A large cow skull is located amongst the cables.

The power supply board is bolted to a metal board in one corner of the shed. A PVC pipe appears to supply electrical power to the power supply bulb. A light fitting is attached to the upper portion of the shed wall and connected by a cable to the power supply board.

What appears to be the rusting remains of a computer server rack is collapsed across the floor of the shed. The server rack appears to have been emptied with the exception of some plastic coated wires and a power supply cable.

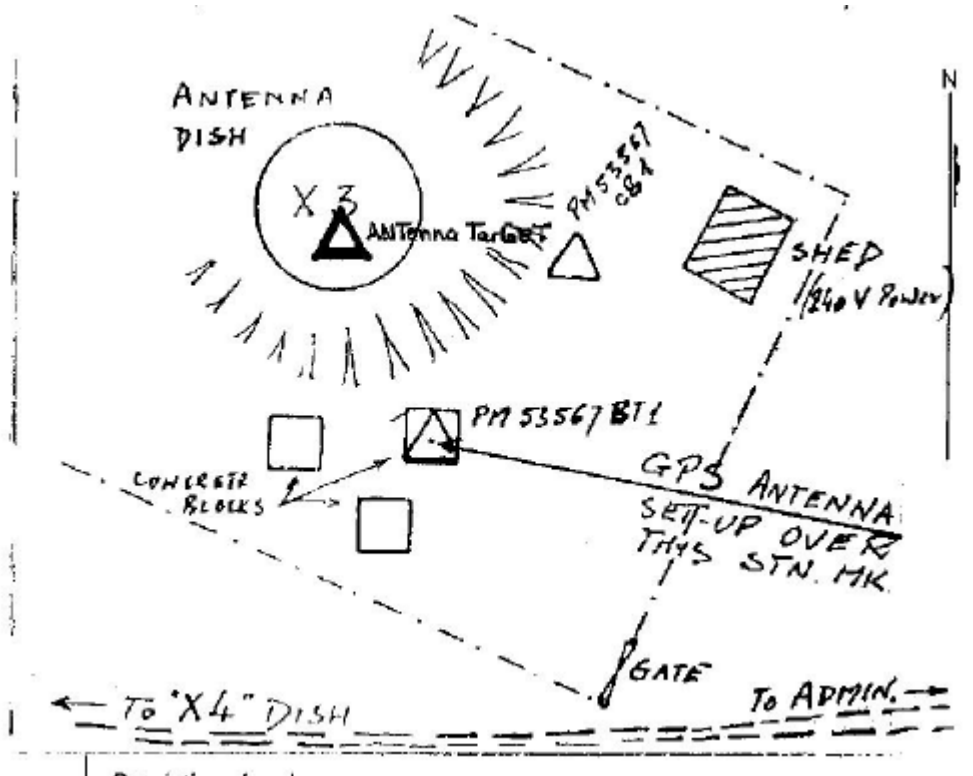
Overall, some of the former function of the shed as a location for housing antenna control equipment are still legible. However, the shed is partially collapsed and server infrastructure appears to have largely been removed. The condition of the metal shed is **poor**.

Three aggregate concrete plinths

Three aggregate concrete plinths are located immediately southeast of the basin. These are situated in a triangle formation, with the plinths spaced at approximately 3.3m from each other. Very similar concrete plinths were identified in the EIS at South Creek 1 Antenna Complex and at the North Antenna Complex. The plinths identified out South Creek 1 Antenna Complex were disturbed and not *in situ*, whilst the plinths at the North Antenna Complex appeared intact.

Historical geodetic reconnaissance and maintenance reports dating between 1987 and 2012 indicate that a brass marker on one of the concrete 'plinths' may have functioned as a survey marker.

Figure 34: Survey marker location on one of the three concrete blocks at South Creek 3 antenna complex



No evidence of a brass plate was identified on the concrete plinths during the site inspection.

The term 'plinth' is used in this document to remain consistent with the terminology used in the EIS for the same features identified at South Creek 1 Antenna Complex and at the North Antenna Complex. However, the originally intended function of these features and whether they were ever used to support a structure remains unknown. The use of at least one concrete plinth at South Creek 3 Antenna Complex as a survey marker is demonstrated by the historic Department of Lands / Central Mapping Authority records (see Figure 46). Whether this was the originally intended function of the concrete plinths is unknown.

Based on aerial photography the concrete plinths at South Creek 3 Antenna Complex appear to be *in situ*. The condition of the three concrete plinths at South Creek 3 Antenna Complex is **good**.

Figure 35: South Creek 3 Antenna Complex – metal shed, landscape context



Figure 36: South Creek 3 Antenna Complex – metal shed



Figure 37: South Creek 3 Antenna Complex – PVC conduits, power cables, compressed air hoses, other cables



Figure 38: South Creek 3 Antenna Complex – detail of compressed air hoses and other control cables



Figure 39: South Creek 3 Antenna Complex – power supply board



Figure 40: South Creek 3 Antenna Complex – potential remains of former server rack



Figure 41: South Creek 3 Antenna Complex – View northwest across former location of Antenna X₃



Figure 42: South Creek 3 Antenna Complex – Partially buried PVC conduit between metal shed and former location of Antenna X₃



Figure 43: South Creek 3 Antenna Complex – View east across former location of Antenna X₃ towards the metal shed



Figure 44: South Creek 3 Antenna Complex – View west across former location of Antenna X₃



Figure 45: South Creek 3 Antenna Complex – Brick fragments and broken PVC conduits



Figure 46: South Creek 3 Antenna Complex – Concrete plinths



Figure 47: South Creek 3 Antenna Complex – Timber post



Figure 48: South Creek 3 Antenna Complex – metal debris



4.1.1.2 South Creek 4

South Creek 4 is located approximately 180m west of South Creek 3 Antenna Complex and 170m east of South Creek 5 Antenna Complex. South Creek 4 consists of a concrete pad with five observed PVC conduits supply cables, power supply, and compressed air hoses. It is likely that the infrastructure was originally housed in a metal shed as at SCAC3, with the majority of the structure having been removed.

Based on the conduits and array of observed cables and hoses it is likely that South Creek 4 was originally included a range of equipment similar to that observed at South Creek 3 Antenna Complex. Four 'Neutral Links' were identified on a degraded fuse box or similar piece of equipment.

One metal box is located beneath the collapsed fuse box. The purpose of the box is unknown but based on one of the remaining connected hoses may possibly have formed part of the compressed air system across the site. No pressure gauges were identified on the outside of the box.

Overall, the remains at SCC4 are in **poor** condition.

Figure 49: South Creek 4 – View west across concrete pad



Figure 50: South Creek 4 – View east across concrete pad



Figure 51: South Creek 4 – Fuse box or similar piece of the electrical system



Figure 52: South Creek 4 – Detail of one of four observed neutral links



Figure 53: South Creek 4 – Collapsed equipment



Figure 54: South Creek 4 – Metal box beneath collapsed equipment



Figure 55: South Creek 4 – Metal box showing adjacent PVC conduits and cables/ compressed air hoses



Figure 56: South Creek 4 – Metal box showing adjacent PVC conduits and cables/ compressed air hoses



Figure 57: South Creek 4 – Detail of compressed air hoses and cut electrical connections at base of fuse box (or similar piece of equipment)



Figure 58: South Creek 4 – PVC conduit with electrical cables



4.1.1.3 South Creek 5 Antenna Complex

South Creek 5 Antenna Complex includes the location of antenna X₄ before it was removed in c.2004. The remains identified at South Creek 5 Antenna Complex include:

- Backfilled area where X₄ was located
- Concrete pad. Remaining equipment in generally poor condition includes PVC conduits and associated cables / compressed air hoses, possible former server rack
- Three aggregate concrete plinths.

Former location of antenna X₄

The original location of antenna X₄ was in an excavated basin similar to the basin remaining at South Creek 3 Antenna Complex. The last available photo of antenna X₄ before removal shows the antenna surrounded by water and bulrush vegetation (see Figure 59).

Figure 59: View of antenna X₄ in c.2004/early 2005 before removal⁷⁰



The basin was backfilled in 2018. During the site inspection the former location of antenna X₄ is grass covered with no visible evidence of the former basin location.

Overall, the former location of antenna X₄ is in **poor** condition.

Concrete pad

A concrete pad was observed at South Creek 5 Antenna Complex, with a single PVC conduit and cables. Although no other PVC conduits were observed, portions of the concrete pad were covered with grass and one portion has collapsed. Therefore, it is possible that further conduits were located at this location as at South Creek 3 Antenna Complex and South Creek 4.

A rusted item adjacent to the concrete pad may be a former server rack, similar to the item seen in the metal shed at South Creek 5 Antenna Complex. Erosion and partial collapse has exposed further PVC conduits beneath the concrete pad.

It is likely the concrete pad formed the base of a metal shed as at SCAC3, and that most of the former infrastructure at SCAC5 has been removed.

Overall, the condition of the concrete pad at SCAC5 is **poor**.

⁷⁰ O'Sullivan and Jacka, "The Australian NTD and XNTD Projects. Presented at the Astron FPA Workshop, 30 June 2005."

Three aggregate concrete plinths

Three aggregate concrete plinths are located immediately south of the backfilled former location of antenna X4. These are situated in a triangle formation, with the plinths spaced at approximately 3.3m from each other. These are positioned in what appears to be an identical layout and arrangement with antenna X4 to the concrete plinths identified at South Creek 3 Antenna Complex. Similar concrete plinths were also identified in the EIS at South Creek 1 Antenna Complex and at the North Antenna Complex.

No survey markers were identified on the concrete plinths at South Creek 5 Antenna Complex. No Department of Lands / Central Mapping Authority information for survey markers associated with the concrete plinths at South Creek 5 Antenna Complex has been identified. One survey marker was identified in the grass approximately 20m northwest of the concrete plinths and 4m southwest of the concrete pad.

As per the EIS and the analysis of the plinths at South Creek 3 Antenna Complex, the originally intended function of these plinths is unknown. Analysis of aerial photography does not provide any indication that they formed part of a structure.

The condition of the three aggregate concrete plinths is **good**.

Figure 60: South Creek 5 Antenna Complex – View northwest across the concrete pad showing possible former server rack and PVC conduit with cables



Figure 61: South Creek 5 Antenna Complex – View southeast across the concrete pad showing exposed PVC conduits



Figure 62: South Creek 5 Antenna Complex – View northwest across the concrete plinths



Figure 63: South Creek 5 Antenna Complex – Survey marker located approximately 4m southwest of the concrete pad

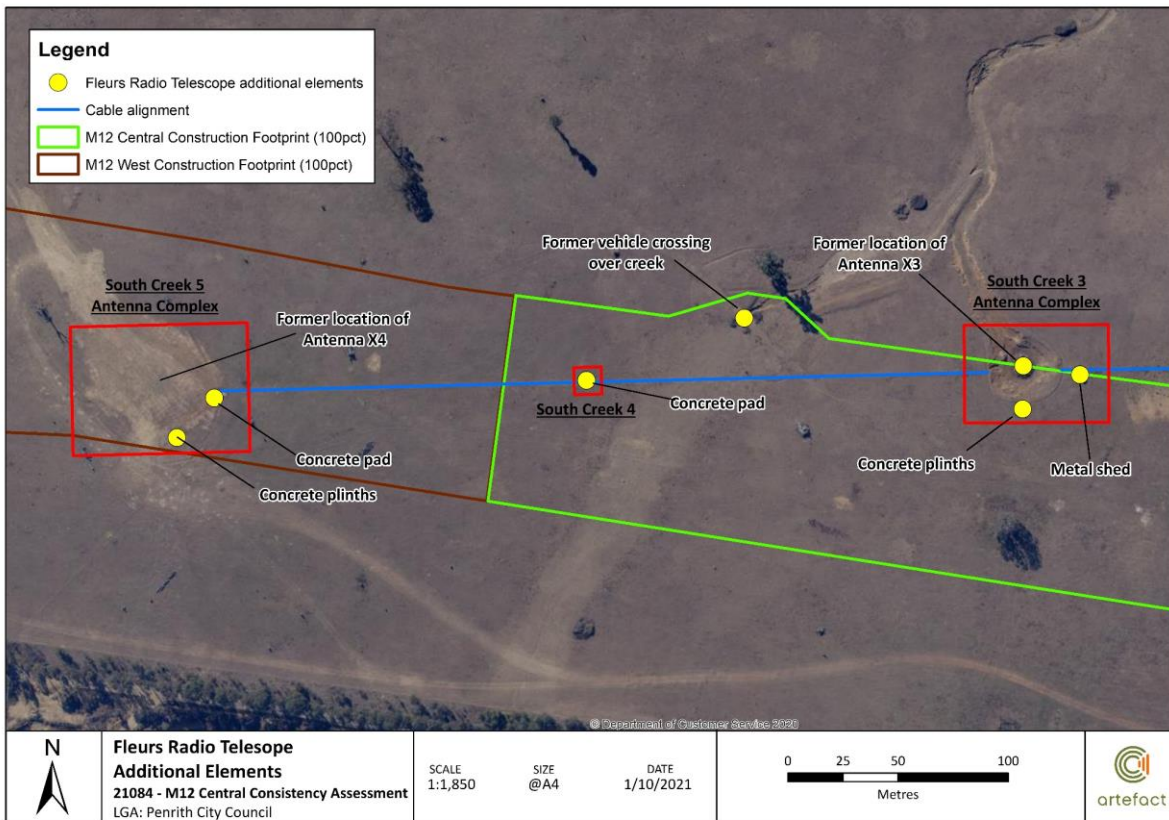


4.1.1.4 Cable alignment

Aerial photographs indicate what appears to be an excavated trench for cable and hose installation between X₃ and X₄, the signal box at South Creek 1 Antenna Complex, and presumably across South Creek to South Creek 2 Antenna Complex and to the main Fleurs Radio Telescope complex.

The cables and hoses seen emerging from PVC conduits at the concrete pads at South Creek 3 Antenna Complex, South Creek 4, and South Creek 5 Antenna Complex provides an indication of the extent of sub-surface cables and hoses along the cable alignment. However, surface inspection did not identify evidence of the cable trench due to grass cover. The cable alignment is visible on aerial photographs (see Figure 64).

Figure 64: Approximate alignment of cable alignment (blue) based on aerial photographs of the site



It is likely that a series of conduits along the cable alignment carry the following:

- Power supply cables
- Server cables
- Compressed air hoses

The function of the compressed air hoses is unknown, but may have either been to control equipment, assist with keeping equipment cool/ dry, and/or to assist with function of the antenna dishes.

4.1.1.5 Former vehicle creek crossing

A dilapidated vehicle crossing over an unnamed watercourse was identified during the site inspection. Historical aerial photographs suggest the creek crossing was part of a vehicle access track to antennas X₃ and X₄.

Remains identified during the site inspection include:

- Concrete culverts
- Fill
- One timber pole.

The vehicle creek crossing is in **poor** condition.

Figure 65: Former vehicle crossing over unnamed watercourse



5.0 ASSESSMENT OF SIGNIFICANCE

5.1 Fleurs Radio Telescope Site

This section provides an assessment of significance for elements of the Fleurs Radio Telescope Site within the study area. An assessment of significance for the overall Fleurs Radio Telescope heritage item (which includes the 2016 and revised 2019 assessments) has been sourced from the non-Aboriginal heritage technical paper (informed by Gorman’s 2018 heritage survey) from the EIS,⁷¹ and presented in Table 3.

As discussed in Section 4, two dish antennas and other equipment associated with the FST were constructed within the study area in the 1970s and 1980s. The surviving evidence of the FST within the study area is outlined in Section 4.

Statements of significance are also provided for the other heritage items identified in the EIS that are within the M12 Central project area. The statements of significance for the heritage listed and potential items within the M12 – Central project area have been extracted from the M12 EIS Non-Aboriginal Heritage Technical Paper (Section 6). Heritage items identified in the EIS but not discussed in this consistency assessment are listed in Table 7. All information has been drawn from the EIS and the updated and revised significance assessments made in that document.

5.1.1 Assessment of significance: Fleurs Radio Telescope Site

The Fleurs Radio Telescope is listed in part on the Penrith LEP 2010 (I832) and in part on the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (I5) as an item of local heritage significance. A significance assessment of the site was prepared in 2016. This was updated for the 2019 EIS assessment. Both assessments identified that the Fleurs Radio Telescope Site may be an item of State or potentially National heritage significance. However, there is no indication that the item has been nominated or listed for either the State Heritage Register or National Heritage List.

Table 3: Assessment of significance for Fleurs Radio Telescope Site

Criterion	Explanation
A – Historical Significance	<p>Assessment by Australian Govt et al. (2016) Fleurs was ‘historically important at periods of the State’s history—in the development of radio physics during the 1950s and 1960s’. It has potential historical significance at a local or State level. However, the low to moderate intactness of the site may reduce it to local significance (Australian Govt et al. 2016:77).</p> <p>Revised 2018 Assessment While radioastronomy has been practiced at other scientific sites in Australia the CSIRO field sites around Sydney were the location of the major developments in the field of radioastronomy following WWII. These were the places where Mills, Christiansen, Payne Scott, Pawsey and others established some of the fundamental principles of radioastronomy. This work established the CSIRO as a world leader, as evidenced by the 1952 URSI conference taking place here. Fleurs was significant as the field site which hosted the mature technologies of the interferometer, Mills Cross and cross grating antennas. Hence it can be argued that Fleurs represents a period, prior to the development of the ATNF, where state-based research was leading the way.</p> <p>Tangible elements relating to state significance are standing elements of the Shain Cross and the FST, and the materials of Mills Cross, Chris Cross and FST located in rubbish mounds scattered across the site. While the telescopes are not in good condition and are completely dismantled in some cases, intactness is not a reason for exclusion (OEH 2001:12).</p>

⁷¹ Biosis, 2019. *M12 Motorway Non-Aboriginal Archaeological Impact Assessment Report*. pp. 76 - 85

Criterion	Explanation
	<p>At the local level, Fleurs is one site of a number of research stations in the area, including the University of Sydney McGarvie Smith Farm, established in 1936 for veterinarian studies (Australian Govt et al. 2016:139–146), and the CSIRO McMaster Animal Health Research Farm (M12 H4; Australian Govt et al. 2016:124–127). It forms one component of a wider landscape of institutional research facilities interspersed with small scale pastoral and horticultural industries— science at local scale.</p> <p>Intrusive values are associated with agricultural activities such as pasture, fencing, and ploughing, which have contributed to the erasure of the original ground reflecting surfaces and obscured the visibility of the Shain Cross.</p>
<p>B – Associative Significance</p>	<p>Fleurs is associated with pioneering radio astronomers Bernard Mills, Bruce Slee, Alex Shain, Chris Christiansen, Charlie Higgins and J.L. Pawsey. It represents a significant chapter in the history of the CSIRO’s Division of Radiophysics, which was the foundation of the CSIRO’s continuing work in radioastronomy. The ground-breaking scientific contributions of these astronomers has been extensively researched by scholars such as Orchiston (see References). Both Mills and Christiansen became professors at the University of Sydney, which supported Christiansen’s continued work on the Chris Cross and FST. As a school of radioastronomy, these men were technological innovators, dedicated teachers and pioneers of Australian science with international reputations, who launched Australian science onto a world stage.</p> <p>Mills, Shain and Christiansen were each primarily responsible for the design, construction and operation of the antenna which bears their name, although there was clearly also much cross-fertilisation of ideas. The final configuration of the arrays indicates both individual achievement and the impacts of working in a close-knit research group which fostered innovation and experimentation.</p> <p>The astronomers of Fleurs are associated with State, National and International networks of scientists. Their integration into, or participation in, the local community is not known.</p>
<p>C – Aesthetic or Technical Significance</p>	<p>The antennas demonstrate a high degree of both creative and technical achievement by prominent NSW scientists and technicians. Radioastronomy is now an integral part of astronomy, with a multitude of telescopes worldwide. However, in the 1940s and 1950s, it required true creativity and imagination to devise innovative instruments and visualise their signals to portray a ‘vision’ of the universe which barely existed before. These antennas were integral to the global effort to map the radio universe and understand its relationship to the optical universe. The surveys carried out at Fleurs from the 1950s to the 1980s resolved many of these disparate data sources, enabling us to more fully understand the structure of the universe. The construction and design of the antennas is directly related to a way of perceiving the universe.</p> <p>While scientific instruments are not always associated with aesthetic values, there are some themes that emerge from Fleurs (Table 5 in Gorman 2018). The selection of Fleurs for the siting of the arrays was due to the availability of a sufficiently large area of flat ground in a radio-quiet area, thus relating to local topography. The repetition of modular elements in all three crosses also lends a distinctive appearance, although this is now only evident in the remaining Shain Cross elements.</p> <p>The individual elements of the telescopes are in various states of decay. Further elements have been dismantled and are stockpiled in the rubbish mounds. As noted for the management of heritage values at Mt Stromlo following the 2003 fires, in recent years such decay and destruction are being recognised as having social and aesthetic value in their own right. While nothing as dramatic as a firestorm occurred at Fleurs, there was nonetheless at least two moments of destruction, in the 1990s and in 2005 when the bulk of the site was bulldozed and the materials stockpiled. The demolition created dis-array of the arrays, disrupting the careful geometry that listened to the sky.</p> <p>The antennas have not entirely left the site: they are simply deconstructed, re-arranged from an organic assemblage forming a complete unit, into a bricolage of body parts and groupings defined by material and form.</p>

Criterion	Explanation
	<p>With the exception of the two FST dishes, the remainder of the antenna parts are not sufficiently different from average rural construction materials to be immediately identifiable as scientific instruments. The dishes are an unusual and uncommon feature in the local landscape, where nothing else like them exists; however, due to the flat topography and degree of vegetation along the creek lines, they are not easily visible from surrounding roads and properties.</p> <p>Unlike many dish antennas at major astronomical and satellites tracking stations in Australia, which imported their antennas from the USA, the Fleurs antennas were all manufactured in NSW. Further research could identify how distinctive their style is in comparison to imported antennas.</p>
<p>D – Social Significance</p>	<p>The associations with the site for the local community at the present time would require further consultation. However, it is clear that there has been an interest in Fleurs in the past. For example, local historian Stacker (2002) included the Fleurs antennas in her 2002 pictorial history of Penrith and St Mary’s. The 2005 demolition of the Mills Cross and Chris Cross antennas were, as reported by Orchiston et al. (2005:68), a result of concerns about children playing in the structures. This implies it was frequent enough an activity to warrant concern, and speaks to the re-purposing of the antennas into an informal playground for local children—a charming (albeit alarming from the safety perspective) image. The feelings of the children deprived of their cosmic playground are unknown.</p> <p>However, the ease with which the process of demolition was suggested and approved suggests that the local adult community did not have strong associations with the science or aesthetic qualities of the Fleurs infrastructure.</p> <p>The site has very strong associations for the NSW, national and international astronomy community, including people who worked on the various antennas, former students at the University of Sydney and University of Western Sydney, and historians of astronomy. Numerous works by Orchiston and others, and the continued concern of the IAU radioastronomy working group, emphasise that the physical infrastructure of antennas is meaningful for them, as demonstrated in this quote from Orchiston (2004b:68) prior to the final destruction of the Chris Cross:</p> <p><i>... a visit to Fleurs reveals that the novel Mills Cross and Shain Cross antennas are no more, having long ago rotted, rusted and disintegrated. Thus, to track Slee’s initial exploits in radio astronomy is to explore the early history of these Radiophysics field stations and to mourn the loss of so much of our pioneering radio astronomical heritage. We can but hope that reason will prevail and that those early radio telescopes that have survived, including the 18 m Kennedy parabola at Parkes, parts of the Chris Cross and the Fleurs Synthesis Telescope at Fleurs, and the Radioheliograph and Radiospectrograph at Culgoora, will be restored and preserved for posterity.</i></p> <p>With increased interest in the life and work of Ruby Payne-Scott and Australian women scientists generally, the community of women involved with the Fleurs site should not be forgotten. A footnote in a published research paper acknowledges the work of two women who performed calculations for the antennas before computers were installed. The work of women ‘computers’ is increasingly being highlighted at places like the Defence space launch site of Woomera, and further research would undoubtedly lead to the identification of more women involved with science at Fleurs.</p>
<p>E – Research Potential</p>	<p>Assessment by Australian Govt et al. (2016:78) ‘Inherent to most of the sites inspected as part of the March 2016 survey, is a level of research significance. This is largely attributable to the moderate intactness of most of these items. Ranging from the nature of historical community social hubs such as those at Cecil Park, through to the experimental undertakings of institutions in the twentieth century across domains as diverse as radiophysics, animal husbandry, and military defence.’</p> <p>Australian Govt et al. (2016:78) concluded that Fleurs has research potential, despite compromised intactness.</p> <p>Revised 2018 Assessment The site has the potential to contribute to the understanding of the manufacture, and hence the science and technology 2018, behind the construction of early radiotelescopes. These</p>

Criterion	Explanation
	<p>materials are still present on the site, although the Mills Cross and Chris Cross are mainly represented in the rubbish mounds. As the controversy over the 2C catalogue demonstrates, the nature of the instruments was integrally bound up with what was perceived, and hence the theories the data supported. The antennas and their remains are tangible evidence of two intangibles: the radio waves they were designed to pick up, and the cultural context of how the universe was understood in the 1950s and 1960s. The changing configurations of the antennas reflect a positive feedback loop whereby data from one iteration led to the refining of hypotheses and redesigning of the antenna configurations to validate new theories. Without the (admittedly compromised) physical remains at the site, it would not be possible to pursue research into the social context of the technology.</p> <p>Subterranean evidence of cable infrastructure may reveal successive phases of development such as automation, the move from employing women 'computers' to electronic computers, and increased power demands as the sophistication of the capacity of instruments increased.</p>
<p>F – Rarity</p>	<p>Assessment by Australian Govt et al. (2016:78) The Fleurs Radio Telescopes are rare examples of early radiophysics technology in Australia, providing the lead in this field during a narrow window of innovation between 1954 and 1963.</p> <p>Further historical and archaeological research is required to determine whether significance is at State or local level due to various compromises to the site's integrity.</p> <p>Revised 2018 Assessment There are few extant remains at other Division of Radiophysics field sites around Sydney. An antenna footing survives at Dover Heights along with a replica antenna created as a memorial. Orchiston notes that of all these significant sites, including Badgerys Creek and Penrith (Figure 4), only the 12 Chris Cross antennas survived in 2004 (Orchiston 2004a:161); four were removed to unknown locations, and none now survive at the site. Fleurs appears to be all that remains as physical fabric in its original location.</p> <p>In the Australian context, the only comparable antenna arrays were built by Grote Reber in Tasmania; his square kilometre dipole array at Bothwell and other non-dish antennas no longer exist. The Molonglo Mills Cross, the technological successor of the Fleurs Mills Cross, is still in operation using one arm.</p> <p>Gorman 2018 shows that there are no other cross antennas or low frequency arrays surviving nationally. Original Mills Cross antennas are rare globally, as the parabolic reflector has superseded cross, horn and other configurations as the most common form of antenna. For example, the Seneca Mills Cross, influential for its role in the discovery of Jovian radio emissions, was destroyed at some point between 1955 and 2005 (however, it is on the Maryland SHR). The Stanford University (California, USA) Mills Cross antenna at Site 515 was destroyed in 2010, much to the dismay of the IAU's Working Group on Historic Radio Astronomy (Orchiston and Kellerman 2010:246). Orchiston (2004) pointed to the rapidly disappearing infrastructure of radio astronomy in Australia and the central significance of Fleurs in this history. Hence the remaining Shain Cross and FST antennas, based on Mills' principles, are both rare and endangered.</p>
<p>G – Representativeness</p>	<p>Assessment by Australian Govt et al. (2016:78) Australian Govt et al. (2016:79) stated that 'In nearly all cases, further historical and/or archaeological research is required to fully assess both the significance and intactness of both the sites identified during this project, and those identified from previous studies.'</p> <p>Revised 2018 Assessment The current survey indicates that Fleurs retains portions of the fabric of a scientific field site, in the topography required for the construction of long antenna arrays, and the remnants of the arrays which partially show the original layout in the distinctive cross shape. It demonstrates the characteristics of an early radioastronomy field site, the only</p>

Criterion	Explanation
	one which retains archaeological evidence of the early development of radioastronomy in NSW and nationally.

5.1.1.1 Statement of significance

The following statement of significance has been sourced from the Non-Aboriginal Heritage technical paper prepared for the EIS.⁷²

The Fleurs Radio Telescope Site was a CSIRO facility established in the 1950s for radioastronomy research. Three innovative antenna arrays were designed and built in order to pick up low frequency radio signals from galaxies, the Sun and Jupiter. There are few extant remains at other CSIRO radioastronomy field sites around Sydney. Fleurs appears to be all that remains as physical fabric in its original location. Nationally, no other cross antennas or low frequency arrays survive.

The site is considered to have State and potentially National significance as evidence of ground breaking scientific discoveries, leading to revisions of our understanding of the origins of the universe, and as evidence of Australia's pre-eminence in the international development of radioastronomy. There is renewed interest in the history of radioastronomy due to Australia's key role in the Square Kilometre Array, to which the Fleurs antennas can be considered historical precursors. The elements are considered to have outstanding interpretive potential.

5.2 Significant elements: Fleurs Radio Telescope Site

5.2.1 Previous assessments of significant elements

The M12 EIS included assessment of South Creek 1 Antenna Complex and South Creek 2 Antenna Complex portions of the FST, including the remains of antenna X₂ and two signal boxes (South Creek 1 Antenna Complex; South Creek 2 Antenna Complex).

The M12 EIS significance gradings for identified elements of the FST at South Creek 1 Antenna Complex and South Creek 2 Antenna Complex are reproduced in Table 4 below. The M12 EIS assessment of the potential effects of impact to South Creek 1 Antenna Complex and South Creek 2 Antenna Complex is reproduced in Table 5.

Table 4. Grades of significance for Fleurs elements recorded during Gorman's 2018 survey.⁷³

Site	Element	Grading	Justification
South Creek 1 Antenna Complex	Signal box	High	In excellent condition; demonstrates a key part of antenna operation
	3 x plinths	Little	Function unknown, position disturbed
	Cable trench	Moderate	This is the only location at the site where cables are exposed, with the potential for further research on the operation of the FST antennas
	Antenna footing trench	Little	The trench indicates where an antenna has been removed from the site but provides no further information about its operation or configuration.

⁷² Biosis, 2019, pp. 76 - 85

⁷³ Wallace Heritage Consulting and Alice Gorman, 2018, p. 72.

Site	Element	Grading	Justification
South Creek 2 Antenna Complex	FST	Exceptional	One of only two extant antennas remaining on the site. Demonstrates how the Chris Cross was augmented to become the FST. Although collapsed, the dish is sufficiently intact to allow recording of its configuration and allow comparison with the North Antenna and FST antennas located at CSIRO Marsfield and Parkes.
	Signal box	Moderate	Mostly identical to Signal Box 1 but in poorer condition.
	Power structure	Little	The purpose of the structure is unclear.
	Fenced enclosure	Little	A later addition to protect the antenna and signal box from stock and other damage; unrelated to original function

Table 5. Potential impacts and recommendations for the affected elements, and the implications for the significance of Fleurs as a whole.⁷⁴

Element	Condition	Significance	Impact	Recommendation	Effect if impacted
South Creek 1 Antenna Complex	Good	Low, as the antenna has been removed. However, the 'signal box' is intact and in good condition. The plinths have been moved from original location and cables are exposed.	Moderate, due to proximity of creek and distance from motorway.	The signal box, trench, plinths and cables are not to be disturbed and are to be left in situ. A 25 m buffer zone should be maintained around the site. No vehicle entry or road construction activities should take place within this zone. Archival photographic recording should be undertaken	The cables have research potential but there are likely intact cables at other parts of the site. Another 'signal box' is present on site.
South Creek 2 Antenna Complex	Poor	High. This is one of two FST elements remaining on site, and despite having collapsed, the structure is in better condition than the North antenna, (which will not be impacted).	Moderate, due to proximity of creek and distance from motorway	The power structure, signal box and antenna are not to be disturbed and are to be left intact. A 25 m buffer zone should be maintained around the site. No vehicle entry or road construction activities should take place within this zone. Archival photographic recording should be undertaken	Damage or removal of the antenna impacts on the visual representation of the extent of the FST, in relation to the North Antenna.

⁷⁴ Wallace Heritage Consulting and Alice Gorman, 2018, p. 76.

5.2.2 Assessment of additional Fleurs Radio Telescope elements

Table 6 provides an assessment of significance for additional Fleurs Radio Telescope that were not subject to inspection and assessment in the M12 EIS. The relevant section of the M12 project footprint (M12 Central and M12 West) is also identified for each site.

Table 6. Grades of significance for FST elements within the study area

Site	Element	Grading	Justification
South Creek 3 Antenna Complex (M12 Central)	Former location of antenna X ₃	Little	In poor condition. Antenna removed, livestock and erosion are altering the appearance of the excavated basin, remaining visible conduits are generally in poor condition
	Metal shed	Moderate	In poor condition. Shed collapsing, hazardous to access. Conduit access points for high pressure hoses, power supply, and other cables still in place, former server rack collapsed and in poor condition. Power supply board intact
	Concrete plinths	Moderate	Original function unknown, evidence from late 1980s that the concrete plinths were used as a survey marker and to orient GPS equipment; similar to concrete plinths identified in the M12 EIS at South Creek 1 Antenna Complex and North Antenna Complex
South Creek 4 Complex (M12 Central)	Concrete pad	Little	Element in poor condition, most fabric has been removed, potential remains of a former server or control equipment
South Creek 5 Antenna Complex (M12 West)	Former location of antenna X ₄	Little	Former location of antenna X ₄ has been backfilled and is no longer visible
	Concrete pad	Little	Element in poor condition, most fabric has been removed, potential remains of a former server rack, concrete pad eroding exposing PVC conduits
	Concrete plinths	Little	Original function unknown, similar to concrete plinths identified in the M12 EIS at South Creek 1 Antenna Complex and North Antenna Complex
Cable alignment (M12 Central and M12 West)	Cables and high-pressure hose	Moderate	Likely to be in good condition – sub-surface. The range of cables and high-pressure hoses that are installed on the alignment between X ₂ , X ₃ and X ₄ is indicated by the PVC conduits and cables/hoses visible at SC3AC, SC4C, and SC5AC. The cables and high-pressure hose remains have significance as an element of the FST operation. However, with the antennas removed, most of the operating equipment removed, and cables/hoses severed, their original function and operation is not easily interpreted based on remaining evidence.
Former vehicle creek crossing (M12 Central)	Concrete culverts overlaid with fill	Little	Access to antennas during construction and use, deteriorated and in poor condition

5.3 Statements of significance for other items in the project area

5.3.1 Fleurs Aerodrome

Fleurs Aerodrome has local significance based on its historical and social significance, rarity, and representativeness.

Fleurs Aerodrome represents an integral part of the RAAF defence of Australia and the larger US military strategy in the Asia-Pacific. An operational aerodrome, Fleurs housed and serviced multiple flight squadrons throughout the war, dependant on the deployment needs of the group. Fleurs Aerodrome is not unique but one of the few operational parent aerodromes built or established by the RAAF in WWII. Better preserved examples of WWII aerodromes survive at Bankstown and Evans Head, but these were training bases rather than operational ones, serving a different function in the wartime effort. Fleurs aerodrome was one of only two parent Operational aerodromes in the greater Sydney region, and had the largest number of satellite airfields of any of the Operational aerodromes. It represents a rare surviving example of such an airfield in both the Sydney region and greater NSW, as operational airfields are typically of importance to Defence.

Although situated in a large grass reserve, and similar in form to its original surfacing, the loss of the greater lands and second runway of the aerodrome has reduced its integrity, with only a portion of its original layout and infrastructure remaining. This has reduced its heritage value accordingly. Fleurs Aerodrome retains some integrity, despite subdivision and development (primarily agricultural and scientific) and enough general features remain to allow interpretation of its original usage.⁷⁵

5.3.2 Exeter Farm Archaeological Site

The property was originally part of the Exeter Farm owned by James Badgery, and while the property ceased to belong to the family in the mid-1800s, the family gave the name to the adjacent creek and suburb. The whole property is therefore considered to be historically significant at a local level. The artefact scatter may be indicative of subsurface deposits which would have potential to yield information about the previous use of the site. Despite the condition of the individual trees, the remnant hedge of Osage orange is a rare local example of an imported species being used as field markers and is indicative of that European practice.⁷⁶

5.3.3 South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape

The South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape is significant for the weirs and surrounds located at the confluences of Badgerys and Kemps Creek with South Creek, remnant vegetation along creeks and roads, cultural landscapes associated with early homesteads, and presence of overall traditional rural landscape. However, the small section of the landscape adjacent to the study area is limited in these elements. The landscape adjacent to the study

⁷⁵ NSW Government, "M12 Motorway Environmental Impact Statement, Appendix J Non-Aboriginal Heritage Assessment Report," 121.

⁷⁶ NSW Government, "M12 Motorway Environmental Impact Statement, Appendix J Non-Aboriginal Heritage Assessment Report," 139

area comprises traditional rural landscape with open paddocks with occasional small trees located in the vicinity of buildings associated with the eastern side of the Fleurs Radio Telescope site. The South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape is considered to have sufficient significance to fulfil the criteria for local listing.⁷⁷

5.4 New items subject to impacts under amended design

A review of the boundary changes has identified no additional heritage items within the amended investigation boundary.

5.5 Items excluded from this consistency assessment

The M12 EIS Non-Aboriginal Heritage Technical Paper assessed a number of listed and potential unlisted heritage items which are not relevant to this consistency assessment, as they are either located outside of the Central Package area or they were assessed as not reaching the threshold of heritage significance. Table 7 below identifies which items were assessed in the EIS but are not discussed in this consistency assessment.

Table 7: List of items identified in the EIS that are excluded from this consistency assessment

Item	Listing	EIS significance	Justification
McGarvie Smith Farm	Penrith LEP 857	Local	Located outside M12 Central Package
Luddenham Road Alignment	Penrith LEP 843	Local	Located outside M12 Central Package
Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)	SHR 01373	State	Located outside M12 Central Package
South Creek Bridge	Potential heritage item	None	EIS did not consider to be a heritage item therefore no further impact assessment is required ⁷⁸
McMaster Field Station	Potential heritage item	Not currently listed but assessed as State	Located outside M12 Central Package
Cecil Park School, Post Office and Church Site	Potential heritage item	Not currently listed but assessed as local	Located outside M12 Central Package
Karingal	Potential heritage item	None	Located outside M12 Central Package
Artefact Scatter Salisbury Ave	Potential heritage item	None	EIS did not consider to be a heritage item therefore no further impact assessment is required ⁷⁹
Former Cecil Park Public Hall	Potential heritage item	None	Located outside M12 Central Package

⁷⁷ NSW Government, "M12 Motorway Environmental Impact Statement, Appendix J Non-Aboriginal Heritage Assessment Report," 143-144

⁷⁸ NSW Government, "M12 Motorway Environmental Impact Statement, Appendix J Non-Aboriginal Heritage Assessment Report," 94 & 150.

⁷⁹ NSW Government, "M12 Motorway Environmental Impact Statement, Appendix J Non-Aboriginal Heritage Assessment Report," 142 & 150.

6.0 HERITAGE IMPACT ASSESSMENT

6.1 Heritage impacts

This section outlines the amended heritage impact assessment for items within the M12 – Central Package area in relation to the proposed boundary changes. The following assessment is based on the 100% detailed design construction footprint from July 2021. The impact assessment for Fleurs Radio Telescope Site considers the general boundary change within M12 Central as well as providing a detailed impact assessment for the additional elements within both M12 Central and M12 West.

6.1.1 Proposed works to Fleurs Radio Telescope

Construction of dual carriageway motorway with two lanes in each direction. The proposed works bisects the 'Fleurs Radio Telescope Site' from west to east on the southern boundary of the site. The proposed boundary changes within M12 Central are minor in nature and include both an expansion and a reduction to the boundary at the west end of the footprint. As a result, the size of the project boundary would remain largely the same.

6.1.1.1 Potential impacts to Fleurs Radio Telescope Site

Concrete pads, cables and cable trenches located within the study area are associated with dish antennas established for the FST (formerly the Chris Cross) between 1975 and 1978. These were erected by the University of Sydney after it took over management of the site in 1963.

Due to their associations with the FST and the Fleurs Radio Telescope site overall, they are considered to have **moderate** significance as individual elements of the former dish antennas.

The detailed design in the area of the FST additional elements is shown in Figure 66 and Figure 67, and Table 8 outlines the assessed impacts to these elements as a result of the project. It is noted that all of the additional elements identified were located within the approved AR Submissions Report boundary, and are still within the 100% detailed design construction footprint. As a result, there is no change in impact resulting from the boundary changes.

6.1.2 Proposed works to Fleurs Aerodrome

The proposed boundary through the 'Fleurs Aerodrome' remains unchanged compared to the AR Submissions Report. There are no boundary changes proposed within 500m of the item, therefore, there would no increase in potential visual impacts. Overall, the boundary changes near 'Fleurs Aerodrome' are consistent with the previously approved AR Submissions Report project footprint.

6.1.2.1 Potential impacts to Fleurs Aerodrome

There is no change to the assessed impact to the heritage item. Therefore, the impacts to the item would still be considered **major**.

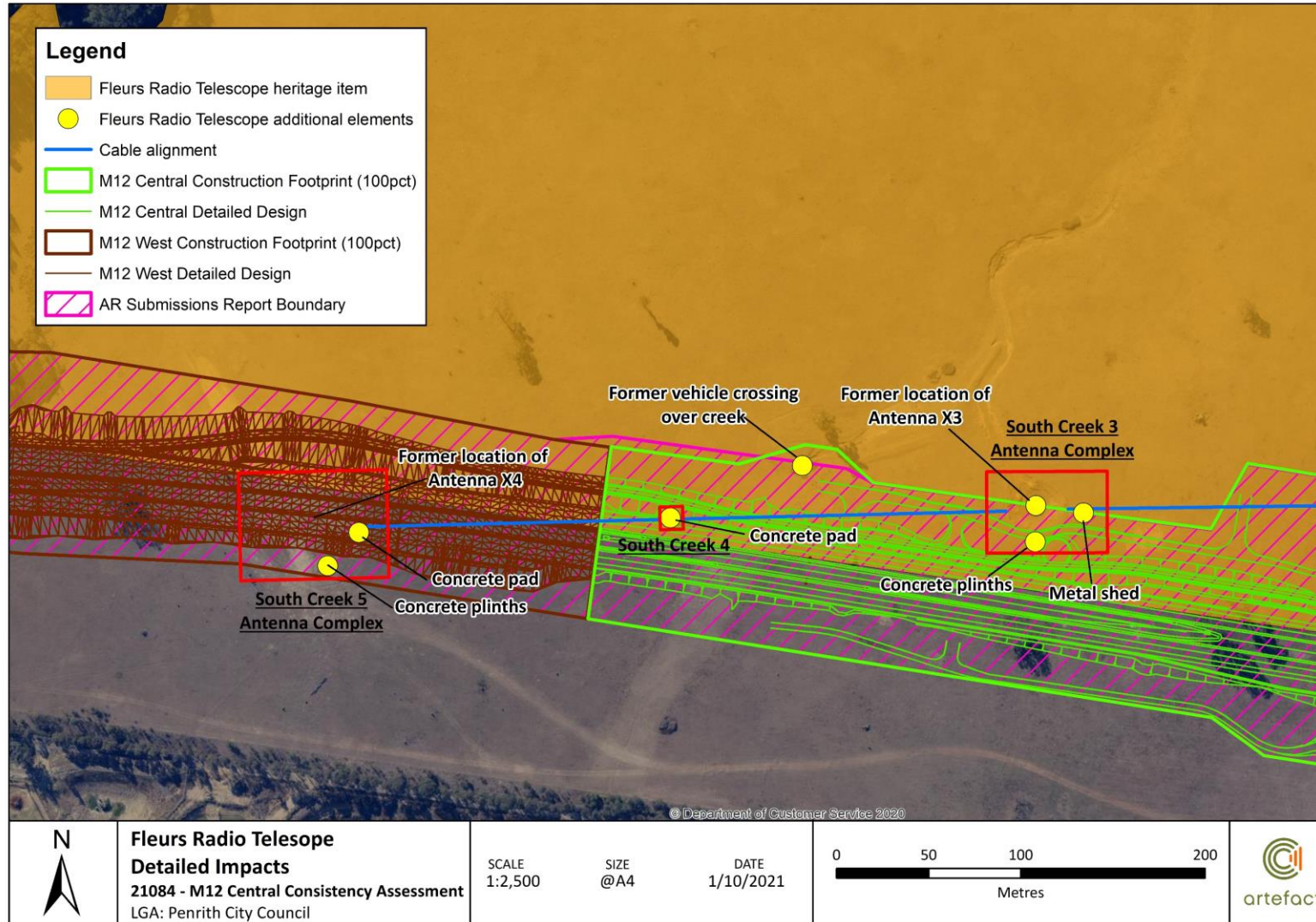
6.1.3 Proposed works to Exeter Farm archaeological site

The proposed boundary changes at the west end of the Central Package do not extend into 'Exeter Farm archaeological site'. The closest proposed boundary changes to the item are located 190m to the north west. The proposed boundary changes are minor in nature and include both an expansion and a reduction to the boundaries. As a result, the size of the project boundary would remain largely the same and would not increase potential visual impacts. Overall, the boundary changes near 'Exeter Farm archaeological site' are consistent with the previously approved AR Submissions Report project footprint.

6.1.3.1 Potential impacts to Exeter Farm archaeological site

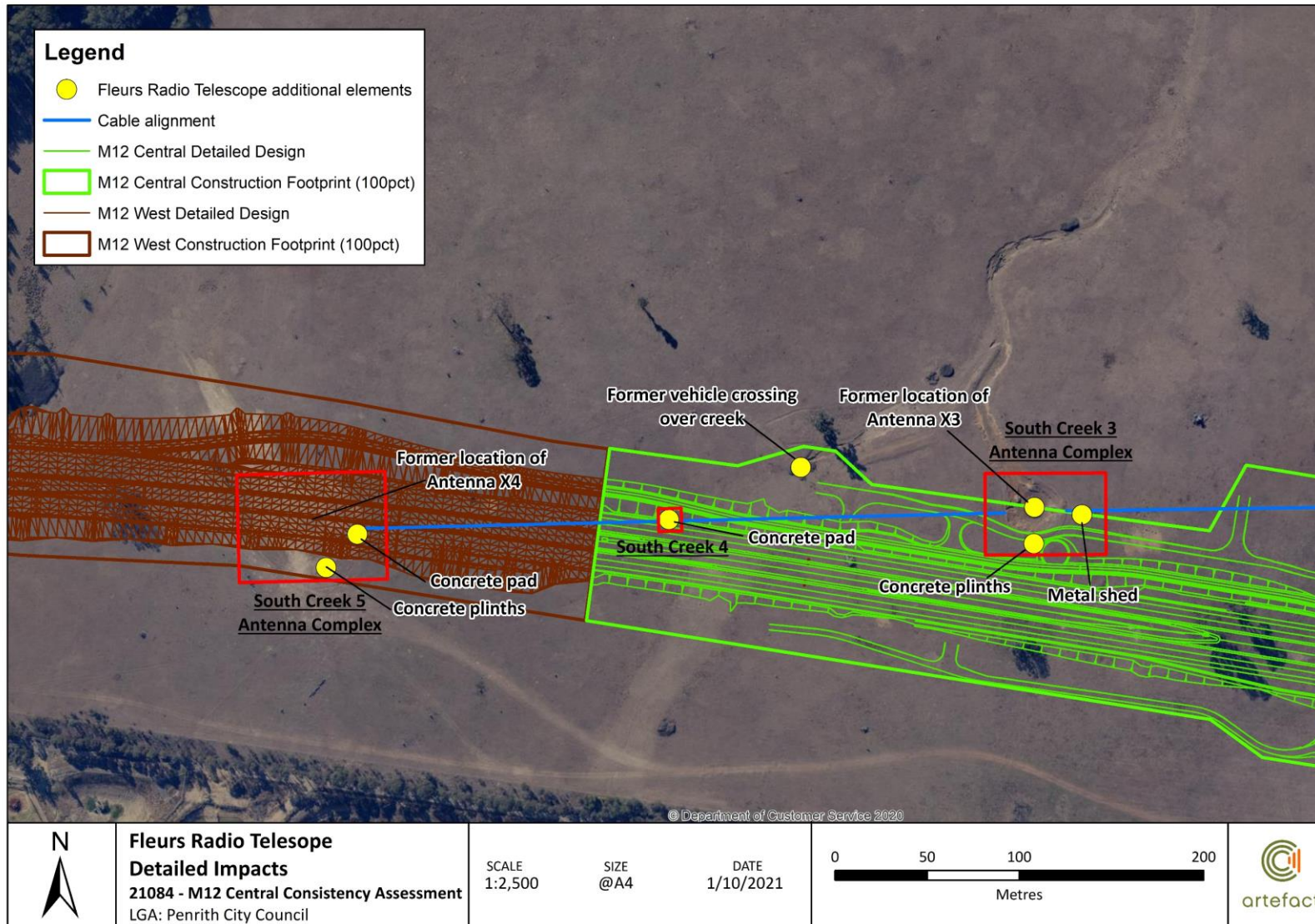
There is no change to the assessed impact to the heritage item. Therefore, the impacts to the item would still be considered **neutral**.

Figure 66: Detailed design in the area of the FST additional elements, shown in relation to the Fleurs heritage item and AR Submissions Report boundary



Document Path: D:\GIS\GIS_Mapping\21084 M12 Haul Road\MXD\Central_Package\2021.10.01\Fleurs_Detailed_Central_Designs_20211001.mxd

Figure 67: Detailed design in the area of the FST additional elements



Document Path: D:\GIS\GIS_Mapping\21084 M12 Haul Road\MXD\Central_Package\2021.10.01\Fleurs_Detailed_Central_Designs_wo.Curtilage_20211001.mxd

Table 8: Potential effect of impacts for identified elements of FST within the study area

Element	Condition	Significance Grading	Impact	Recommendation	Effect of impact
South Creek 3 Antenna Complex	Poor – Good	Little - Moderate	Will be partially impacted	Archival photographic recording and detailed survey of items should be undertaken	Impact will remove the concrete plinths. The former location of antenna X ₃ and the metal shed would be avoided. The remaining visible components would demonstrate operation of FST antenna X ₃ . However, most fabric has been removed from SC3C
South Creek 4 Complex	Poor	Little	Will be impacted	Archival photographic recording and detailed survey of items should be undertaken	Impact will remove remaining visible components that demonstrate operation of FST antennas X ₃ and X ₄ . However, most fabric has been removed from SC4C
South Creek 5 Antenna Complex	Poor – Good	Little	Will be impacted	Archival photographic recording and detailed survey of items should be undertaken	Impact will remove remaining visible components of the former location of antenna X ₄ . However, most fabric has been removed and former antenna location backfilled
Cable alignment	Good	Moderate	Will be partially impacted	Removal and storage of a representative sample, between 2-5m, of the remaining cables/power supply cords/high pressure hose Extensive management policies concerning the sampling, repository and discarding of samples are outlined in Section 9.2 below and are to be guided by Transport NSW. Separate management has been outlined for material in Central and West M12 packages	The cables have research potential regarding operation of X ₃ and X ₄ , however, portions of the cable alignment will not be impacted and will remain <i>in situ</i>
Former vehicle creek crossing	Poor	Little	Will be impacted	Archival photographic recording and detailed survey of item should be undertaken	Impact will remove tangible evidence of the former vehicle access to antenna X ₃ and X ₄ . However, the fabric of the creek crossing is in poor condition and is of little significance compared to the other elements associated with the operation of the FST

6.1.4 Proposed works to South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape

The proposed boundary changes at the west end of the Central Package do not extend into 'South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape'. The closest proposed boundary changes to the item are located 300m to the south west. The proposed boundary changes are minor in nature and include both an expansion and a reduction to the boundaries. As a result, the size of the project boundary would remain largely the same and would not increase potential visual impacts. Overall, the boundary changes near South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape' are consistent with the previously approved AR Submissions Report project footprint.

6.1.4.1 Potential impacts to South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape

There is no change to the assessed impact to the heritage item. Therefore, direct impacts to the item would still be considered **neutral** and the potential visual impacts would still be **negligible**.

7.0 COMPARATIVE IMPACT ASSESSMENT AND HERITAGE RECOMMENDATIONS

7.1 Heritage impact comparison

The following is a summary of the comparative impacts between the approved project as assessed in the M12 Motorway AR Submissions Report construction footprint and the Fleurs Radio Telescope elements not identified in the M12 EIS. A comparison of adverse heritage impacts to the remainder of the heritage items within the M12 Central Package as a result of the boundary changes is provided in Table 10.

7.1.1 Fleurs Radio Telescope Site

Certain elements of the Fleurs Radio Telescope heritage item within the M12 project footprint were not assessed in the EIS. Inspection and assessment of those elements in this report has identified the following elements of the Fleurs Radio Telescope site within the M12 Central project footprint:

- Fabric associated with the former location of FST antenna X₃
- Fabric associated with the former location of FST antenna X₄
- A concrete pad between antennas X₃ and X₄ likely to have been equipment for control and power
- Sub-surface cables, power supply, and compressed air hoses
- Sections of the former vehicle access track to antennas X₃ and X₄

The former location of antenna X₄ is outside the heritage curtilage of the Fleurs Radio Telescope heritage item. However, due to antenna X₄ being an integral part of the Fleurs Radio Telescope site, it is assessed as part of that heritage item.

This assessment has identified evidence to suggest that antenna X₃ and antenna X₄ were removed by the CSIRO in 2004/2005, refurbished, and installed at CSIRO Marsfield. The refurbishment and continued use of the dishes by the CSIRO is a positive heritage outcome. No identified portion of antenna dish X₃ and dish X₄ will be impacted by the M12 project.

Remains of equipment for control and power of antennas X₃ and X₄ will be partially impacted, including the concrete plinths associated with X₃, the former location of antenna X₄ and associated concrete pad, the concrete pad between antennas X₃ and X₄, and the former vehicle access track. Impacts to the former location of antenna X₃ and associated metal shed would be avoided, as well as the concrete plinths associated with antenna X₄. However, much of the control and power equipment at these sites have been removed, and what remains is in generally poor condition.

The M12 EIS assessed overall impacts to the Fleurs Radio Telescope site as **minor**.

Due to the previous removal of antenna X₃ and X₄, and the generally poor condition of remaining control equipment, impact to additional FST remains assessed in this report will result in a **minor** overall impact to the Fleurs Radio Telescope heritage item, which is consistent with the M12 EIS impact assessment for the Fleurs Radio Telescope site.

Table 9: Comparison of adverse heritage impacts between the M12 AR Submissions Report construction footprint and M12 80% detailed design construction footprint

Heritage item name	Register listing and significance	M12 AR Submissions Report construction footprint	M12 Central design construction footprint
The Fleurs Radio Telescope Site	Penrith LEP 2010 Item no. I832 Assessed as local on LEP Assessed as State with potential for National in 2016 Strategic Route Options Analysis and 2019 EIS	Minor – no change from M12 EIS impact assessment	Minor – no change from M12 EIS and M12 AR Submissions Report

Table 10: Comparison of physical heritage impacts on potential items

Heritage Item	Register listings	Impact type	CSSI approved impact	Proposed Amendment Submission impact
Fleurs Aerodrome	Potential item	Direct (physical) impacts	Major	Major
		Indirect (visual) impacts	Major	Major
Exeter Farm archaeological site	Potential item	Direct (physical) impacts	Neutral	Neutral
		Indirect (visual) impacts	Neutral	Neutral
South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape	Potential item	Direct (physical) impacts	Neutral	Neutral
		Indirect (visual) impacts	Negligible	Negligible

7.2 Assessment of amended design against relevant Minister's Conditions of Approval

The proposed changes have been assessed in relation to the relevant conditions of approval in Table 11.

Table 11: Consistency against relevant Minister's conditions of approval for the project

No.	Condition of Approval	Discussion	Consistent
E25	Construction and operation of the CSSI should aim to not diminish the potential for the heritage items for nomination to the State Heritage Register beyond the impacts to significance already identified in the documents listed in Condition A1: McGarvie Smith Farm, McMaster Field Station and Fleurs Radio Telescope site.	The detailed design of the M12 Motorway has been undertaken in a manner that avoids impacts to Non-Aboriginal Heritage items beyond that assessed as part of the EIS and Amendment Report. There would be no change in impacts to Fleurs Radio Telescope Site', 'Fleurs Aerodrome', 'Exeter Farm archaeological site' or 'South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape.'	Yes

No.	Condition of Approval	Discussion	Consistent
E26	<p>An experienced and qualified heritage specialist(s) must prepare and/or endorse the:</p> <p>(a) Heritage Interpretation Plan required by Condition E27;</p> <p>(b) Archival photographic digital recording required by Condition E28; and</p> <p>(c) Heritage Report required by Condition E29</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E27	<p>A Heritage Interpretation Plan must be prepared that identifies and interprets the key heritage values and stories of the heritage items impacted by the CSSI. The Heritage Interpretation Plan must include, but not be limited to:</p> <p>(a) Integration of heritage themes and values in the design of the CSSI;</p> <p>(b) Design elements (form and fabric) and themes for the CSSI;</p> <p>(c) Consideration of the design concepts for Western Sydney International Airport and Sydney Metro Western Sydney Airport; and</p> <p>(d) Opportunities for design responses for Aboriginal and non-Aboriginal heritage.</p> <p>The Heritage Interpretation Plan must be provided to Western Sydney International Airport and Sydney Metro Western Sydney Airport to assist in guiding opportunities for integration of heritage themes and values into their design.</p> <p>The Heritage Interpretation Plan must be prepared in accordance with the <i>Interpreting Heritage Places and Items Guidelines</i> (NSW Heritage Office, 2005) and in consultation with Heritage NSW, Aboriginal Cultural Heritage Advisory Committee, LALC and relevant council(s).</p> <p>The Plan must be implemented and inform the Place, Design and Landscape Plan required by Condition E69.</p> <p>The Heritage Interpretation Plan must be submitted to the Planning Secretary and Heritage NSW for information prior to finalising the Place, Design and Landscape Plan required by Condition E69.</p> <p><i>Note: Nothing in this condition prevents the Proponent from preparing separate Heritage Interpretation Plans for Aboriginal and Non-Aboriginal Heritage.</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p> <p>Additional elements associated with the Fleurs Telescope Site would need to be incorporated within this plan, per the findings of this report.</p>	Yes
E28	<p>Archival photographic digital recording must be undertaken as outlined in the documents listed in Condition A1 for all listed heritage items and for all sites assessed to have heritage significance which will be affected by the CSSI. The recordings must be undertaken prior to the commencement of Work which may impact the items. The recordings must include buildings, structures and landscape features and detailed maps showing the location of features. The archival recording must be prepared in accordance with <i>How to Prepare Archival Records of Heritage Items</i> (NSW Heritage Office, 1998) and <i>Photographic Recording of Heritage Items Using</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p> <p>Additional elements associated with the Fleurs Telescope Site would need to be incorporated into the archival photographic digital recording, per the findings of this report. This would include extensive documentation and photographing of individual elements such as the cabling and associated location coordinates, including detail survey</p>	Yes

No.	Condition of Approval	Discussion	Consistent
	<i>Film or Digital Capture</i> (NSW Heritage Office, 2006).		
E29	<p>Following completion of all Work described in the documents listed in Condition A1 in relation to heritage items, a Heritage Report including the details of archival recordings, further historical research either undertaken or to be carried out and archaeological excavation (with artefact analysis and identification of a final repository for finds), must be prepared in accordance with any guidelines and standards required by the Heritage Council of NSW and Heritage NSW.</p> <p><i>Note: Nothing in this condition prevents the Proponent from preparing separate Heritage Reports for Aboriginal and Non-Aboriginal Heritage.</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement. Details of archival recording undertaken for additional elements associated with the Fleurs Telescope Site would need to be incorporated into the Heritage Report.</p>	Yes
E30	<p>The Heritage Report must be submitted to the Planning Secretary and Heritage NSW for information within 12 months of completing all Work described in the documents listed in Condition A1 in relation to heritage items. Copies of the Heritage Report must also be provided to relevant local libraries and relevant local historical societies.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E31	<p>An Unexpected Heritage Finds and Human Remains Procedure must be prepared to manage unexpected heritage finds in accordance with any guidelines and standards prepared by the Heritage Council of NSW and Heritage NSW. The procedure must be prepared in consultation with Heritage NSW and form part of the Heritage CEMP Sub Plan required by Condition C4.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E32	<p>The Unexpected Heritage Finds and Human Remains Procedure, as submitted to the Planning Secretary, must be implemented for the duration of Work.</p> <p><i>Note: Human remains that are found unexpectedly during the carrying out of work must be under the jurisdiction of the NSW State Coroner and must be reported to the NSW Police immediately.</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E33	<p>Where previously unidentified Aboriginal objects are discovered, all work must immediately stop in the vicinity of the affected area. Works potentially affecting the previously unidentified objects must not recommence until Heritage NSW has been informed. The measures to consider and manage this process must be specified in the Unexpected Heritage Finds and Human Remains Procedure required by Condition E31 and include registration in the Aboriginal Heritage Information Management System (AHIMS).</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

7.3 Assessment of amended design against project REMMs

Table 12 assesses the M12 Central and M12 West detailed design construction footprint against the project's REMMs, as outlined in Section 7 of the AR Submission Report.

Table 12: Assessment of the updated design against relevant non-Aboriginal heritage REMMs for heritage items in the M12 Central and M12 project areas

Environmental Issue	Ref.	Revised Environmental Management Measures (AR Submissions Report)	Recommendations for detailed design
The Fleurs Radio Telescope Site (Item 2: Penrith LEP I832)	NAH05	<ul style="list-style-type: none"> All extant elements of the radio telescopes and associated infrastructure, including rubbish mounds situated outside the construction footprint will be left intact. Ground penetrating radar, or other remote sensing survey techniques, will be carried out under the supervision of a suitably qualified and experienced archaeologist before any ground disturbance within the heritage curtilage of the Fleurs Radio Telescope Site contained within the construction footprint to identify any sub-surface cables. Measures will be included in the CHMP to describe how the heritage values of the site will be conserved and managed during construction. TfNSW will engage a suitably qualified heritage consultant to prepare an archival photographic recording of the impacted areas of the property, in accordance with DPC (Heritage guidelines (Heritage Council of NSW 2006) The heritage interpretation framework for the project (NAH02) will include interpretation measures that will improve community awareness of the history of the Fleurs Radio Telescope as well as determine suitable locations for the presentation of information that are publicly accessible. 	Additional heritage recommendations regarding the Fleurs Radio Telescope Site additional components are discussed in Section 8.4
Fleurs Aerodrome (Item 7)	NAH08	<ul style="list-style-type: none"> A suitably qualified heritage consultant will be engaged to prepare an archival photographic recording of the impacted area before its disturbance and/or removal, in accordance with DPC (Heritage) guidelines (Heritage Council of NSW 2006). The recording will include a detailed map showing the location of the features. An interpretive framework developed for the project will include consideration of elements to enable the continued interpretation and understanding of the airstrip at Fleurs Aerodrome as a linear and continuous element. This will be carried out in consultation with Department of Defence and consider opportunities for involvement of veterans groups. Relevant guidelines and associated safe working distances will be adhered to for remaining heritage structures as outlined in the Appendix K of the EIS. 	No change
South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape (Item 12)	NAH10	<ul style="list-style-type: none"> Management measures identified in the project UDLP (LVIA01) will be implemented during detailed design to minimise impacts on landscape and vistas. Flooding management measures (F01 to F08) and surface water quality and hydrology management measures (SWH01 to SWH14) will be implemented to reduce broader impacts on the surrounding scenic landscape. 	No change

Environmental Issue	Ref.	Revised Environmental Management Measures (AR Submissions Report)	Recommendations for detailed design
Exeter Farm archaeological site	NAH12	<ul style="list-style-type: none"> None specified 	No change

7.4 Heritage recommendations

This report has identified several recommendations to take into consideration for the additional elements of the FST that will be impacted by the M12 project. Heritage recommendations for the Fleurs Radio Telescope additional components in M12 Central and M12 West are outlined in Table 13. These recommendations / mitigation measures are consistent with other similar studies, such as the approach at Orroral where the significance of sub-surface cables and remaining above ground fabric was also emphasised.⁸⁰

7.4.1 Fleurs Radio Telescope Site

Table 13: Additional recommendations for Fleurs Radio Telescope Site additional components in M12 Central and M12 West

Management	Discussion of additional heritage management
General (M12 Central and M12 West)	<ul style="list-style-type: none"> If additional sub-surface FST components are unexpectedly identified during ground penetrating radar survey which have not been discussed as part of the consistency assessment, then additional assessment and management would be required. This would include, but may not be limited to, archival survey and recording Include specification for detailed survey of remaining above-ground elements of the FST as part of the photographic archival recording program. This survey would record the exact location and orientation of remnant fabric within the landscape, including fabric associated with the former location of FST antenna X₃, antenna X₄, the concrete pad between antennas X₃ and X₄, and the former vehicle access track. Survey drawings should be included in the archival photographic recording report The outcomes of the remote sensing survey undertaken by GHD in 2021 should be included in the archival recording report to provide a comprehensive record of the site (or as comprehensive as possible prior to excavation) Details of sample cables collected should be recorded including original exact location by description, co-ordinates and mapping.
Cable samples (M12 Central and M12 West)	<ul style="list-style-type: none"> Prior to construction TfNSW should consult with relevant interested organisations (such as CSIRO, Universities, amateur telescopic organisations, local heritage bodies and other special interest groups) to determine if there is interest in retaining sub-surface cabling (including details on the type and length cabling to be retained) or other structures identified during archival recording, remote sensing or any unexpected additional cables found during construction. Retrieval of a sample of each type of cable / compressed air hose along the cable alignment between antennas X₃ and X₄ with supervision by a heritage specialist. The M12 EIS identified the research potential of these cables. Keeping a sample of each type of cable / hose will preserve some of this fabric and provide a resource for future research. This will include retrieval of 1-2m (or a length directed by TfNSW following consultation with stakeholders) of each type of cable / compressed air hose including the relevant attachment. The selection of the types and length of cables / hose to be collected will include consideration of the following: <ul style="list-style-type: none"> Physical review of the cables / hose types visible at South Creek 3 Antenna Complex and South Creek 4 Complex

⁸⁰ Gorman, A.C., 2012, *An archaeological investigation of the Orroral Valley NASA Tracking Station*, report to ACT Heritage.

Management	Discussion of additional heritage management
	<ul style="list-style-type: none"> ○ Any additional information identified through remote sensing survey of the cable alignment ○ Discussion with archival recording or other heritage specialists where required ○ Outcomes from consultation undertaken by TfNSW with interested parties ● Cable samples should be carefully collected, with consideration given to potentially contaminated materials, such as asbestos and PCBs. Appropriate WHS measures will be implemented in accordance with the Contractor's WHS Plan. ● The cable samples should be tagged, including exact location by description and relevant coordinates of the cabling prior to its extraction ● The cable samples should be safely stored until collection by interested parties. If samples are unclaimed by interested parties within three months, they are to be appropriately disposed of at a licensed landfill by the contractor ● If further examples of cables / air hoses are identified during ground penetrating radar survey, they should be managed in accordance with the additional heritage management measures detailed above ● Where cabling is not impacted by construction works, it should remain in-situ, otherwise the contractor would be responsible for appropriate disposal.
Concrete plinths (M12 Central and M12 West)	<ul style="list-style-type: none"> ● An exclusion zone should be established around the concrete plinths at South Creek 3 Antenna Complex and South Creek 5 Antenna Complex during construction to protect against inadvertent impacts ● If leaving the concrete plinths in situ is not practicable, they should be removed and stored temporarily with survey information providing details of their position relative to each other and orientation. The contractor should then investigate opportunities for re-establishing the concrete plinths on site close to their original location and/or as part of the interpretative display for the Radio Telescope Site. If re-established, the survey information collected prior to their removal must be used to ensure that the plinths are located in the same orientation and arrangement. ● Prior to removal of the concrete plinths, the contractor should identify whether any of the plinths are used as state survey marks. The contractor must comply with the preservation of survey infrastructure requirements in TfNSW specification G71. It is noted TS7279 is located on one of the plinths at X₃.
Former location of antenna X ₃ (M12 Central)	<ul style="list-style-type: none"> ● An exclusion zone should be established around the former location of antenna X₃ at South Creek 3 Antenna Complex during construction to protect against inadvertent impacts
Metal shed (M12 Central)	<ul style="list-style-type: none"> ● The metal shed is located outside of the M12 operational footprint and would be retained and therefore will be managed by the University of Sydney. An exclusion zone should be established around the metal shed during construction to protect against inadvertent impacts

7.5 EPBC approval

The proposed changes in non-Aboriginal heritage management measures at detailed design do not constitute to any change in project aspects related to the EPBC approval.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

8.1.1 M12 Central boundary changes

This non-Aboriginal consistency assessment has concluded that the impacts of the amended boundary within M12 Central are consistent with the previously approved EIS boundary:

- There would be no increased negative change to the degree of impact to the non-Aboriginal heritage items located within the Central Package 100% detailed design for the M12 Motorway.
 - There are no proposed boundary changes within the following items:
 - Fleurs Aerodrome (potential item)
 - Exeter Farm archaeological site (potential item)
 - South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape (potential item).
 - Boundary changes within the curtilage of Fleurs Radio Telescope (Penrith LEP 2010 I832) would be minor and would not result in any changes in overall impact to the heritage item.

8.1.2 Fleurs Radio Telescope Site

This assessment has concluded the following pertaining to the Fleurs Radio Telescope Site:

- The study area falls within the heritage curtilage of the State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 listed *Fleurs Radio Telescope Site* (I5), an item of local significance
- A Strategic Route Options Analysis prepared in 2016 and heritage survey prepared in 2018 for the M12 Motorway project both assessed the *Fleurs Radio Telescope Site* as having State and potentially National heritage significance
- The FST was a key component of the Fleurs Radio Telescope Site and Australia's role in the field of radioastronomy
- Land within the study area contains surviving elements of the FST erected by the University of Sydney in the 1970s and 1980s. These consist of the following:
 - Fabric associated with the former location of FST antenna X₃
 - Fabric associated with the former location of FST antenna X₄
 - A concrete pad between antennas X₃ and X₄ likely to have been equipment for control and power
 - Sub-surface cables, power supply, and compressed air hoses
 - Sections of the former vehicle access track to antennas X₃ and X₄
- These items are considered to have the following grades of significance:
 - Fabric associated with the former location of FST antenna X₃ – Little to Moderate
 - Fabric associated with the former location of FST antenna X₄ – Little
 - A concrete pad between antennas X₃ and X₄ likely to have been equipment for control and power – Little

- Sub-surface cables, power supply, and compressed air hoses – Moderate
- Sections of the former vehicle access track to antennas X₃– Little
- The following identified elements of the FST will be impacted:
 - Fabric associated with the former location of FST antenna X₃ – Impact to the concrete plinths
 - Fabric associated with the former location of FST antenna X₄ – Impact to the former location of antenna X₄ and the associated concrete pad
 - A concrete pad between antennas X₃ and X₄ likely to have been equipment for control and power – Impact to the identified elements
 - Sub-surface cables, power supply, and compressed air hoses – Impact to a portion of the cable alignment
 - Sections of the former vehicle access track to antennas X₃
- The detailed design avoids impacts to the following identified elements of the FST:
 - Fabric associated with the former location of FST antenna X₃ – former location of antenna X₃ and the associated metal shed
- There would be no increased negative change to the degree of impact to the non-Aboriginal heritage items located within the Central Package 100% detailed design for the M12 Motorway.
 - There are no proposed boundary changes within the following items:
 - Fleurs Aerodrome (potential item)
 - Exeter Farm archaeological site (potential item)
 - South, Kemps and Badgerys Creek Confluence Weirs Scenic Landscape (potential item).
 - Boundary changes within the curtilage of Fleurs Radio Telescope (Penrith LEP 2010 I832) would be minor and would not result in any changes in overall impact to the heritage item.

8.2 Recommended management

Based on the above conclusions, the following recommendations are proposed to manage remnant FST fabric in the study area.

8.2.1 Fleurs Radio Telescope Site

This report has identified several additions to NAH05 to manage the additional elements of the FST that will be impacted by the M12 project.

Where the text of NAH05 has been revised/removed this has been marked with a strikethrough, and where new text has been added to NAH05 the additions are shown in bold.

- All extant elements of the radio telescopes and associated infrastructure, including rubbish mounds situated outside the construction footprint will be left intact
- Ground penetrating radar, or other remote sensing survey techniques, will be carried out under the supervision of a suitably qualified and experienced archaeologist before any ground disturbance within the heritage curtilage of the Fleurs Radio Telescope Site contained within the construction footprint to identify any sub-surface cables.

- **If additional sub-surface FST components are unexpectedly identified during ground penetrating radar survey which have not been discussed as part of the consistency assessment, then additional assessment and management would be required. This would include, but may not be limited to, archival survey and recording.**
- Measures will be included in the CHMP to describe how the heritage values of the site will be conserved and managed during construction
- Transport for NSW will engage a suitably qualified heritage consultant to prepare an archival photographic recording of the impacted areas of the property, in accordance with ~~DPC (Heritage)~~ **Heritage NSW** guidelines (Heritage Council of NSW 2006). The archival recording report will include but not be limited to:
 - **Detailed survey drawings and photographic archival recording of remaining above-ground elements of the Fleurs Radio-telescope site. This survey will detail the exact location and orientation of remnant fabric within the landscape, including fabric associated with the former location of FST antenna X₃ and antenna X₄, the concrete pad between antennas X₃ and X₄, and the former vehicle access track**
 - **Survey drawings will be included in the archival recording report**
 - **Outcomes of the remote sensing survey undertaken by GHD in 2021 to provide a comprehensive record of the site (or as comprehensive as possible prior to excavation)**
 - **Details of sample cables collected including original exact location by description, co-ordinates and mapping.**
- **Prior to construction TfNSW will consult with relevant interested organisations (such as CSIRO, Universities, amateur telescopic organisations, local heritage bodies and other special interest groups) to determine if there is interest in retaining sub-surface cabling (including details on the type and length cabling to be retained) or other structures identified during archival recording, remote sensing or any unexpected additional cables found during construction**
- **The M12 West and M12 Central Contractor will (with advice from TfNSW Overarching Archival Recording Contractor) be responsible for the following:**
 - **Retrieval of a sample of each type of cable / compressed air hose along the cable alignment between antennas X₃ and X₄ with supervision by a heritage specialist. This will include retrieval of 1-2m (or a length directed by TfNSW following consultation with stakeholders) of each type of cable / compressed air hose including the relevant attachment. The selection of the types and length of cables / hose to be collected will include consideration of the following:**
 - **Physical review of the cables / hose types visible at South Creek 3 Antenna Complex, South Creek 4 Complex, and South Creek 5 Antenna Complex**
 - **Any additional information identified through remote sensing survey of the cable alignment**

- Discussion with archival recording or other relevant heritage specialists where required
- Outcomes from the consultation undertaken by TfNSW with interested parties
- Cable samples will be collected, with consideration given to potentially contaminated materials, such as asbestos and PCBs. Appropriate WHS measures will be implemented in accordance with the Contractor's WHS Plan
- Cable samples will be tagged, including exact location by description and relevant coordinates of the cabling prior to its extraction
- Safe storage of cable samples until collection by interested parties. If samples are unclaimed by interested parties within three months, they will be appropriately disposed of at a licensed landfill by the contractor
- Where cabling is not impacted by construction works, it can remain in-situ, otherwise the contractor is responsible for appropriate disposal
- **Concrete plinths:**
 - Prior to construction, the contractor must establish an exclusion zone around the concrete plinths at South Creek 3 Antenna Complex (Central) and South Creek 5 Antenna Complex (West) to protect against inadvertent impacts during construction
 - If leaving the plinths in situ during construction is not practicable, they will be removed and stored temporarily with survey information providing details of their position relative to each other and orientation. The Contractor will then investigate opportunities for re-establishing the concrete plinths on site close to their original location and/or as part of the interpretative display for the Radio Telescope site. If re-established, the survey information collected prior to their removal must be used to ensure that the plinths are located in the same orientation and arrangement
 - Prior to removal of the concrete plinths, the contractor is to identify whether any of the plinths are used as state survey marks. The contractor must comply with the preservation of survey infrastructure requirements in TfNSW specification G71. It is noted TS7279 is located on one of the plinths at X₃
- **Measures for M12 Central only:**
 - Prior to construction the contractor must establish an exclusion zone around the former location of antenna X₃ at South Creek 3 Antenna Complex to protect against inadvertent impacts during construction
 - Prior to construction the contractor must establish an exclusion zone around the metal shed at South Creek 3 Antenna Complex to protect against inadvertent impacts during construction.

- The heritage interpretation framework for the project (NAH02) will include interpretation measures that will improve community awareness of the history of the Fleurs Radio Telescope as well as determine suitable locations for the presentation of information that are publicly accessible.

9.0 REFERENCE LIST

- Batty, Michael J., John D. Bunton, David R. Brown, Julian B. Corben, and Graeme L. White. "Astronomy with the Fleurs Six-Dish Array." *Proceedings (Astronomical Society of Australia)* 6, no. 3 (1986): 346–51.
- Biosis, 2019, *M12 Motorway Environmental Impact Statement*, report prepared for Roads and Maritime Services
- Christiansen, W. N. "Extensions to the Fleurs Synthesis Telescope." *Proceedings (Astronomical Society of Australia)* 3, no. 1 (September 1976): 35.
- Frater, R. H., W. M. Goss, and H. W. Wendt. "Chris Christiansen: Telescope Design and Earth-Rotational Synthesis." In *Four Pillars of Radio Astronomy: Mills, Christiansen, Wild, Bracewell*. Astronomers' Universe. Cham: Springer, 2017.
- Frater, R. H., R. G. Gough, and A. Watkinson. "The Synthesised Beamshapes for the Fleurs Extension." *Proceedings (Astronomical Society of Australia)* 4, no. 1 (1980): 24–25.
- Gorman, Alice C., 2012. *An archaeological investigation of the Orroral Valley NASA Tracking Station*. Prepared for ACT Heritage.
- Gorman, Alice C. "A Heritage Survey of the Fleurs Radiotelescope Field Site, Badgerys Creek, NSW." Prepared for Jacobs Arcadis Joint Venture." Wallis Heritage Consulting, March 5, 2018.
- Gorman, Alice C. "A Review of the Heritage Significance of the Fleurs Synthesis Telescope, Badgerys Creek, NSW". Draft report prepared for Roads and Maritime Services. Wallis Heritage Consulting, August 19, 2021.
- Jacobs October 2020, *M12 Motorway Non-Aboriginal heritage supplementary technical memorandum*. Report prepared for TfNSW.
- Jones, I. G., A. Watkinson, P. C. Egau, T. M. Percival, D. J. Skellern, and Graves, G. R. "The FST - A 20 Arc Second Synthesis Telescope." *Proceedings (Astronomical Society of Australia)* 5, no. 4 (1984): 574–78.
- Orchiston, Wayne, and Don Mathewson. "Chris Christiansen and the Chris Cross." *Journal of Astronomical History and Heritage* 12, no. 1 (2009): 11–32.
- O'Sullivan, John, and Colin Jacka. "The Australian NTD and XNTD Projects. Presented at the Astron FPA Workshop, 30 June 2005," 28. Accessed July 20, 2021. https://www.astron.nl/fpaworkshop2005/Monday/OSullivan_FPA2005.pdf.
- Wallace Heritage Consulting, 2018. *A Heritage Survey of the Fleurs Radio Telescope Field Site, Badgerys Creek, NSW*. Prepared for Jacobs Arcadis Joint Venture, p. vi.



artefact

Artefact Heritage
ABN 73 144 973 526
Suite 56, Jones Bay Wharf
26-32 Pirrama Road
Pyrmont NSW 2009 Australia
+61 2 9518 8411
office@artefact.net.au
www.artefact.net.au

Appendix D

Noise and vibration impact assessment

Technical Memorandum

Issued by	Evan Milton, GHD Technical Director – Noise and Vibration
Subject	M12 Motorway Central Section Consistency Assessment – Noise and vibration Technical Memorandum
Client	Transport for New South Wales
Project	M12 Motorway Central Section
Date	October 2021
Document reference	M12CDD-GHDA-ALL-EV-MEM-000008

1. Background

The new M12 Motorway will provide direct access to the Western Sydney International Airport at Badgerys Creek and connect to Sydney’s motorway network. The Motorway’s east-west alignment consist of 16 kilometres of dual carriageway between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham.

The Motorway will be built as a four-lane divided road and designed to be readily widened to six lanes to meet future demand. It will be designed to 110 km/h and posted at 100 km/h. The Motorway will provide increased road capacity and reduce congestion and travel times in line with future needs. It will also improve the movement of freight in and out of Western Sydney while serving the Western Sydney Priority Growth Area and the Western Sydney Employment Area.

The M12 is being delivered in three sections. This report covers the central section of the M12 shown within the red area marked in Figure 1.1.



Figure 1.1 M12 central section extents

Within the central section, the project comprises:

- A four lane dual-carriageway motorway, designed to facilitate widening to six lanes in the future
- Seven bridge locations as detailed below:
 - BR06 – M12 twin bridges over South Creek
 - BR07 – Clifton Avenue bridge over M12
 - BR08 – M12 twin bridges over Kemps Creek
 - BR09 – M12 twin bridges over Elizabeth Drive
 - BR10 – M12 twin bridges over Range Road
 - BR11 – Water Tower Access Road bridge over M12

- Private property access bridge to Sydney University land
- Miscellaneous structures including retaining walls, ITS gantries, sign supports, noise barriers and culverts
- Road drainage, comprising pits, pipes, channels and water quality facilities
- Culverts to convey existing or diverted watercourses
- Separate shared user path, including connections to existing networks
- Relocation and/or protection of existing utilities
- ITS infrastructure to support future smart motorways operation
- Signage, line marking, safety barriers and related road furniture
- Urban design including landscaping and public art.

2. Project approvals

The project (SSI-9364) has been approved under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID:2018/8286). The project received approval from the NSW Minister for Planning and Public Spaces on 23 April 2021 and conditions of approval (CoA) were subsequently issued. The project received approval from the Minister for Commonwealth Department of Agriculture, Water and the Environment on 3 June 2021 and conditions were subsequently issued. The project's environmental impacts and commitments were presented in the following Approval Documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement* (the EIS)
- Transport for NSW (2020, October) *M12 Motorway, Amendment Report* (the amendment report)
- Transport for NSW (2020, October) *M12 Motorway, Submissions Report* (the submissions report).
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report* (the AR submissions report)
- Transport for NSW (2021, March) *M12 Motorway Amendment Report Submissions Report - Amendment*

3. Purpose of this assessment

The purpose of this noise and vibration consistency assessment is to:

- Describe the proposed changes to the project that have been developed during detailed design relative to the Division 5.2 Approval and the EPBC Approval
- Assess changes to the environmental impacts associated with the detailed design of the project relative to the Division 5.2 Approval and the EPBC Approval
- Determine if the detailed design is consistent with the Division 5.2 Approval or whether further approval is required either for a modification application or a new project
- Determine if the detailed design is consistent with the EPBC Approval or whether a variation to the conditions of approval or a new referral is required
- Determine if the proposed change is consistent with the CoA.

This assessment considers the potential changes to the noise and vibration impacts for construction and operation of the project.

4. Description of the proposed changes

The principle design changes to the central section of the M12 Motorway that are considered in this assessment are outlined below:

Changes to the construction noise and vibration assessment are detailed below:

- Construction compound AF14 identified in the AR submissions report has been removed as it is not available to use

Changes to the operational noise assessment are detailed below:

- Changes to the horizontal and vertical alignment as a result of the detailed design process
- Change in pavement surface from concrete to diamond grind asphalt along the main carriageway.

A review of the design changes for both operation and construction of the project, including minor boundary changes, has not identified other modifications that would alter the approved noise and vibration assessment. The construction program has not changed from the duration outlined in Section 4.2.8 of the M12 amendment report. The duration would commence in early 2022 and continue through to early 2026.

5. Assessment methodology

This assessment has reviewed the approval documents listed in Section 2 and the following reports relating to noise and vibration impacts prepared for the approval documents:

- Transport for NSW (2019, October), *M12 Motorway Environmental Impact Statement, Appendix K Noise and Vibration Assessment Report*
- Transport for NSW (2020, May), *M12 Motorway Amendment Report, Appendix G Noise and vibration updated technical report*
- GHD (2021), *M12 Motorway Noise and Vibration Assessment Report (NVAR)*
- GHD (2021), *M12 Motorway Operational Noise and Vibration Review (ONVR)*.

The following guidelines have been referenced for the assessment:

- *Interim Construction Noise Guideline (ICNG)* (DECC, 2009)
- *Road Noise Policy (RNP)* (DECCW, 2011)
- *Noise Criteria Guideline (NCG)* (TfNSW, 2015)
- *Noise Mitigation Guideline (NMG)* (TfNSW, 2015)
- *Construction Noise and Vibration Guideline (CNVG)* (RMS, 2016)
- *Draft Construction Noise and Vibration Guideline* (RMS, 2019).

6. Existing environment

The central section of the M12 Motorway Project is located within Kemps Creek and Badgerys Creek. The land uses in this area comprise predominantly of rural residential areas with primary access off Elizabeth Drive and Mamre Road. The existing environment is dominated by road traffic noise from Elizabeth Drive and Mamre Road and natural noise sources during periods of low traffic.

Changes in the operational design has the potential to affect all sensitive receivers assessed as part of the EIS and amendment report. The potential changes in operational noise impacts are discussed in Section 9.

The EIS defines noise catchment areas (NCAs) which have been used to group areas with similar existing noise environments. The central section includes sensitive receivers located in the following NCAs:

- **NCA03:** located to the north of Elizabeth Drive and west of the M7 Motorway, extending to the west of Mamre Road
- **NCA04:** located to the north of Elizabeth Drive and west of the M7 Motorway and extends west to the intersection of Devonshire Road and Cross Street
- **NCA05:** located to the south of Elizabeth Drive and west of the M7 Motorway and extends west to Kemps Creek
- **NCA06:** located to the west of Kemps Creek and east of South Creek and extends to the north and south of Elizabeth Drive
- **NCA07:** located to the west of Kemps Creek, east of Cosgrove Creek, and north of Elizabeth Drive.

7. Assessment criteria

7.1 Construction noise

7.1.1 Construction noise

Construction noise management levels (NML) are based on the guidance set out in the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) used to assess and manage impacts from construction noise. The NML adopted for the project are detailed in Section 7.7.6 of the EIS and summarised in Table 7.1.

Table 7.1 Construction noise management levels at residential receivers, dBA

Noise catchment area	Standard hours	Outside standard hours					Sleep disturbance
		Morning shoulder	Daytime	Evening	Evening shoulder	Night	
NCA03	49	44	44	44	44	40	50
NCA04	64	59	59	53	53	42	52
NCA05	46	41	41	41	41	39	49
NCA06	49	44	44	44	44	40	50
NCA07	44	39	39	39	39	36	46

7.2 Operational noise

Assessment criteria for operational noise would be consistent with the criteria detailed in the following sections:

- Section 3.2 of the EIS Appendix K
- Section 4 of the NVAR.

8. Assessment of construction impacts

8.1 Construction noise impacts

The amendment report considered two construction compounds (AF13, AF14) in the vicinity of Salisbury Avenue. Construction compound AF14 has been removed as it is not available to use therefore construction noise impacts at sensitive receivers located near AF14 have the potential to decrease. The locations of the construction compounds are shown in Figure 8.1.

Construction noise modelling from operation of the following compound scenarios near Salisbury Avenue was undertaken to determine the change in impacts from the removal of AF14:

- Operation of two compounds: AF13 and AF14
- Operation of one compound: AF13.

Activity sound power levels are based on the details provided in Annexure C of the amendment report.

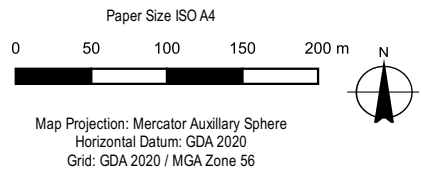
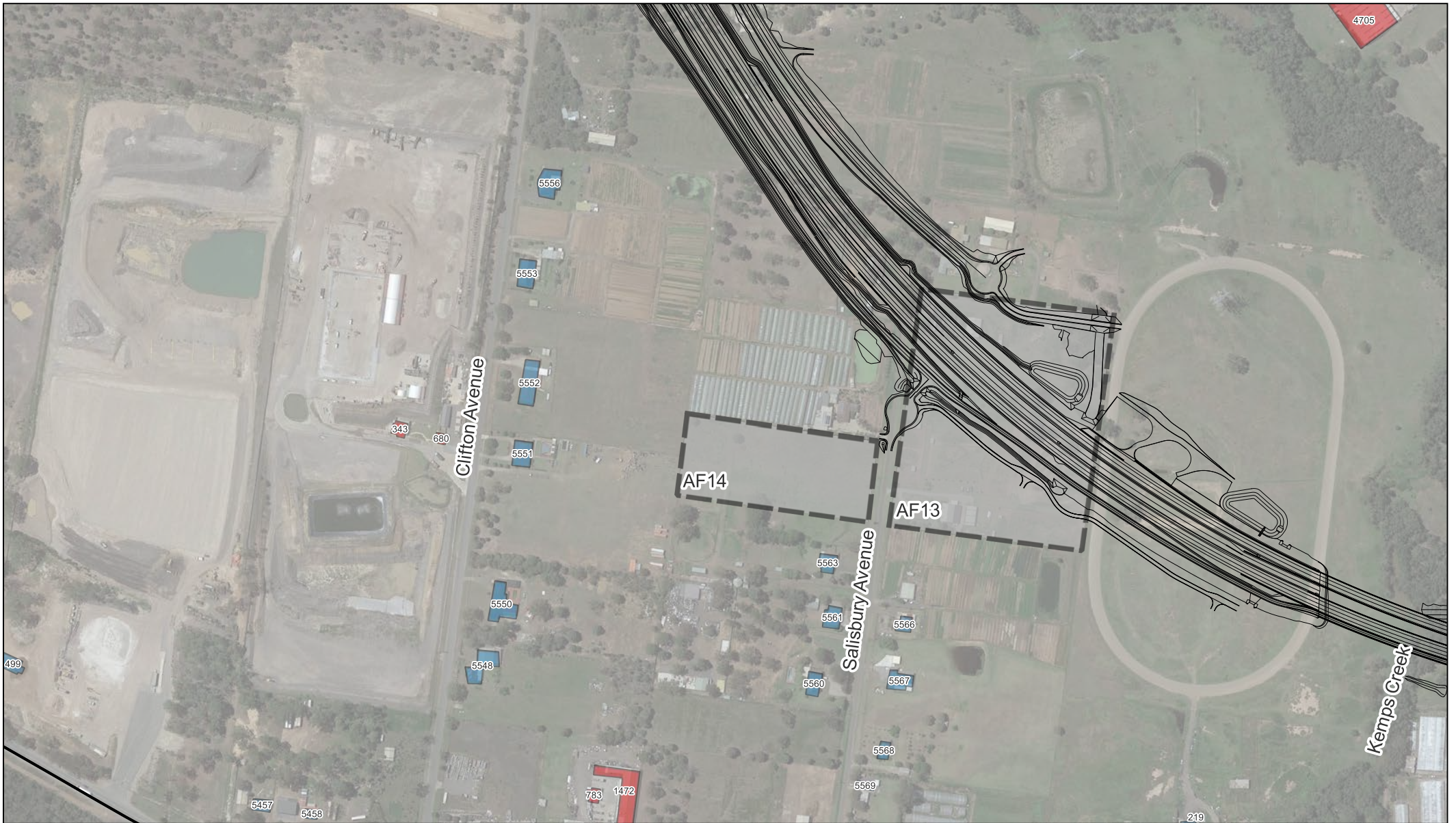
The residences where construction noise levels are predicted to decrease as a result of the removal of AF14 are listed in Table 8.1 and shown in Figure 8.2.

Construction noise levels are predicted to reduce at up to 15 sensitive receivers with the reduction in noise level ranging from 0.1 dBA at receivers on the eastern side of Salisbury Avenue to 12 dBA at receivers located along Clifton Avenue. No change in the predicted construction noise impacts detailed in the amendment report are anticipated at other sensitive receivers.

The highest reduction in noise levels are located at receivers on Clifton Avenue as the removal of the proposed compound AF14 results in construction compound activities being located at further distances.

Table 8.1 Receivers where predicted construction noise levels decrease

Receiver ID	Address	NCA	Decrease in predicted construction noise level, dBA
5542	1650 Elizabeth Drive, Kemps Creek	NCA06	3.8
5543	1650 Elizabeth Drive, Kemps Creek	NCA06	3.9
5546	51 Salisbury Avenue, Kemps Creek	NCA06	0.8
5547	1451 Elizabeth Drive, Kemps Creek	NCA06	2.7
5548	442 Clifton Avenue, Kemps Creek	NCA06	9.6
5550	434 Clifton Avenue, Kemps Creek	NCA06	8.7
5551	422 Clifton Avenue, Kemps Creek	NCA06	12
5552	410 Clifton Avenue, Kemps Creek	NCA06	9
5553	395 - 409 Clifton Avenue, Kemps Creek	NCA06	8.9
5560	41 - 49 Salisbury Avenue, Kemps Creek	NCA06	0.1
5561	41 - 49 Salisbury Avenue, Kemps Creek	NCA06	1.3
5563	Salisbury Avenue, Kemps Creek	NCA06	4.6
5566	36 Salisbury Avenue, Kemps Creek	NCA06	0.1
5567	44 - 56 Salisbury Avenue, Kemps Creek	NCA06	0.1
8014	1650 Elizabeth Drive, Kemps Creek 2178	NCA06	0.4



Legend

- Receiver type
- Commercial
 - Residential
- Road design
- Compound location

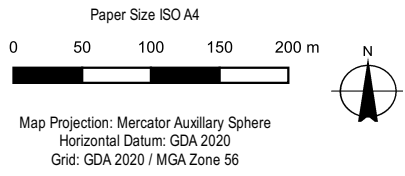
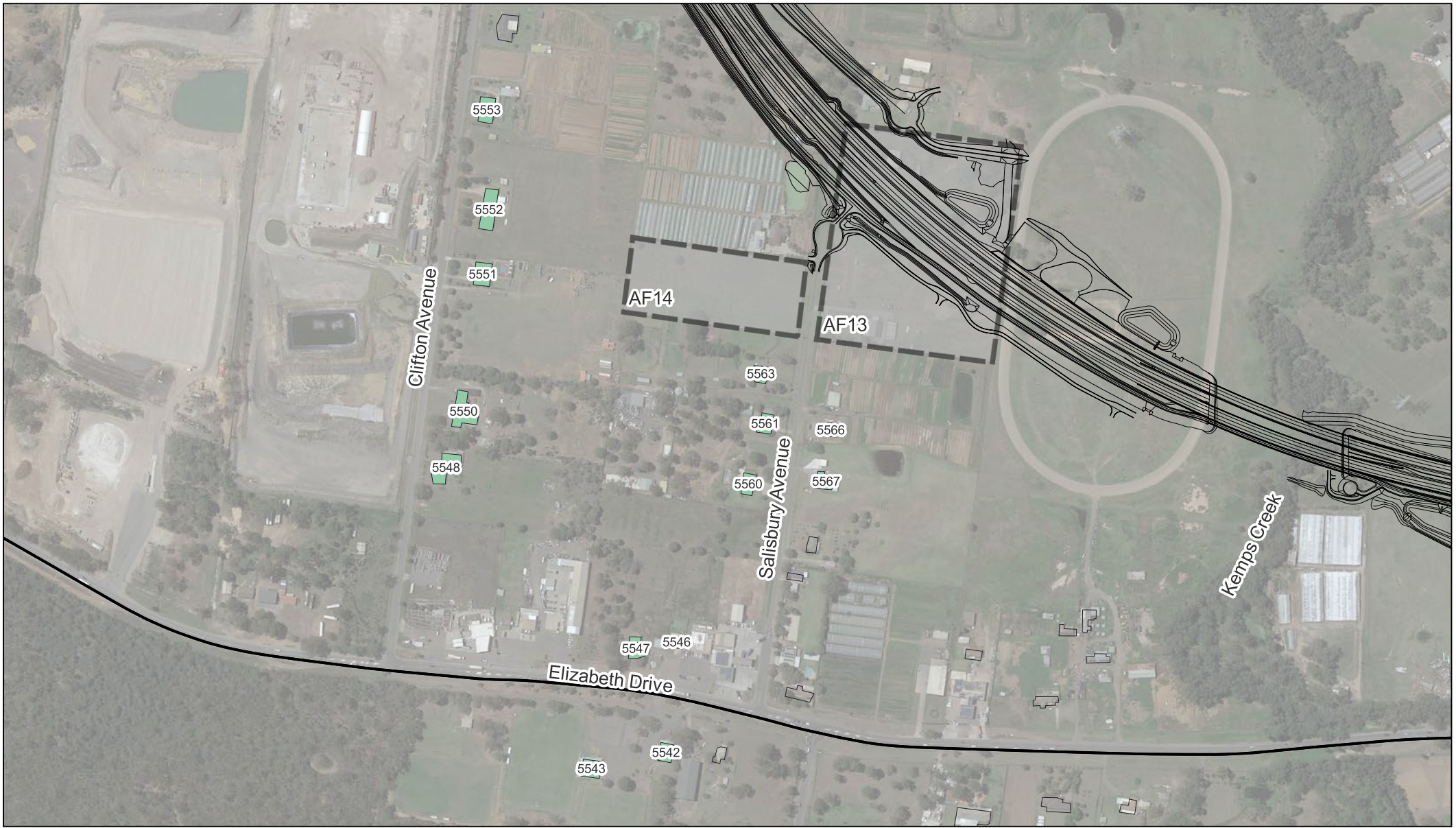


Transport for NSW
M12 Motorway Central Section
Consistency Assessment - Noise and Vibration

Compound locations

Project No. 12514239
Revision No. A
Date. 16/08/2021

Figure 8.1



- Legend**
- Road design
 - Compound location
 - Decrease in noise level



Transport for NSW
M12 Motorway Central Section
Consistency Assessment - Noise and Vibration
Locations with a predicted decrease
in compound construction noise
levels

Project No. **12514239**
 Revision No. **A**
 Date. **16/08/2021**

Figure 8.2

9. Assessment of operational impacts

A qualitative assessment of the likely noise impacts associated with the design, parameter and model input changes is provided in Table 9.1. Design changes include horizontal and vertical alignment changes and road surface changes between the detailed design alignment and the AR submission report alignment.

Only items that have changed between the amendment report noise model and the detailed design noise model have been included in Table 9.1. All other modelling parameters and design inputs are deemed to be consistent with the approved project.

Predicted noise levels are anticipated to decrease due to the change in road surface correction from concrete to diamond grind. This would not increase the requirements for mitigation (such as at-property treatments or noise walls). The impacts from the design changes are deemed to be consistent with the approved project.

The *M12 Motorway Noise and Vibration Assessment Report (NVAR)* (GHD, 2021) prepared for the project details the modelling undertaken for detailed design and the operational noise mitigation required as a result of design changes.

Table 9.1 Likely impacts on noise levels due to model changes

Parameter/model input	Change between amendment report and detailed design model (NVAR)	Likely impact on noise level predictions
Model inputs		
Building footprints	Yes	Minor impact. Additional buildings identified or changes in the building occupation type may affect the number of receivers qualifying for consideration of additional noise mitigation.
Receiver locations	Yes	The most-impacted façade used for the barrier analysis is not defined in the EIS assessment. Changes to the most-impacted façade between assessments may have a minor impact on barrier analysis results.
Receiver heights	Yes	Minor to moderate impact as source heights have the potential to change significantly. Ground floor receivers are unlikely to change significantly, however first floor receivers may change as height between floors will increase from 2.8 m to 3.0 m.
Road source heights	Yes	Minor to moderate impact due to vertical realignment of the proposed road alignment and additional effects due to the detailed design terrain adjacent the road.
Road surface corrections	Yes	Predicted noise levels would be lower due to changing the road surface along the project road from concrete (+3.0) to diamond grind (+0.0) correction.
Road source traffic volumes	Yes	Road traffic volumes along Salisbury Avenue have changed between the AR and the NVAR due to the removal of traffic volumes associated with the Devonshire Road to Mamre Road link. The removal of this link would increase traffic volumes along Elizabeth Drive and Mamre Road however the impacts are expected to be low due to high levels of existing traffic on these roads.
Noise barrier locations (mitigation)	Yes	No noise barriers were proposed as part of the approved project based on a reasonable and feasible assessment. No changes to this assessment would be expected.

10. Assessment of the detailed design against conditions of approval and commitments

Table 8.1 assesses the M12 central section detailed design construction footprint against the project's REMMs as outlined in Section 6 of the AR submission report.

Table 8.2 assesses the M12 central section detailed design construction footprint against the project's NSW conditions of approval issued on 23 April 2021.

Technical Memorandum

Table 8.1 Assessment of the updated design for the M12 Central package against relevant noise and vibration REMMs in the M12 Central project area

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
NV01	<p>A construction noise and vibration management plan (CNVMP) will be prepared for the project to mitigate and manage noise and vibration impacts during construction.</p> <p>The CNVMP will be implemented for the duration of construction of the project and will:</p> <ul style="list-style-type: none"> - Identify nearby sensitive receivers - Include a description of the construction activities equipment and working hours - Identify relevant noise and vibration performance criteria for the project and license and approval conditions. - Include modelling results showing construction noise impacts based on detailed design information - Outline standard and additional mitigation measures from the Construction Noise and Vibration Guideline (CNVG) (Roads and Maritime 2016) and information about when each will be applied - Outline requirements for the development and implementation of an Out-of-hours Work Protocol - Outline requirements for noise and vibration monitoring that will be carried out to monitor project performance associated with the noise and vibration criteria - Describe community consultation and complaints handling procedures in accordance with the Community Communication Strategy to be developed for the project - Outline measures to manage noise impacts associated with heavy vehicle movements both on and offsite - Outline measures to minimise cumulative construction impacts and the likelihood for 'construction fatigue' from concurrent and consecutive projects in the area - Outline requirements to minimise and manage construction fatigue, in consultation with the community. 	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
NV02	<p>Measures to minimise and manage construction fatigue are to be investigated through the planning of construction staging.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
NV03	<p>Detailed noise assessments will be carried out for ancillary facilities with the potential to involve high noise generating activities (including batching plant operations). The assessments will consider the proposed site layouts and noise generating activities that will occur at the facilities and assess predicted noise levels against the relevant noise management criteria.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	The assessments will also consider the requirement for appropriate noise mitigation within ancillary facilities and adjacent to construction works, depending on the predicted noise levels. Any mitigation measures required will be implemented before the start of activities that generate noise and vibration impacts.		
NV04	Monitoring will be carried out at the start of high noise and vibration activities to confirm that actual noise and vibration levels are consistent with the noise and vibration impact predictions. Where mitigation measures were included, measurements will be carried out to confirm the effectiveness. Where the monitoring identifies higher levels of noise and vibration compared to predicted levels, or where mitigation is shown to be ineffective against measured noise and vibration levels, additional mitigation measures will be identified and implemented to appropriately manage impacts where feasible and reasonable.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV05	Where reasonable and feasible, receivers identified as requiring at-property treatment for operational noise mitigation will be identified and offered treatment before construction activities begin that are likely to impact them.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV06	Activities that generate vibration will be managed to avoid impacts on structures and sensitive receivers. This includes implementing appropriate safe working distances where practicable.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV07	The use of alternatives to vibration generating equipment will be considered where vibration impacts are predicted.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV08	Where works are within the minimum working distances and considered likely to exceed the cosmetic damage objectives (as shown in Figure 7-3 of Appendix K of the EIS G of the amendment report), construction works will not proceed unless: <ul style="list-style-type: none">- A different construction method with lower source vibration levels is used, where feasible- Attended vibration measurements are carried out at the start of the works to determine the risk of exceeding the vibration objectives.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV09	Building Condition Surveys will be offered in writing to property owners before construction where there is a potential for construction activities to cause structural or cosmetic damage. A comprehensive report will be prepared by a suitably qualified professional before the relevant works begin and will comprise a written and photographic condition.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV10	Surveys will be carried out to confirm the existing condition of the WaterNSW Upper Canal System and Jemena high pressure gas pipelines to determine appropriate vibration criteria. This will also include consideration of distances from the vibration intensive activity (piling, rock-breaking and vibratory rolling), as well as ground conditions. A vibration criterion of a peak particle velocity (PPV) will be determined in consultation with the relevant utility/service providers, including WaterNSW.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	In-situ monitoring will be carried out to confirm the vibration levels and assess the impact of vibration. Where the monitoring identifies exceedances in the relevant criteria, or where impacts are identified, additional mitigation measures will be identified and implemented to appropriately manage impacts.		
NV11	<p>The following structures have the potential to be within the safe working distances for sensitive structures (Group 3 from DIN 4150):</p> <ul style="list-style-type: none"> - Item 1: McGarvie Smith Farm - Item 2: Fleurs Radio Telescope Site - Item 4: Upper Canal System - Item 6: McMaster Field Station - Item 7: Fleurs Aerodrome <p>A detailed survey will be completed to determine the potential for vibration impacts and to define appropriate criteria for each heritage item. Vibration monitoring will be carried out when vibration intensive tasks are occurring within the minimum working distances to heritage structures. Where the monitoring identifies exceedances in the relevant criteria, or where impacts are identified, additional mitigation measures will be identified and implemented to appropriately manage impacts.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV12	<p>Construction vehicle movements (both on and offsite) will be managed to minimise noise impacts. Where feasible, this will include (but not be limited to):</p> <ul style="list-style-type: none"> - Establishment and use of internal haul routes, or existing major roads where this is not feasible - Restriction of heavy vehicle movements to standard construction hours - Locating traffic marshalling areas away from residences to minimise noise impacts from idling vehicles - Instructing workers on the operation of heavy vehicles entering and exiting the site to minimise noise 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV13	The likelihood of cumulative construction noise impacts will be considered during detailed design when detailed construction schedules of other projects are available. Construction works will be scheduled with the aim of minimising concurrent works near sensitive receivers where possible in consultation with managers of other nearby projects that are likely to result in a cumulative impact. This will include the coordination of respite between the various construction projects where receivers are likely to experience concurrent construction impacts where feasible. Coordination between project teams would be carried out throughout construction.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV14	<p>Operational noise and vibration mitigation measures will be identified in an Operational Noise and Vibration Review (ONVR).</p> <p>Requirements for mitigation measures, including quieter noise pavements, noise barriers, and at-property treatments, will be reviewed as part of the ONVR and as the detailed design progresses. The implementation of treatments will be carried out in accordance with TfNSW Noise Mitigation guidelines (2015).</p> <p>Owners of residences identified as eligible for noise treatment triggered by the project will be contacted by TfNSW and/or TfNSW's contractor.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
NV15	Within 12 months of start of operation of the project, actual operational noise performance will be compared to predicted operational noise performance. The need for additional mitigation or management measures to address	The proposed changes to the project would not impact	Yes

No.	Statement of Commitment / mitigation measure	Discussion	Consistent
	identified operational performance issues and meet relevant operational noise criteria will be assessed and implemented where feasible and reasonable.	on the ability to comply with this requirement.	

Table 8.2 Consistency against relevant Minister's conditions of approval for the project

No.	Condition of Approval	Discussion	Consistent
E34	Work must only be undertaken during the following hours: (a) 7:00 am to 6:00 pm Mondays to Fridays, inclusive; (b) 8:00 am to 6:00 pm Saturdays; and (c) at no time on Sundays or public holidays.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E35	Except as permitted by an EPL, highly noise intensive works that result in an exceedance of the applicable noise management level (NML) at the same receiver must only be undertaken: (a) between the hours of 8:00 am to 6:00 pm Monday to Friday; (b) between the hours of 8:00 am to 1:00 pm Saturday; and (c) if continuously, then not exceeding three hours, with a minimum cessation of work of not less than one hour. For the purposes of condition, 'continuously' includes any period during which there is less than one hour between ceasing and recommencing any of the Work.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E36	Notwithstanding Condition E34 and E35, Work may be undertaken outside the hours specified in any of the following circumstances: (a) Safety and Emergencies, including: (i) for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or (ii) where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm. On becoming aware of the need for emergency work in accordance with E36(a), the Proponent must notify the ER, the Planning Secretary and the EPA of the reasons for such emergency work. The Proponent must use best endeavours to notify all noise and/or vibration affected sensitive land user(s) of the likely impact and duration of the emergency work. (b) Work that causes: (i) $L_{Aeq(15\text{ minute})}$ noise levels: - no more than 5 dB(A) above the rating background level at any residence in accordance with the ICNG, and - no more than the 'Noise affected' NMLs specified in Table 3 of the ICNG at other sensitive land user(s); and (ii) $L_{AFmax(15\text{ minute})}$ noise levels no more than 15 dB(A) above the rating background level at any residence during the night time period; and	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
	<ul style="list-style-type: none"> (iii) continuous or impulsive vibration values, measured at the most affected residence, that are no more than the preferred values for human exposure to vibration, specified in Table 2.2 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006); and (iv) intermittent vibration values measured at the most affected residence that are no more than the preferred values for human exposure to vibration, specified in Table 2.4 of <i>Assessing Vibration: a technical guideline</i> (DEC, 2006). <p>(c) By Approval, including:</p> <ul style="list-style-type: none"> (i) where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or (ii) works which are not subject to an EPL that are approved under an Out-of-Hours Work Protocol as required by Condition E37; or (iii) negotiated agreements with directly affected residents and sensitive land user(s). 		
E37	<p>An Out-of-Hours Work Protocol must be prepared to identify a process for the consideration, management and approval of Work which is outside the hours defined in Condition E34, and that are not subject to an EPL. The Protocol must be approved by the Planning Secretary before commencement of the out-of-hours Work. The Protocol must be prepared in consultation with the ER. The Protocol must provide:</p> <ul style="list-style-type: none"> (a) identification of low and high-risk activities and an approval process that considers the risk of activities, proposed mitigation, management, and coordination, including where: <ul style="list-style-type: none"> (i) the ER reviews all proposed out-of-hours activities and confirm their risk levels, (ii) low risk activities can be approved by the ER, and (iii) high risk activities that are approved by the Planning Secretary; (b) a process for the consideration of our-of-hours work against the relevant NML and vibration criteria; (c) a process for selecting and implementing mitigation measures for residual impacts in consultation with the community at each affected location, including respite periods consistent with the requirements of Condition E47. The measures must take into account the predicted noise levels and the likely frequency and duration of the out-of-hours works that sensitive land user(s) would be exposed to, including the number of noise awakening events; (d) procedures to facilitate the coordination of out-of-hours Work including those approved by an EPL or undertaken by a third party, to ensure appropriate respite is provided; and (e) notification arrangements for affected receivers for all approved out-of-hours Work and notification to the Planning Secretary of approved low risk out-of-hours Work. <p>This condition does not apply to Work where the requirements of Condition E36(a) or (b) are met.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E38	<p>Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration objectives:</p> <ul style="list-style-type: none"> (a) construction 'Noise affected' NML established using the Interim Construction Noise Guideline (DECC, 2009); (b) vibration criteria established using the <i>Assessing vibration: a technical guideline</i> (DEC, 2006) (for human exposure); 	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
	<p>(c) BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and</p> <p>(d) the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage).</p> <p>Any construction or early works identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the respective Noise and Vibration CEMP Sub-plan or Early Works Environmental Management Plan.</p> <p><i>Note: The ICNG identifies 'particularly annoying' activities that require the addition of 5 dB(A0 to the predicted level before comparing to the construction NML.</i></p>		
E39	<p>Noise generating work in the vicinity of potentially-affected community, religious, educational institutions, noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless offers of other reasonable arrangements have been made to the affected institutions and are implemented at no cost to the affected institution.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E40	<p>Noise and Vibration Impact Statements (NVIS) must be prepared for any Work that may exceed the noise management levels and vibration criteria specified in Condition E38 at any residence outside the construction hours identified in Condition E34, or where receivers will be highly noise affected. The NVIS must include specific mitigation measures identified through consultation with affected sensitive land user(s) and the mitigation measures must be implemented for the duration of the Work. A copy of the NVIS must be provided to the ER prior to the commencement of the associated Work. The Planning Secretary may request a copy/ies of the NVIS.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E41	<p>Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before Work that generates vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owners and occupiers must be provided with a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Noise and Vibration CEMP Sub-plan required by Condition C4 and the Communication Strategy required by Condition B1.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E42	<p>The Proponent must conduct vibration testing during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In addition, vibration monitoring must be undertaken during construction for relevant remaining Fleurs Radio Telescope structures, the Upper Canal (in consultation with WaterNSW) and McMaster Farm and McGarvie-Smith Farm group of remaining buildings. In the event that the vibration testing and attended monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E43	<p>Advice from a heritage specialist must be sought on methods and locations for installing equipment used for vibration, movement and noise monitoring at heritage-listed structures.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E44	Before conducting at-property treatment at any heritage item identified in the documents listed in Condition A1, the advice of a suitably qualified and experienced built heritage specialist must be obtained and implemented to ensure such work does not have an adverse impact on the heritage significance of the item.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E45	All Work undertaken for the delivery of the CSSI, including that undertaken by third parties (such as utility relocations), must be coordinated to ensure respite periods are provided. The Proponent must: (a) reschedule any work to provide respite to impacted noise sensitive land user(s) so that the respite is achieved in accordance with Condition E47; or (b) where respite outlined in Condition E47 cannot be achieved, consider the provision of alternative respite or mitigation to impacted noise sensitive land user(s); and (c) provide documentary evidence to the ER in support of any decision made by the Proponent in relation to respite or mitigation.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E46	Mitigation measures such as temporary alternative accommodation or other agreed mitigation measures, must be offered/ made available to residents affected by out-of-hours Work (including where utility works are being undertaken for the CSSI or under a road occupancy licence) where the construction noise levels between: (a) 10:00 pm and 7:00 am, Monday to Friday; (b) 10:00 pm Saturday to 8:00 am Sunday; and (c) 6:00 pm Sunday and public holidays to 7:00 am the following day unless that day is Saturday then to 8:00 am, are predicted to exceed the NML by 25 dB(A) or are greater than 75 dBA (LAeq(15 min)), whichever is the lesser and the impact is planned to occur for more than two (2) nights over a seven (7) day rolling period. The NML must be reduced by 5 dB where the noise contains annoying characteristics and may be increased by 10 dB if the property has received at-property noise treatment. The noise levels and duration requirements identified in this condition may be changed through an EPL applying to the CSSI.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E47	In order to undertake out-of-hours Work outside the hours specified under Condition E34, the Proponent must identify appropriate respite periods for the out-of-hours work in consultation with the community at each affected location on a regular basis. This consultation must include (but not be limited to) providing the community with: (a) a progressive schedule for periods no less than three (3) months, of likely out-of-hours Work; (b) a description of the potential Work, location and duration of the out-of-hours Work; (c) the noise characteristics and likely noise levels of the Work; and (d) likely mitigation and management measures which aim to achieve the relevant noise management levels and vibration criteria under Condition E38(a) and (b) (including the circumstances of when respite or relocation offers will be available and details about how the affected community can access these offers). The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour Work must be provided to the ER, EPA and the Planning Secretary for information prior to Work scheduled for the subject period being undertaken. <i>Note: Respite periods can be any combination of days or hours where out-of-hours work would not be</i>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

No.	Condition of Approval	Discussion	Consistent
	<i>more than 5 dB(A) above the rating background noise level at any residence.</i>		
E48	Crushing and grinding works must only be undertaken during the hours specified in Condition E34 unless otherwise approved by the Planning Secretary or through an EPL or it meets the requirements of Condition E36(a).	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E49	Blasting is not permitted as part of this CSSI approval.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E50	<p>An independent and experienced noise specialist must be approved by the Planning Secretary to verify the validity (including being accurate and consistent with the requirements of this approval) of the:</p> <ul style="list-style-type: none"> (a) operational noise modelling required under Conditions E51; (b) Operational Noise Review required under Condition E52; and (c) Operational Noise Compliance Report required under Condition E60. <p>The Planning Secretary's approval of the noise specialist must be sought no later than one (1) month before undertaking operational noise modelling.</p> <p>Each verification must be submitted to the Planning Secretary for information within 30 days of the verification and be attached to submitted documentation as relevant.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E51	<p>Noise modelling of the detailed design must be undertaken and address the following parameters:</p> <ul style="list-style-type: none"> (a) application of source emission corrections to take into account the proportions of heavy vehicles; (b) modelling heavy vehicles using three distinct sources in line with Appendix B4 of the NSW Road Noise Policy (DECCW, 2011); (c) road surface corrections to address the assessment timeframes outlined in the NSW Road Noise Policy (DECCW, 2011) corresponding to the year of opening, and ten (10) years after opening; and (d) meteorological conditions in accordance with the NSW Road Noise Policy. 	<p>Noise modelling of the detailed design has been undertaken as part of the ONVR. Changes to the parameters are discussed in Section 9 of this report.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E52	<p>An Operational Noise Review (ONR) must be prepared (based on the detailed design of the CSSI) to confirm noise mitigation measures that would be implemented for the operation of the CSSI. The ONR must be prepared in consultation with the Planning Secretary and relevant council(s) and must:</p> <ul style="list-style-type: none"> (a) confirm the appropriate operational noise objectives and levels for existing sensitive receivers; (b) confirm the operational noise impacts based on the final design of the CSSI and modelling undertaken under Condition E51, including operational daytime LAeq,15 hour and night-time LAeq, 9-hour traffic noise contours; (c) review the suitability of the operational noise mitigation measures identified in the documents listed in Condition A1 and, where necessary, investigate and identify additional noise and vibration mitigation measures required to achieve the noise criteria outlined in the NSW Road Noise Policy (DECCW, 2011), including the timing of implementation; 	<p>An ONVR has been prepared to identify the noise mitigation measures that would be implemented.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
	<p>(d) include a consultation strategy to seek feedback from directly affected landowners on the noise and vibration mitigation measures; and</p> <p>(e) procedures for the management of operational noise and vibration complaints.</p> <p>The ONR must be undertaken at the Proponent's expense and be submitted to the Planning Secretary for information prior to implementing at-property noise mitigation, unless otherwise agreed by the Planning Secretary.</p> <p>The Proponent must implement the identified noise mitigation measures and make the ONR publicly available following its submission to the Planning Secretary for information.</p> <p><i>Note: The design of noise barriers and the like must be undertaken in consultation with the community as part of the Place, Design and Landscape Plan required under Condition E69.</i></p>		
E53	<p>Operational noise mitigation measures as identified in Condition E52 that will not be physically affected by construction and where the noise management level in Condition E38(a) is likely to be exceeded, must be implemented within six (6) months of the commencement of construction in the vicinity of the impacted residence(s) to minimise construction noise impacts, unless otherwise agreed by the Planning Secretary in accordance with Condition E55. The operational noise mitigation measures must be detailed in the Noise and Vibration CEMP Sub-plan required by Condition C4</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E54	<p>If the ONR required by Condition E52 is not prepared within six (6) months of the commencement of construction, the at-property operational noise mitigation measures required by Condition E53 must be consistent with the measures and the properties identified in Appendix G of the M12 Motorway Amendment Report (October, 2020).</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E55	<p>All requests to the Planning Secretary under Condition E53 must be accompanied by a report justifying why operational noise mitigation measures will not be implemented within six (6) months, along with details of the temporary measures that the Proponent would implement to reduce construction noise impacts, until such time that the operational noise mitigation measures are implemented. The report must be submitted to the Planning Secretary before the commencement of construction which would affect identified residences. All temporary measures must be implemented within six (6) months of the commencement of construction in the vicinity of the impacted residences.</p> <p><i>Note: Not having finalised detailed design is not sufficient justification for not implementing the proposed mitigation measures.</i></p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E56	<p>The implementation of at-property treatment does not preclude the application of other noise and vibration mitigation and management measures including temporary accommodation to address construction noise.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E57	<p>All operational noise mitigation measures must be implemented prior to operation of the CSSI.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
E58	<p>Within 12 months of the commencement of operation of the CSSI, the Proponent must undertake monitoring of operational noise to compare actual noise performance of the CSSI against the noise performance predicted in the review of operational noise mitigation measures required by Condition E52.</p>	<p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes

No.	Condition of Approval	Discussion	Consistent
E59	Classified traffic counts must be undertaken simultaneously with noise measurements to confirm traffic volumes and traffic mix assumptions.	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes
E60	<p>An Operational Noise Compliance Report (ONCR) must be prepared to document the findings of the operational noise monitoring carried out under Condition E58. The ONCR must be prepared in accordance with the Model Validation Guideline (RMS, 16 May 2018 Version 1.1) and must address the following:</p> <ul style="list-style-type: none"> (a) compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under Condition E52; (b) compliance with the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy (DECCW, 2011); (c) methodology, location and frequency of noise monitoring undertaken, including grouping monitoring sites at which CSSI noise levels are ascertained with specific reference to locations indicative of impacts on receivers. Monitoring locations must be grouped by - <ul style="list-style-type: none"> (i) pavement type, (ii) topography; (d) visibility of sensitive receivers, i.e. line of sight and shielded by mounds and/or noise walls; (e) model light and heavy vehicles separately; (f) pavement corrections for light and heavy vehicles; (g) details on the acoustic performance of the different pavement types used for the CSSI ; (h) effects of meteorological conditions on traffic noise consistent with the requirements of the NSW Road Noise Policy (DECCW, 2011); (i) details of any complaints and enquiries received in relation to operational noise generated by the CSSI between the date of commencement of operation and the date the report was prepared; (j) any required recalibrations of the noise model taking into consideration factors such as noise monitoring, and actual traffic numbers and proportions; (k) an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of mitigation measures; and (l) identification of additional measures to those identified in the review of noise mitigation measures required by Condition E52, that are to be implemented with the objective of meeting the criteria outlined in the NSW Road Noise Policy (DECCW, 2011), when these measures are to be implemented and how their effectiveness is to be measured and reported to the Planning Secretary and the EPA. <p>The ONCR must be submitted to the Planning Secretary and the EPA for information within 60 days of completing the operational noise monitoring (required by Condition E58) and be made publicly available.</p> <p>Any additional measures identified in Condition E60(l) must be implemented within 18 months of submitting the ONCR to the Planning Secretary, unless an alternative timeframe is agreed to by the Planning Secretary.</p>	The proposed changes to the project would not impact on the ability to comply with this requirement.	Yes

11. Environmental management measures

11.1 Construction management measures

The removal of AF14 is predicted to reduce construction noise levels from compound operations at up to 15 sensitive receivers. No change to the construction noise and vibration management measures would be required as a result of the removal of this compound as these receivers would still be impacted by other activities associated with road construction.

The CNVG additional management measures are detailed in Table 7-2 of Appendix G Noise and vibration updated technical report to the amendment report.

The management measures for construction noise and vibration would be consistent with the measures outlined in the EIS and the amendment report.

11.2 Operational management measures

The management measures for operational noise would generally be consistent with the measures outlined in the EIS and the amendment report however the change in road pavement surface has the potential to reduce the number of receivers that would require mitigation.

Operational noise and vibration mitigation measures would be detailed in the ONVR that would be finalised following detailed design in accordance with NV14 of the AR submissions report. This report would summarise the changes to the operational noise management measures.

12. References

DECC (2009) *Interim Construction Noise Guideline*

DECCW (2011) *Road Noise Policy*

GHD (2021) *M12 Motorway Noise and Vibration Assessment Report (NVAR)*

GHD (2021) *M12 Motorway Operational Noise and Vibration Review (ONVR)*.

Roads and Maritime Services (2016) *Construction Noise and Vibration Guideline*

Roads and Maritime Services (2019) *Draft Construction Noise and Vibration Guideline*

Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement*

Transport for NSW (2020a) *M12 Motorway, Amendment Report*

Transport for NSW (2020b) *M12 Motorway, Submissions Report*

Transport for NSW (2020c) *M12 Motorway, Amendment Report Submissions Report*

Transport for NSW (2019, October), *M12 Motorway Environmental Impact Statement, Appendix K Noise and Vibration Assessment Report*

Transport for NSW (2020, May), *M12 Motorway Amendment Report, Appendix G Noise and vibration updated technical report*

Transport for NSW (2015) *Noise Criteria Guideline*

Transport for NSW (2015) *Noise Mitigation Guideline*

Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*

Appendix E

Flooding and hydrology impact assessment

Technical Memorandum

Issued by	David Bannigan - Technical Director – Water Resources
Subject	M12 Motorway Central Section Consistency Assessment – Flooding and Hydrology impact assessment
Client	Transport for New South Wales
Project	M12 Motorway Central Section
Date	October 2021
Document reference	M12CDD-GHDA-ALL-EV-MEM-000004

1. Background

The new M12 Motorway will provide direct access to the Western Sydney International Airport at Badgerys Creek and connect to Sydney’s motorway network. The Motorway’s east-west alignment consists of 16-kilometres of dual carriageway between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham.

The Motorway will be built as a four-lane divided road and designed to be readily widened to six lanes to meet future demand. It will be designed to 110 km/h and posted at 100km/h. The Motorway will provide increased road capacity and reduce congestion and travel times in line with future needs. It will also improve the movement of freight in and out of Western Sydney while serving the Western Sydney Priority Growth Area and the Western Sydney Employment Area.

The M12 is being delivered in three sections. This memorandum covers the central section of the M12 shown within the red area marked in Figure 1.1.



Figure 1.1 M12 central section extents

Within the central section, the project comprises:

- A four lane dual-carriageway motorway, designed to facilitate widening to six lanes in the future
- Seven bridge locations as detailed below:
 - BR06 – M12 twin bridges over South Creek
 - BR07 – Clifton Avenue bridge over M12
 - BR08 – M12 twin bridges over Kemps Creek
 - BR09 – M12 twin bridges over Elizabeth Drive
 - BR10 – M12 twin bridges over Range Road
 - BR11 – Water Tower Access Road bridge over M12
 - Private property access bridge to Sydney University land

- Miscellaneous structures including retaining walls, ITS gantries, sign supports, noise barriers and culverts
- Road drainage, comprising pits, pipes, channels and water quality facilities
- Culverts to convey existing or diverted watercourses
- Separate shared user path, including connections to existing networks
- Relocation and/or protection of existing utilities
- ITS infrastructure to support future smart motorways operation
- Signage, line marking, safety barriers and related road furniture
- Urban design including landscaping and public art.

2. Project approvals

The project (SSI-9364) has been approved under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID:2018/8286). The project received approval from the NSW Minister for Planning and Public Spaces on 23 April 2021 and conditions of approval (CoA) were subsequently issued. The project received approval from the Minister for Commonwealth Department of Agriculture, Water and the Environment Minister on 3 June 2021 and conditions were subsequently issued. The projects environmental impacts and commitments were presented in the following Approval Documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement* (the EIS)
- Transport for NSW (2020, October) *M12 Motorway, Amendment Report* (the amendment report)
- Transport for NSW (2020, October) *M12 Motorway, Submissions Report* (the submissions report).
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report* (the AR submissions report)
- Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*.

3. Purpose of this assessment

The purpose of this flooding and surface water hydrology consistency assessment is to:

- Describe the proposed changes to the project that have been developed during detailed design relative to the Division 5.2 Approval and the EPBC Approval
- Assess changes to the environmental impacts associated with the detailed design of the project relative to the Division 5.2 Approval and the EPBC Approval
- Determine if the detailed design is consistent with the Division 5.2 Approval or whether further approval is required either for a modification application or a new project
- Determine if the detailed design is consistent with the EPBC Approval. Or whether a variation to the conditions of approval or a new referral is required.
- Determine if the proposed change is consistent with the CoA.

This assessment considers the following impacts of the detailed design:

- Increases in flood affectation
- Changes to peak stormwater flows, downstream velocity and scour potential
- Changes in flood hazards

- Changes to hydraulic flow conveyance and beneficial floodplain inundation
- Impacts on emergency management, evacuation and access
- Climate change
- Impacts on farm dams.

4. Description of the proposed changes

The principal design changes to the central section of the M12 Motorway that are considered in this assessment are outlined below. A review of changes to the construction methodology and construction footprint of the project, has not identified other modifications that would alter the approved construction flooding assessment. This report has therefore reviewed the operational impacts of the project only.

- The South Creek and Kemps Creek bridges were reduced in length. Flood relief culverts were provided through both bridge abutments to reduce flood impact
- Bridge piers were repositioned to minimise impacts on the existing watercourses. This also resulted in creek adjustments at South Creek and Kemps Creek not being required and the existing creek alignments being retained under the bridges
- Updated road design geometry, maintenance access tracks, channels and operational water quality basins were added to the design.

A review of the changes for the operation of the project, including minor boundary changes, has not identified other modifications that would alter the approved flooding assessment.

5. Assessment methodology

This consistency assessment is based on a review of the flooding and surface water hydrology assessments that have been carried out as part of the assessment and has reviewed the approval documents listed in section 2 and the detailed design of the project, the details of which are set out in the following reports:

- Approval documents:
 - Roads and Maritime Services (2019, October) M12 Motorway Environmental Impact Statement Appendix L Flooding assessment report
 - Roads and Maritime Services (2019, October) M12 Motorway Environmental Impact Statement Appendix M Surface water quality and hydrology assessment report
 - NSW Government (2020 October) M12 Motorway Amendment Report Appendix H Flooding supplementary technical memorandum
- Detailed design:
 - GHD (2021a) M12 Motorway Central Package Detailed Design Report Flooding and Hydrology.

The approval documents were assessed against the Secretary's Environmental Assessment Requirements (SEARS) as part of the EIS (Section 7.8 of the EIS). The Flooding SEARS were assessed with the approval documents concluding that SEARS would be achieved by the project. The amendment report included only minor updates to the flooding component of the EIS, related to the cumulative impacts of future development to private land. These impacts have been assessed through the detailed design flood model, while a cumulative flood study of the Western Sydney Aerotropolis area was considered beyond the scope of the central section of the project.

During the detailed design phase of the project, flooding criteria were updated with the baseline conditions of approval (2020) and the final NSW conditions of approval (issued in 23 April 2021).

The approval documents project flood assessment focused on the five key areas influenced by flooding including the M12 central section South Creek and Kemps Creek bridge crossings. Flood modelling of

minor waterways and drainage lines were not included in that assessment, and culverts were separately designed for free-flowing drainage.

As part of the detailed design process the flood model was updated to include the entire M12 central section alignment including all transverse drainage culverts. In addition the minor waterways and drainage lines were assessed within the flood model. Figure 5.1 to Figure 5.3 show the increase in study area considered as part of the detailed design flooding assessment.

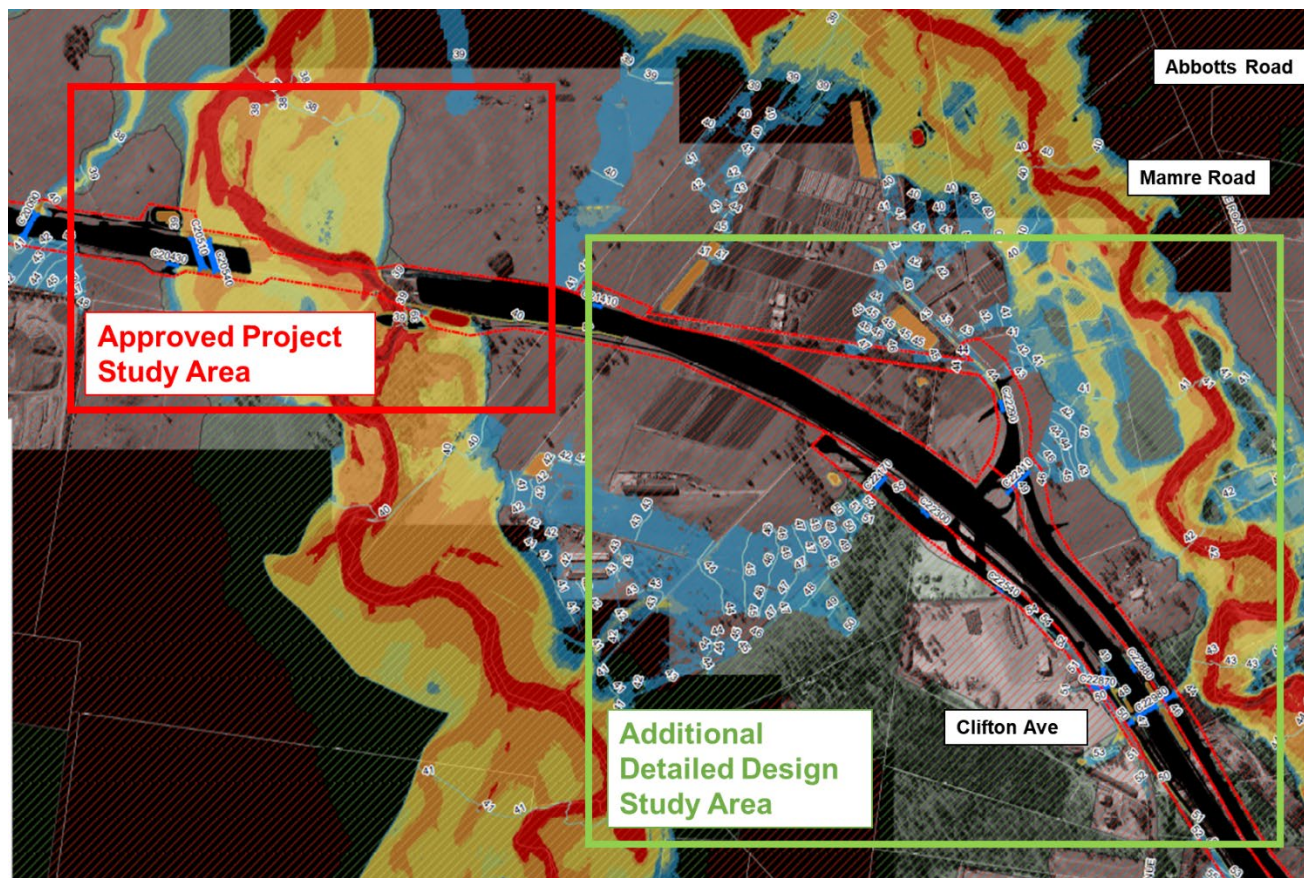


Figure 5.1 South Creek detailed design study area comparison with Approved Project study area

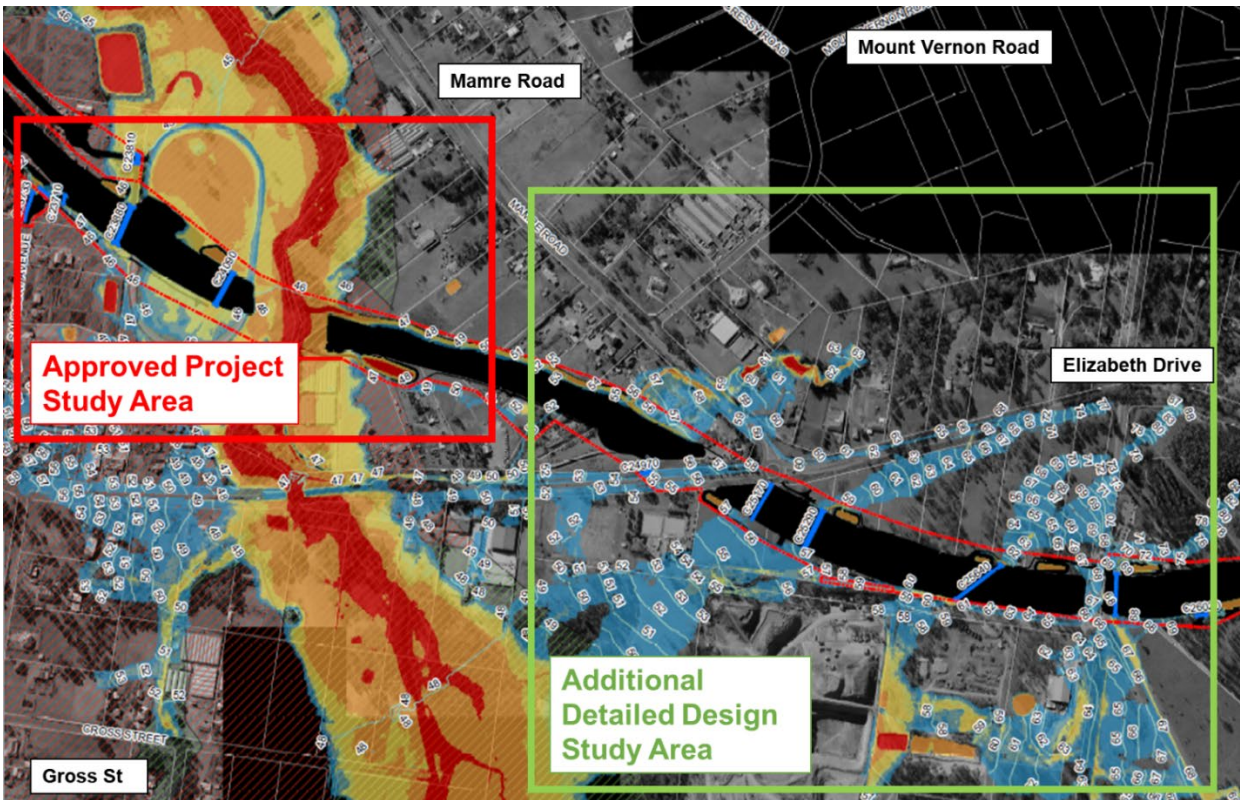


Figure 5.2 Kemps Creek detailed design study area comparison with Approved Project study area

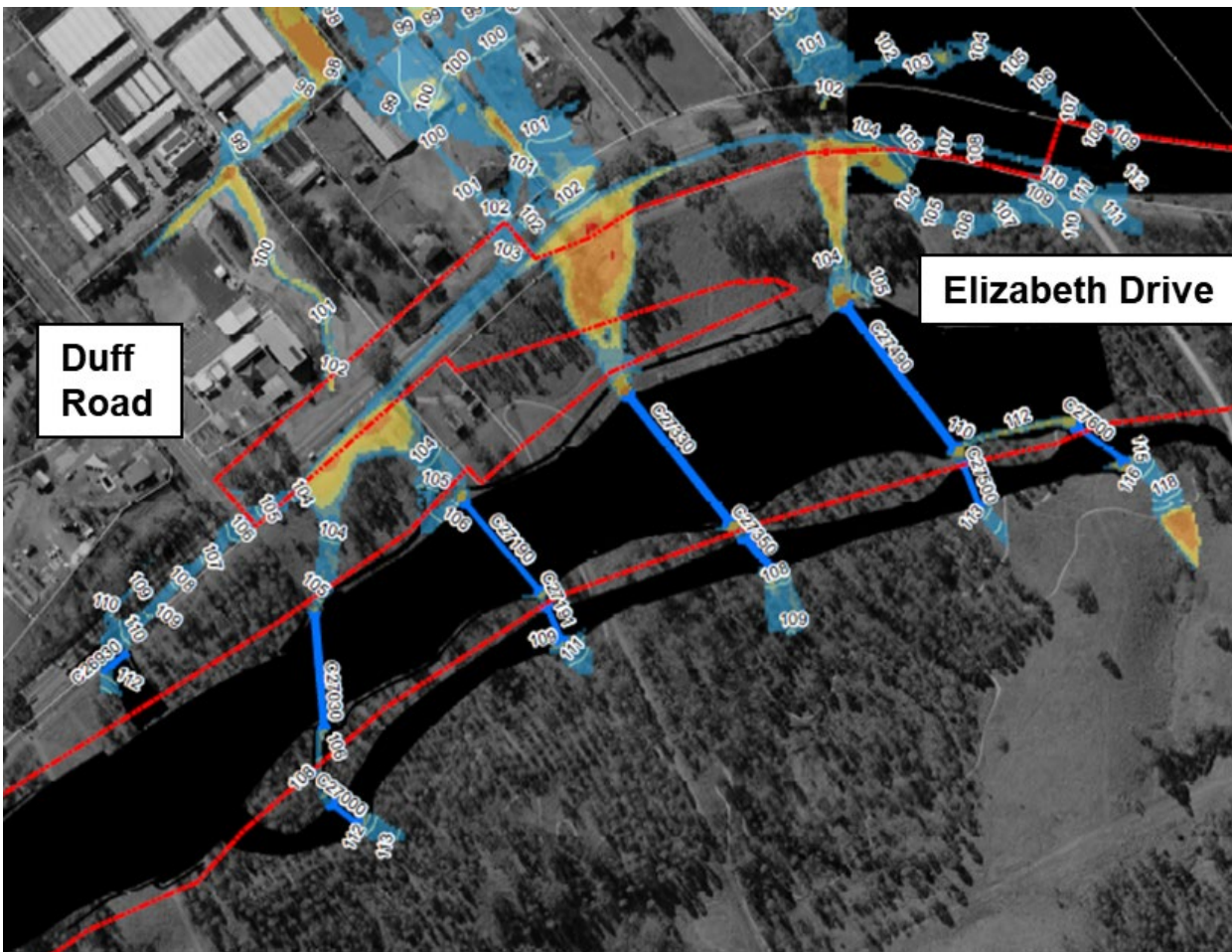


Figure 5.3 Ropes Creek detailed design study area for M12 Motorway central section

6. Existing environment

A description of the existing environment is provided in Section 5 of the EIS *Appendix L Flooding assessment report*. The project is located within the South Creek sub-catchment of the Hawkesbury-Nepean catchment and intersects Cosgroves Creek, Badgerys Creek, Kemps Creek and South Creek. The M12 central section project covers the Kemps and South Creek crossings. The project also intersects a number of minor drainage lines, including Ropes Creek. A description of the existing surface water environment is provided in Section 4 of the EIS *Appendix M Surface Water and Hydrology assessment report*.

7. Assessment of potential impacts

7.1 Summary of flooding assessment changes

The detailed design of the M12 central section has resulted in a number of design changes when compared with the approved project. Detailed comparisons with the approved project revised environmental management measures (REMMs) that are contained in Section 7 of the AR submission report and NSW conditions of approval are listed in Section 7.10. A summary of the key changes to the impact assessment findings resulting from the detailed design are listed below.

- Bridge updates. The Kemps Creek and South Creek bridges have been reduced in length and flood relief culverts have been provided through the bridge abutments. The geometric details of the Sydney University access bridge and approaches were included in the flood model and the cumulative flood impacts of the University access bridge and the M12 South Creek bridge were modelled. The updated assessment identified localised increases in flood levels above 100 mm outside the project operational boundary at the western abutment of South Creek bridge and upstream of the Sydney University access bridge. Velocity increases exceeding 10% were also found to occur through and downstream of the Sydney University access bridge. Increases in time of inundation over 1 hour have also been identified within the racetrack on the western side of the Kemps Creek bridge.
- Cross drainage structures have been included in the model to assess local catchment flow paths. Localised flood level increases above 50 mm outside the project have been identified.
- Updated road design geometry was added to the model, including road surface geometry, drainage channels and detention basins. These changes to the model did not result in significant changes to what was assessed in the approval documents.

7.2 Changes in Flood Affection

The results of the flood assessment have identified the following increases in flood level assessed during detailed design that are above the criteria set out in condition of approval E17. Condition of approval E17 requires a maximum increase in flood level of 100 mm in land zoned as rural or environmental and a maximum increase of 50 mm in land zoned as residential, industrial or commercial. Table 7.3 documents locations where flood affection is not compliant with the criteria outlined in conditions of approval. Where the criteria cannot be met, the conditions of approval allow for consultation with affected landowners.

Afflux refers to the increase in flood level due to the proposed design when compared with the existing condition. Afflux at locations other than South Creek and Kemps Creek was not assessed in the approval documents. The focus of the flooding assessment for the EIS (reported in EIS Appendix L Flooding assessment report) was on flood impacts at South Creek and Kemps Creek to meet the SEARs. At South Creek, the EIS predicted 1% AEP afflux of 93 mm and 143 mm at the upstream and downstream M12 boundaries respectively. The latest flood modelling predicts higher upstream impacts (up to 206 mm) largely occurring as result of the design of the Sydney University access bridge (BRXX) and approaches upstream of the M12 which have been modelled in greater detail, compared to the EIS. Figure 7.1 shows the EIS Flood level afflux at South Creek bridge and Appendix A, Figures A1 to A5 show the results of the detailed design assessment of flood level afflux along the entire M12 Central alignment.

Time of inundation refers to the duration of time that flooding depths are above 50 mm. CoA E17(a) requires that the increase in time of inundation is not greater than 1 hour when compared with the existing condition, unless agreed with the Planning Secretary. It was found that the detailed design would result in increased inundation times greater than 1 hour on the western side of the Kemps Creek floodplain, downstream of the M12 motorway. The affected area is shown in Appendix A, Figure A11. Further investigations will be carried out to determine whether this impact can be mitigated.

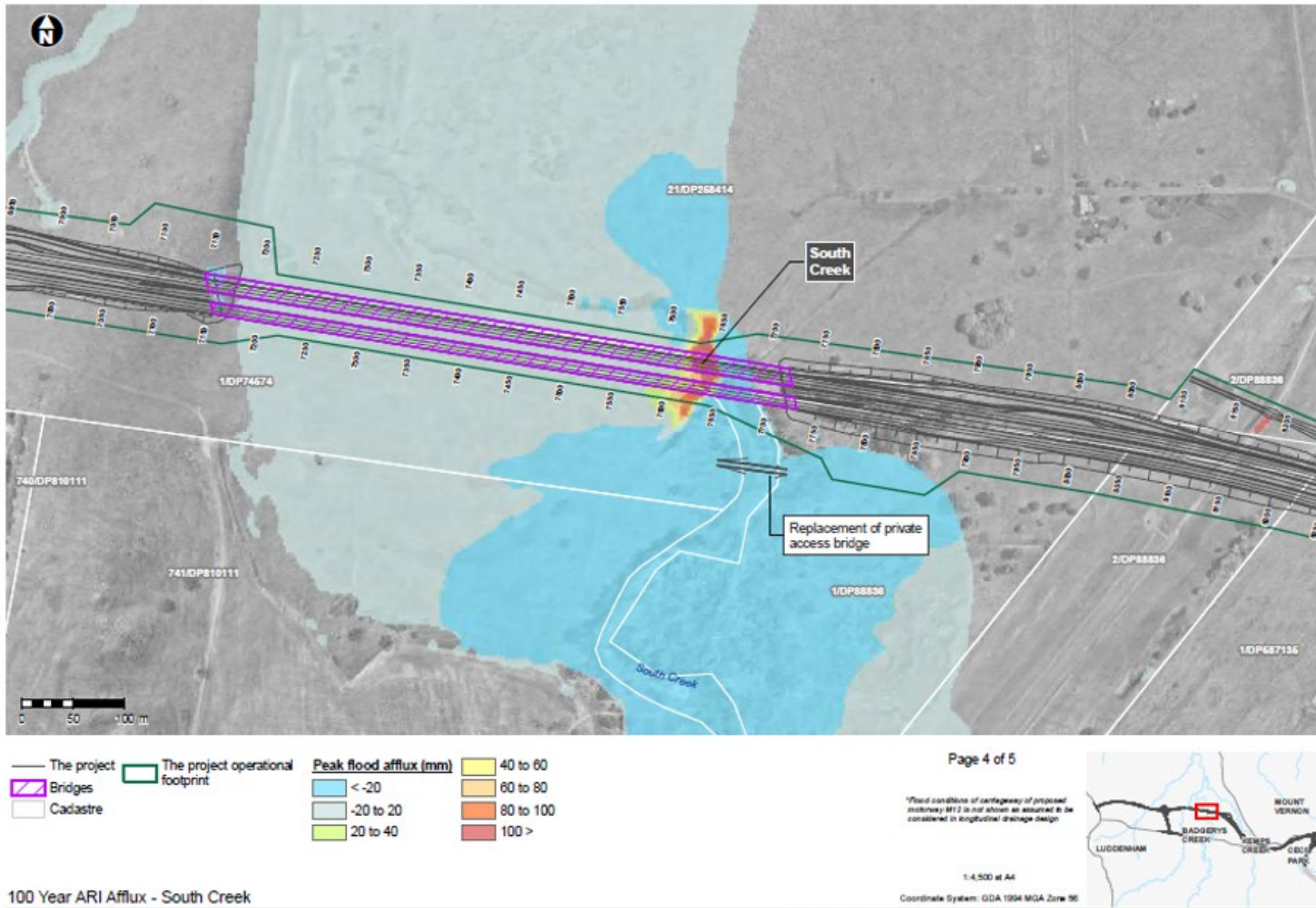


Figure 7.1 EIS Flood level afflux at South Creek bridge (Source: Roads and Maritime Services (2019, October) M12 Motorway, Environmental impact statement)

7.3 Changes to peak stormwater flows, downstream velocity and scour potential

The results of the flood assessment have identified the following increases in flood velocity assessed during detailed design that do not meet the criteria outlined in the conditions of approval. Condition of approval E17 requires a maximum increase in velocity of 10% where the resulting velocity is greater than 1 m/s. The conditions of approval allow increases above the criteria where adequate scour protection measures are implemented, and/or where velocity increases do not exacerbate erosion (as demonstrated through a site-specific risk or scour or geomorphological assessment) or where alternate mitigation can be negotiated with the landowner. Table 7.3 documents locations where flood velocity increases are not compliant with the criteria in the conditions of approval. Locations other than South Creek and Kemps Creek were not assessed during the EIS. While the EIS did note that velocity increases in excess of 20% would occur at South Creek which is consistent with the findings of the updated assessment, the terms of the Infrastructure Approval prevail and must be complied with.

Figures A6 to A10 in Appendix A, show the location where increases in velocity are not compliant with the criteria outlined in the conditions of approval and are not consistent the approved project, which, other than at South Creek and Kemps Creek, did not assess flooding impacts outside of the project operational footprint. These increases occur outside of the operational boundary on private land.

7.4 Changes in flood hazards

Changes in flood hazards were assessed by considering areas where the hazard rating had increased from H2 to H3 or larger. No significant increases in flood hazard category outside of the project operational boundary were observed.

As such the detailed design has not resulted in any changes to flood hazard compared to what was assessed in the approval documents and is consistent with the approved project.

7.5 Changes to hydraulic flow conveyance and beneficial floodplain inundation

The detailed design is consistent with the approved project in that flow distributions are largely unaltered and floodplain storage is retained by minimising changes in flood levels in the waterways outside the M12 operational boundary.

Changes to flow conveyance are consistent with the approved project with the exception that the creek adjustments proposed in the approval documents have been removed and existing flow conveyance at South Creek and Kemps Creek is largely retained.

7.6 Impacts on emergency management, evacuation and access

Flood evacuation routes in the vicinity of the project are improved due to the flood immunity of the M12.

The detailed design has not resulted in any changes to emergency management and evacuation as assessed in the approval documents and is consistent with the approved project.

7.7 Climate change

The 0.5% AEP and 0.2% AEP storm events have been considered as an approximation to the representative concentration pathways (RCP) RCP 4.5 and RCP 8.5 future emissions scenarios leading to climate change. These results have been compared with the 1% AEP results as a sensitivity check.

The detailed design has not resulted in any negative changes to the assessment of climate change in the approval documents and is consistent with the approved project.

7.8 Impacts on farm dams

The EIS noted that the M12 would have the potential to affect the yield of farm dams and a preliminary assessment of the M12 impact on yields was carried out. As part of the detailed design investigations, the effect of the project on farm dam yields was assessed in more detail.

CoA condition E24 states that for property/ies zoned primary production and where hydrologic modelling predicts that the CSSI will potentially reduce and adversely affect the available stormwater runoff yield to a farm dam, the Proponent must, in consultation with the affected landowner agree and implement appropriate mitigation measures.

The farm dams potentially affected by the M12 Central portion within land that is zoned primary production have been identified and these occur in the Ropes Creek catchment. The affected dams are shown on Figure 7.2. Four potentially affected dams were identified located on the north side of Elizabeth Drive.

The existing and proposed catchment areas and the proposed change in catchment area following construction of the M12 are shown in Table 7.1. The changes in catchment area are minor and range from zero to 3.9%. The net effect on the water balance is shown in Table 7.2. Despite the small reduction in catchment areas to three of the affected dams there is predicted to be a small increase in the annual yield as a result of an increase in paved area runoff in the catchments.



Figure 7.2 Potentially affected farm dams

Table 7.1 Farm dam catchment areas – existing and proposed

Dam affected	Lot ID	Pre developed catchment (ha)	Post developed catchment (ha)	Change in catchment (ha)	% change in catchment area
Dam 01	Lot 7 DP1014394	5.07	5.07	0.00	0.0%
Dam 02	Lot 1, DP508759	21.76	20.92	-0.84	-3.9%
Dam 03	Lot 12 DP507590	24.82	23.98	-0.84	-3.4%
Dam 04	Lot 2 DP707256	47.96	46.65	-1.31	-2.7%

Table 7.2 M12 Central impact on farm dam water balance

Dam affected	Change in catchment (ha)	Catchment area change impact on annual runoff (ML/yr)	Conversion of vegetated catchment to paved catchment (ha)	Increase in runoff from paved areas (ML/yr)	Net change in runoff (ML/yr)
Dam 01	0.00	-	-	-	-
Dam 02	-0.84	-1722	0.78	3104	1382
Dam 03	-0.84	-1722	0.78	3104	1382
Dam 04	-1.31	-2686	1.27	5055	2369

7.9 Locations where further consideration of impacts is required

As a result of the more detailed analysis of flooding impacts using the updated flood model which incorporates latest detailed design of bridges and transverse culverts, the flood impacts where the final conditions of approval criteria are not achieved are noted in Table 7.3. Table 7.3 also provides a comparison with the flood impacts that were documented in the approval documents. Proposed consultation and mitigation measures are also discussed in Table 7.3. Each of the locations in Table 7.3 are shown on the mapping that is contained in Appendix A.

In accordance with the flood impact criteria that is set out in condition E17 of the final conditions of approval, the flood assessment that has been carried out to support the detailed design of the project has considered a range of design flood events up to the 1% (1 in 100) Annual Exceedance Probability (AEP) in magnitude. For the purpose of summarising the key findings of the flood assessment and for comparison with the approval documents, the presentation of results in this memo has focused on the 1% AEP design flood event.

Table 7.3 M12 central section comparison of flood impacts where further assessment is required – 1% AEP event

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
C20090	Velocity increase exceeds criteria in Conditions of Approval (E17 (g))	Sydney University	<p>Velocities increased from 1.4 m/s to 1.7 m/s over small area of land near the M12 operational boundary in a 1% AEP flood event. Impacts are reduced in more frequent flood events.</p> <p>Additional land was acquired at the downstream side of the culvert to assist with transitioning culvert to a more natural velocity near the project boundary.</p>	Not assessed in approval documents	<p>In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present.</p> <p>The site specific assessment would involve consulting with Sydney University, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.</p>
South Creek Bridge	<p>Flood level afflux¹ exceeds criteria in Conditions of Approval (E17(e))</p> <p>Velocity increase exceeds criteria in Conditions of Approval (E17(g))</p>	Sydney University	<p>Afflux 0.11 m exceeds 0.10 m allowable impact criteria in land zoned environment and recreation over small portion of land upstream of M12 operational boundary at the western edge of the floodplain.</p> <p>The predicted flood level increase is 0.01 m higher than the Conditions of Approval criteria allow and this is the limit of accuracy of the flood model. Various relief culvert configurations were trialled to minimise the impact. A second flood relief culvert was introduced into the design with the aim of reducing flood level impacts during detailed design. Limited project corridor space precluded further refinement.</p> <p>Velocities increase from 1.3 m/s to 2.0 m/s downstream of M12 in a 1% AEP flood event. This impacts a small area of land adjacent to South Creek zoned Environment and Recreation within the Sydney University property.</p>	Afflux 0.93 m recorded at upstream project operational boundary at South Creek in approval documents	<p>Afflux:</p> <p>The predicted flood level increase is 0.01 m higher than the Conditions of Approval criteria allow and this is the limit of accuracy of the flood modelling. In accordance with the conditions, it is proposed to consult with Sydney University to obtain acceptance of the impact which occurs in the floodplain immediately upstream of the M12 corridor.</p> <p>Velocity:</p> <p>In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present.</p> <p>The site specific assessment would involve consulting with Sydney University, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.</p>

¹ Afflux refers to the increase in flood level due to the proposed design when compared with the existing condition.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
BRXX Sydney University Access Bridge) and South Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(e)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Sydney University	Afflux 0.21 m exceeds 0.10 m allowable impact criteria in land zoned environment and recreation Velocities increase from 2.1 m/s to 2.4 m/s on floodplain and from 1.2 m/s to 2.0 m/s in South Creek. The Sydney University access bridge was part of the EIS Concept Design however the localised flooding impacts of this bridge were not assessed for the EIS. Lowering of the bridge is not expected to reduce afflux due to additional head losses associated with the bridge deck being submerged. Additionally this would increase the risk of flood damage to the bridge and creek scour depths would be increased due to pressure scour from the interaction of flood water with the bridge deck.	Afflux 0.93 m recorded at upstream project operational boundary at South Creek in approval documents	Afflux: The predicted flood level increase is attributable to the presence of the University access bridge. . In accordance with the conditions, it is proposed to consult with Sydney University to obtain acceptance of the impact which occurs in the floodplain immediately upstream of the M12 corridor. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Scour protection has been provided in the design under the Sydney Uni access bridge and downstream on the eastern bank of South Creek. This will be placed in vulnerable areas of the creek banks following a site inspection and assessment of existing creek bank vegetation, prior to the construction phase. The site specific assessment would involve consulting with Sydney University, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.
C22981	Flood level afflux exceeds criteria in Conditions of Approval (E17(d)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Lot 6, DP812284	Afflux 0.20 m exceeds 0.05 m allowable impact criteria in land zoned Enterprise. The M12 outflow joins the Kemps Creek 1% AEP flood extent some 10 m downstream of the boundary. As noted in the EIS there is an increase in flowrate predicted downstream of the M12 boundary at this location. The corridor does not provide space to provide detention storage to mitigate the flow increase. Velocities increase from 0.9 m/s to 1.1 m/s downstream of M12. The velocity impact is not considered likely to result in scour.	Appendix M (Surface Water Quality and Hydrology Assessment) of the EIS predicted an increase of 0.16 m at this location.	Afflux: In accordance with the conditions of approval, it is proposed to consult with the affected landowner to obtain acceptance of the impact which occurs in the floodplain immediately downstream of the M12 corridor. Mitigation may include acquisition of a drainage easement in accordance with landowner approval, as proposed as a possible mitigation solution in the EIS. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
					<p>Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present.</p> <p>The site specific assessment would involve consulting with the affected landowner, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary.</p>
C23810	Flood level afflux exceeds criteria in Conditions of Approval (E17(e))	Lot 2, DP736951	Afflux 0.31 m exceeds 0.10 m allowable impact criteria in land zoned Environment and Recreation.	Not assessed in approval documents	Land is to be acquired by TfNSW. No mitigation is required.
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot B, DP102214	<p>Afflux exceeds 0.01 m at building floor level upstream of the project boundary. The building appears to be a shed located with the 5% AEP flood extent of Kemps Creek.</p> <p>The land is zoned Environment and Recreation.</p> <p>Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation and approval from with the owner Lot B, DP102214.</p>	EIS determined a 1mm impact upstream of the M12	<p>Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the shed and its contents and seek permission to undertake a site visit.</p> <p>If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary would need to be obtained.</p>
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot 30, DP30265	<p>Afflux exceeds 0.01 m at building structures upstream of the project boundary. The structures appear to be greenhouse structures located with the 5% AEP flood extent of Kemps Creek.</p> <p>The land is zoned Environment and Recreation.</p> <p>Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation, additional consistency assessment and approval from with the owner Lot B, DP102214.</p>	EIS determined a 1mm impact upstream of the M12	<p>Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the structures and their contents and seek permission to undertake a site visit.</p> <p>If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary would need to be obtained.</p>
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot 13 DP30265	<p>Afflux exceeds 0.01 m at building floor level downstream of the project boundary. The structure appears to be shed located with the 1% AEP flood extent of Kemps Creek.</p> <p>The land is zoned Environment and Recreation.</p> <p>Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require</p>	EIS did not determine a downstream impact at this location	<p>Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the structure and its contents and seek permission to undertake a site visit.</p> <p>If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary would need to be obtained.</p>

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
			consultation and approval from with the owner of Lot B, DP102214.		
Kemps Creek Bridge	Flood level afflux exceeds criteria in Conditions of Approval (E17(b))	Lot 8, DP30265	Afflux exceeds 0.01 m at building floor level downstream of the project boundary. The structures appear to be greenhouse structures located with the 1% AEP flood extent of Kemps Creek. The land is zoned Environment and Recreation. Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation, additional consistency assessment and approval from with the owner Lot B, DP102214.	EIS did not determine a downstream impact at this location	Further options will be investigated to mitigate the impact. If the impact cannot be mitigated, consultation will be required with the landowner to establish the nature of the structure and its contents and seek permission to undertake a site visit. If the impact cannot be mitigated and the shed is considered to be a 'Habitable Room', agreement from the Planning Secretary would need to be obtained.
C24090 (Kemps Creek Bridge Flood Relief Culvert)	Increase in inundation time exceeds criteria in Conditions of Approval ² (E17(a))	Lot B, DP102214	Increase in duration of inundation exceeds 1 hour within existing racetrack on west bank of Kemps Creek. Increase of between 1 and 2 hours in 1% annual exceedance probability (AEP). Options are being investigated to reduce the impact. The land is zoned Environment and Recreation. Further flood modelling shows that this impact could be removed by enlarging culverts under the race track north of the M12 within private land. This option would require consultation, additional consistency assessment and approval from with the owner Lot B, DP102214.	Not assessed in approval documents	Further options will be investigated to mitigate this impact. If this impact cannot be mitigated, Planning Secretary agreement will be required for this impact.
C26440	Flood level afflux exceeds criteria in Conditions of Approval (E17(e)) Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Western Sydney Parklands	Afflux 0.11 m exceeds 0.10 m allowable impact in land zoned environment and recreation in bushland downstream of M12 operational boundary. Velocities increase from 1.3 m/s to 1.8 m/s and 1.8 m/s to 2.0 m/s in bushland downstream of M12. These impacts are partly due to increased runoff from conversion of bushland to pavement and partially through the need to divert a small portion of the Hinchinbrook Creek catchment to the Kemps Creek. This was required because it was not possible to achieve the Water NSW NorBE requirements for flowrate and water quality in Hinchinbrook Creek within the confined corridor space. An option to install a gross pollutant trap was investigated but no suitable space was available and the road grading made outletting a buried structure difficult at this location due to a lack of	Not assessed in approval documents	Afflux: In accordance with the conditions of approval, it is proposed to consult with Western Sydney Parklands to obtain acceptance of the impact which occurs in the bushland immediately downstream of the M12 corridor. The afflux is 0.01m above the 0.10 m allowable impact. Velocity: In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present.

² Time of inundation refers to the duration of time that flooding depths are above 50 mm. CoA require that the increase in time of inundation is not greater than 1 hour when compared with the existing condition.

Location (Chainage)	Description of impact	Affected lots	Nature and extent of impact	Approval documents Impact	Proposed consultation or mitigation measures
			fall between the road pavement level and the boundary level.		The site specific assessment would involve consulting with Western Sydney Parklands, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary
C27191	Velocity increase exceeds criteria in Conditions of Approval (E17(g))	Western Sydney Parklands	Velocities increase from 1.1 m/s to 1.3 m/s upstream of culvert inlet outside M12 operational boundary.	Not assessed in approval documents	In accordance with the conditions of approval, a site-specific risk of scour or geomorphologic assessment will be undertaken to confirm whether exacerbation of erosion is likely due to the velocity increase. Initial assessment indicates no additional scour protection would be necessary as existing vegetation is expected to be adequate provided no pre-existing scour is present. The site specific assessment would involve consulting with Western Sydney Parklands, inspecting the affected area and obtaining photographs to document existing surface conditions downstream of the M12 boundary
C27350	Flood level afflux exceeds criteria in Conditions of Approval (E17(e))	Western Sydney Parklands	Afflux 0.38 m exceeds 0.10 m allowable impact in land zoned environment and recreation in bushland upstream of M12 operational boundary. Impact is localised at culvert inlet upstream of water tower access road. These works lie outside the M12 operational boundary and it is not considered feasible to meet the Conditions of Approval 0.1 m afflux limit at the inlet of the culvert. The impact is confined to a small area of bushland adjacent to the Water Tower Access Road culverts extending less than 5 m upstream of the culvert.	Not assessed in approval documents	In accordance with the conditions of approval, it is proposed to consult with Western Sydney Parklands to obtain acceptance of the impact which occurs in the bushland upstream of the M12 corridor.

7.10 Assessment of the detailed design against project commitments

7.10.1 Assessment of consistency against the approval documents

Table 7.4 assesses the M12 central section detailed design against the project's REMMs as outlined in Section 7 of the AR submission report. This considers if the detailed design would comply with the requirements.

Table 7.4 Assessment of the detailed design against relevant REMMs in the M12 central section project area

Ref.	Revised environmental mitigation measure	Discussion	Consistent
F01	Further flood investigations and hydrological and hydraulic modelling will be carried out during detailed design to ensure the flood immunity objectives and design criteria for the project are met. The modelling will be used to define the nature of both main stream flooding and major overland flow along the full length of the project corridor under pre- and post- project conditions and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow. The hydraulic model(s) will be based on two-dimensional hydraulic modelling software. The modelling will take into account any updated regional flood modelling and information available at the time.	Additional flood impact assessment, modelling and drainage design has been prepared as part of the detailed design. This is included within the M12 central section. Flood modelling undertaken for the detailed design include drainage, landscaping, property access, street lighting, active transport and utilities. The flood impact assessment has been updated to include the final design of the road, including culvert and other drainage structures. These have been assessed within a single model to confirm flood immunity objectives and design criteria for the project	Yes
F02	Should the updated flood modelling show the project will result in an adverse flooding impact, TfNSW will consult with landowners regarding appropriate mitigation measures to be implemented by the contractor in relation to each individual property.	The updated flood modelling has shown that there is the potential for impacts that exceed do not comply with the criteria that are set out in the CoA in relation to increases in the depth of inundation afflux and velocity. Subject to further assessment may occur and landowner consultation is may be required in accordance with the CoA.	Yes
F03	A flood management plan will be prepared as part of the CEMP for the project and will detail the processes for flood preparedness, materials management, weather monitoring, site management and flood incident management. The flood management 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) – TfNSW Erosion and Sedimentation Management Procedure (Roads and Traffic Authority 2009)	The proposed changes to the project would not impact on the ability to comply with this requirement. An overarching Flood Management Plan will be prepared by TfNSW	Yes

Ref.	Revised environmental mitigation measure	Discussion	Consistent
	<ul style="list-style-type: none"> – TfNSW Technical Guideline: Temporary Stormwater Drainage for Road Construction (Roads and Maritime 2011) – TfNSW Stockpile Management Guideline (Roads and Maritime 2011). 		
F04	Creek adjustments would be re-considered and/or further refined to minimise the impact on the creeks during detailed design.	<p>Bridge designs for Kemps Creek and South Creek have been refined to minimise creek impacts as part of the detailed design. This has included realignment of bridge piers to minimise creek disturbance.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
F05	Detailed construction staging plans will be developed during detailed design so that bridges and culverts are constructed in a way that minimises flood risk.	The proposed changes to the project would not impact on the ability to comply with this requirement. Construction staging plans have been developed during the detailed design that will form a basis for further development during the construction phase of the project.	Yes
F06	Measures to address potential impacts of culvert blockage on afflux will be further investigated during detailed design and may include the installation of debris deflectors, trash racks or similar on drainage inlets where reasonable and feasible.	<p>Culvert blockage has been assessed as part of the detailed design using the methodology listed in Australian Rainfall and Runoff 2019 Book 6 Chapter 6 Blockage of Hydraulic Structures. Culverts have been designed to be large enough to allow for blockages. No additional structures such as debris deflectors, trash racks or similar on drainage inlets have been identified as necessary.</p> <p>The proposed changes to the project would not impact on the ability to comply with this requirement.</p>	Yes
F09	The proposed bridges, culverts and changes to watercourses will be further refined during the detailed design to minimise potential flooding impacts.	Further refinement has been carried out to minimise flooding impacts	Yes
SWH 09	<p>Practical measures to prevent water pollution and control, abate or mitigate impacts to the environment will be investigated at the detailed design stages of the project with the aim to make improvements to the currently proposed water quality controls. Such measures may include:</p> <ul style="list-style-type: none"> – Larger or high efficiency temporary basins – Alternative dry bioretention operational basins. 	The design incorporates measures to mitigate water pollution including biofiltration basins, wetlands and spill containment measures.	Yes
SWH 10	The use of water sensitive urban design measures will be considered during detailed design to meet water quality objectives.	The design has incorporated water sensitive design measures where possible. The following measures have been incorporated into the design: swales, wetlands and biofiltration basins.	Yes
SWH 13	A set of hydrologic and hydraulic models will be developed, which are to be used to define the nature of both main stream flooding and major overland flow along the full length of	TUFLOW models have been developed and used to assess flood impacts, size bridges and culverts and develop flood mitigation solutions along the full length of the alignment. Consultation with affected landowners will occur	Yes

Ref.	Revised environmental mitigation measure	Discussion	Consistent
	<p>the project operational footprint under pre- and post-project conditions. The hydraulic model is to extend a sufficient distance upstream and downstream of the project operational footprint, to negate any boundary effects and to define the full extent of any impact that the project will have on patterns of both main stream flooding and major overland flow. The hydraulic model(s) is to be based on the TUFLOW (or equivalent) two-dimensional (in plan) hydraulic modelling software.</p> <p>The models will be used to verify the nature and extent of impacts and to confirm the type of mitigation measures required including potential mitigation measures identified throughout the EIS (see Table 5-9 in Appendix M of the EIS) and the amendment report and supplementary memo (see Table 5-6 in Appendix I of the amendment report).</p> <p>The models will also be used during detailed design to describe the interaction between the project and flows particularly with respect to culverts and to assist in refining the design for flows arriving at and travelling through culverts.</p> <p>If further modelling identifies impacts to private properties, TfNSW will consult with landowners regarding appropriate management measures to be implemented.</p>	where impacts outside the CoA occur and where the CoA allows for such consultation.	

7.10.2 Assessment of consistency against the CoA

Table 7.5 assesses the M12 central section detailed design against the project's NSW conditions of approval (CoA) issued on 23 April 2021.

Table 7.5 Consistency against relevant Minister's conditions of approval for the project

Ref.	Condition of approval	Discussion	Consistent
E17	<p>Unless otherwise agreed by the Planning Secretary, the CSSI must be designed and constructed to limit impacts on flooding characteristics in areas outside the project boundary during any flood event up to and including the 1% AEP flood event, to the following:</p> <p>a) a maximum increase in inundation time of one hour;</p> <p>b) a maximum increase of 10 mm in above-floor inundation to habitable rooms where floor levels are currently exceeded;</p> <p>c) no above-floor inundation of habitable rooms which are currently not inundated;</p> <p>d) a maximum increase of 50 mm in inundation of land zoned as residential, industrial or commercial;</p>	<p>a) Increase in inundation above one hour has been minimised throughout the project, with the exception of at the racetrack at Kemps Creek, which experiences in time of inundation of up to 2 hours, contained within the racetrack as noted in Table 7.3. Further assessment will be carried out to mitigate this impact. If the impact cannot be mitigated, Planning Secretary approval will be sought.</p> <p>b) No increase of above floor inundation where floor levels are currently exceeded is recorded across the project with the exception of a number of sheds and outdoor structures identified within the existing 1% flood extent of Kemps Creek. Further assessment will be carried out to</p>	Yes

Ref.	Condition of approval	Discussion	Consistent
	<p>e) a maximum increase of 100 mm in inundation of land zoned as to rural, primary production, environment zone or public recreational;</p> <p>f) no significant increase in the flood hazard or risk to life; and</p> <p>g) maximum relative increase in velocity of 10%, where the resulting velocity is greater than 1.0 m/s, unless adequate scour protection measures are implemented and/or the velocity increases do not exacerbate erosion as demonstrated through site-specific risk of scour or geomorphological assessments.</p> <p>Where the Proponent cannot meet the requirements set out in clauses (d), (e) and (g) alternative flood levels or mitigation measures may be agreed to with the affected landowner.</p> <p>In the event that the Proponent and the affected landowner cannot agree on the measures to mitigate the impact as described in clauses d), e) and g), the Proponent must engage a suitably qualified and experienced independent person to advise and assist in determining the impact and relevant mitigation measures.</p> <p>Measures identified in the documents listed in Condition A1 that are aimed at minimising the impact of the CSSI on flood behaviour must be incorporated into its detailed design. The incorporation of these measures must be reviewed and endorsed by a suitably qualified and experienced person in consultation with directly affected landowners, EESG, DPI Fisheries, NSW State Emergency Service (SES) and relevant councils</p>	<p>mitigate this impact or to consult with the landowners regarding the nature of the structures and their contents. This would include seeking permission to inspect the site. If the impact cannot be mitigated, Planning Secretary approval will be sought.</p> <p>c) No above floor inundation of habitable rooms which are not currently inundated recorded.</p> <p>d) Some increases greater than 50 mm in residential, industrial or commercial zones are recorded in Table 7.3. Consultation will be undertaken with the affected landowner and if agreement cannot be reached, a suitably qualified and experienced independent person would be engaged to advise and assist in determining the impact and relevant mitigation measures.</p> <p>e) Some increases greater than 100 mm in rural, primary production, environment zone or public recreational zones are recorded in Table 7.3. Consultation will be undertaken with the affected landowner and if agreement cannot be reached, a suitably qualified and experienced independent person would be engaged to advise and assist in determining the impact and relevant mitigation measures.</p> <p>f) A significant increase flood hazard or risk to life has been defined as an increase in the hazard category from H2 to H3 or above. No significant increase in flood hazard has been created by the project.</p> <p>g) Some increases greater than 10% where the resulting velocity is greater than 1.0 m/s are recorded in Table 7.3. At a number of locations where velocity increases are greater than 10% it has been determined that the vegetation will be able to withstand the increased velocities. This will be confirmed by undertaking and documenting a site specific assessment of scour risk. This would include site inspections with permission from the affected landowners. At South Creek, additional scour protection measures will be provided in the form of rock protection to the creek banks at vulnerable locations, subject to site inspection and review of the existing vegetation coverage of the creek banks. At other locations it is proposed to agree on suitable scour protection measures which may include monitoring and remediation during the operational phase. These measures will be carried out in</p>	

Ref.	Condition of approval	Discussion	Consistent
		<p>agreement with the affected landowners.</p> <p>Where the design does not meet the requirements of (d), (e) and (g) and the proponent and affected landowner cannot agree on the measures to mitigate the impact TfNSW will engage a suitably qualified and experienced independent person to advise and assist in determining the impact and relevant mitigation measures. Finally in the event that suitable mitigation measures cannot be included in the design, or where landowner agreement to the impacts cannot be reached, Planning Secretary approval for the impact will be sought.</p>	
E19	<p>Updated flood modelling must be undertaken for the full range of flood events, including 5% AEP, 1% AEP, PMF and 0.5% AEP or 0.2% AEP and must have regard to the Wianamatta (South) Creek Catchment Flood Study - Existing Conditions (Revision H) (Advisian Worley Group, November 2020) when validating existing flood behaviour and constraints. The modelling must identify changes in post-development flood behaviour including cumulative flood impacts associated with Western Sydney International Airport and Sydney Metro Western Sydney Airport, where this information is available, prior to detailed design being finalised.</p>	<p>The updated flood modelling includes all events specified and has been run to assess post development flood behaviour.</p> <p>The updated flood modelling has been developed and validated with regard to the Wianamatta (South) Creek Catchment Flood Study - Existing Conditions (Revision H) (Advisian Worley Group, November 2020).</p> <p>Where relevant, the flood assessment that is being undertaken for detailed design utilises the latest information available on the WSIA and SMWSA projects.</p>	Yes
E24	<p>"For property/ies zoned primary production and where hydrologic modelling predicts that the CSSI will potentially reduce and adversely affect the available stormwater runoff yield to a farm dam, the Proponent must, in consultation with the affected landowner:</p> <p>(a) calculate the nature and extent of impacts on water supply;</p> <p>(b) determine what measures may be implemented to prevent, mitigate, compensate or offset a loss in water supply; and</p> <p>(c) implement the measures agreed with the potentially affected landowner at no cost to the landowner.</p> <p>The agreed measures must be implemented prior to undertaking any works that would directly affect the flow of water into the landowner's farm dams.</p> <p>In the event that the Proponent and landowner cannot agree on the measures to mitigate the impact, the Proponent shall engage a suitably qualified and experienced independent person to advise and assist in determining appropriate mitigation measures. "</p>	<p>Hydrologic modelling has been carried out for property/ies zoned primary production to identify if any properties are adversely affected through a change to the available stormwater runoff yield to a farm dam.</p> <p>The nature and extent of impacts have been assessed and mitigation measures reviewed. Small changes to the overall catchment have been identified but no reduction in yield is noted. No measures have been identified as necessary to mitigate this. This is discussed in Section 7.8.</p> <p>Properties impacted have been identified and are shown in Table 7.1.</p>	Yes
E110	<p>All new or modified drainage systems associated with the CSSI must be designed to:</p>	<p>The Penrith City Council drainage culvert in Clifton Avenue has been upgraded to mitigate impacts from the operation of the M12. New or modified drainage systems</p>	Yes

Ref.	Condition of approval	Discussion	Consistent
	<p>(a) where stormwater drainage is discharged to a council's stormwater system, meet the capacity constraints of any council's drainage system to receive and convey the proposed flows from the CSSI, or otherwise upgrade council's drainage system at the Proponent's expense, in consultation with the relevant council(s);</p> <p>(b) minimise impacts on the receiving environment at the final outflow point resulting from any additional flow volume (including, but not limited to scour, flooding, water quality impacts and impacts on riparian vegetation, aquatic ecology and property); and</p> <p>(c) ensure mitigation measures are implemented where increased flows through cross drainage systems adversely impact on council's or Sydney Water drainage infrastructure and the receiving environment.</p>	<p>have been designed to minimise flow increases to Council drainage systems in the South Creek and Kemps Creek catchments. In the Ropes Creek catchment, downstream flood levels north of Elizabeth Drive are compliant with the CoA (due to increased ponding of flood water upstream of Elizabeth Drive) however the adjoining Elizabeth Drive upgrade works may require detention storage to mitigate the impact of both projects once Elizabeth Drive is altered. This has resulted in no further upgrades to Council systems being required.</p> <p>The project is therefore compliant with the requirement to minimise impacts on the receiving environment at the final outflow point as the design does not increase flow volume.</p>	

8. Environmental management measures

The environmental management measures proposed in the REMMS and CoA are considered appropriate. Primarily the updated flooding assessment has shown the potential requirement for scour protection at some locations outside the M12 operational boundary to address potential velocity increases that were not identified in the approval documents.

A review of flooding impacts outside the project operational boundary at all culverts and bridges has been carried out and Table 7.3 lists those locations where further consideration of impacts is required. In accordance with the CoA, the proposed consultation or mitigation measures proposed are summarised in Table 7.3.

9. Conclusion

The proposed changes to the project relative to the Division 5.2 Approval and EPBC Approval have been described and the results of a detailed flooding assessment of the detailed design are described. The detailed flooding assessment of the changes demonstrates flood impacts consistent with the EIS however it is noted that the EIS did not examine flood impacts in detail along the entire M12 Central project extent and the current assessment has identified impacts not previously reported. These impacts have been reviewed and treatment measures that are consistent with the CoA have been presented and are summarised in Table 7.3.

10. References

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), (2019), Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia

GHD (2021a). M12 Motorway – *Central Package Detailed Design Report – Flooding and Hydrology* (M12CDD-GHDA-ALL-SD-RPT-000100).

GHD (2021b) M12 Motorway – *Central Package Detailed Design Report – Stormwater Drainage Report* (M12DD-GHDA-ALL-SD-RPT-000001)

GHD (2021c) M12 Motorway – *Central Package Detailed Design Report – Design Development Plan* (M12CDD-GHDA-ALL-DN-PLN-000002).

GHD (2021d) M12 Motorway – *Central Package Detailed Design Report – Waterway Report* (M12CDD-GHDA-ALL-SD-RPT-000003)

GHD (2021e) M12 Motorway – *Central Package Detailed Design Report – Construction Wetland Design Report* (M12CDD-GHDA-ALL-SD-RPT-000010)

Transport for NSW (2020b). *M12 Motorway, Amendment Report Submissions Report* (the AR Submissions Report)

Transport for NSW (2020c). *M12 Motorway, Amendment Report* (the Amendment Report)

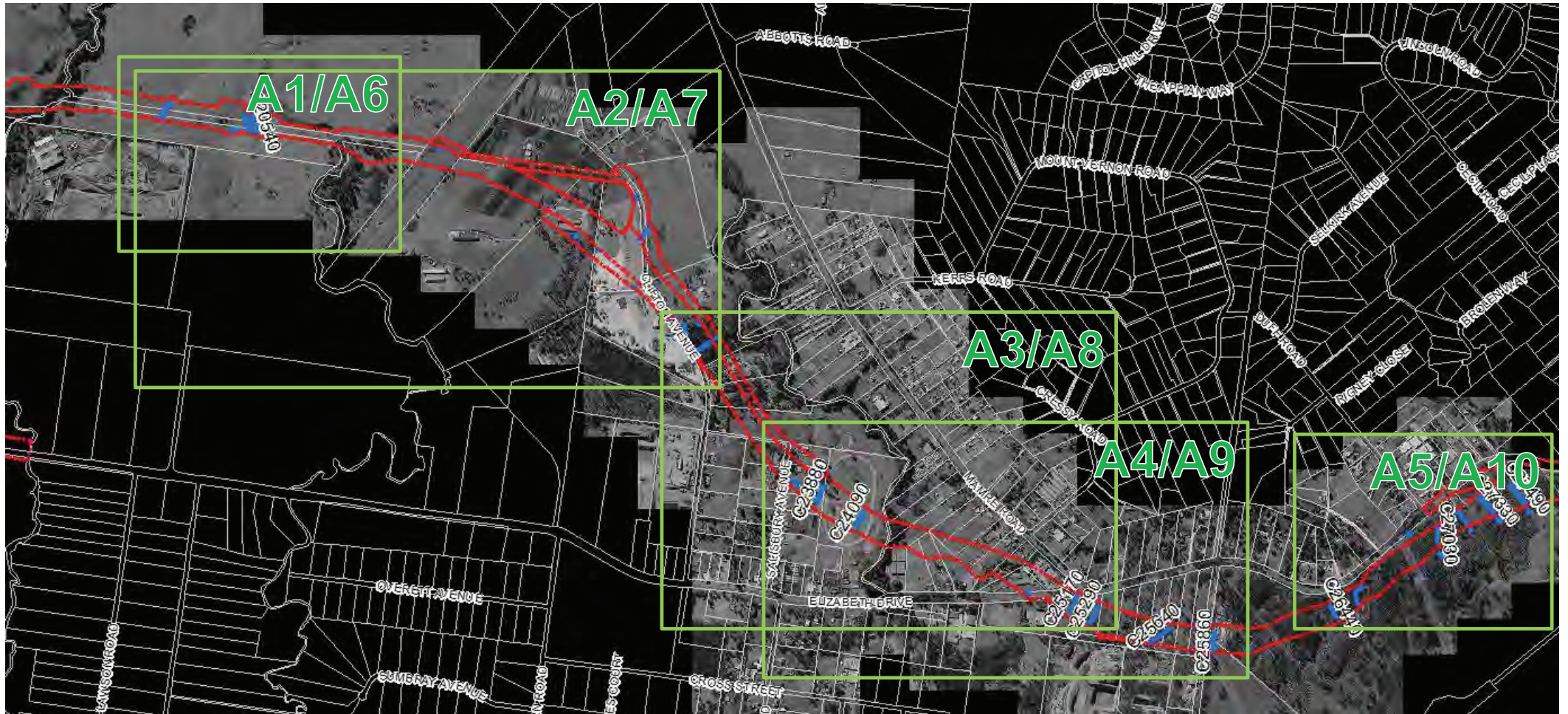
Transport for NSW (2020d). *M12 Motorway, Submissions Report* (the Submissions Report)

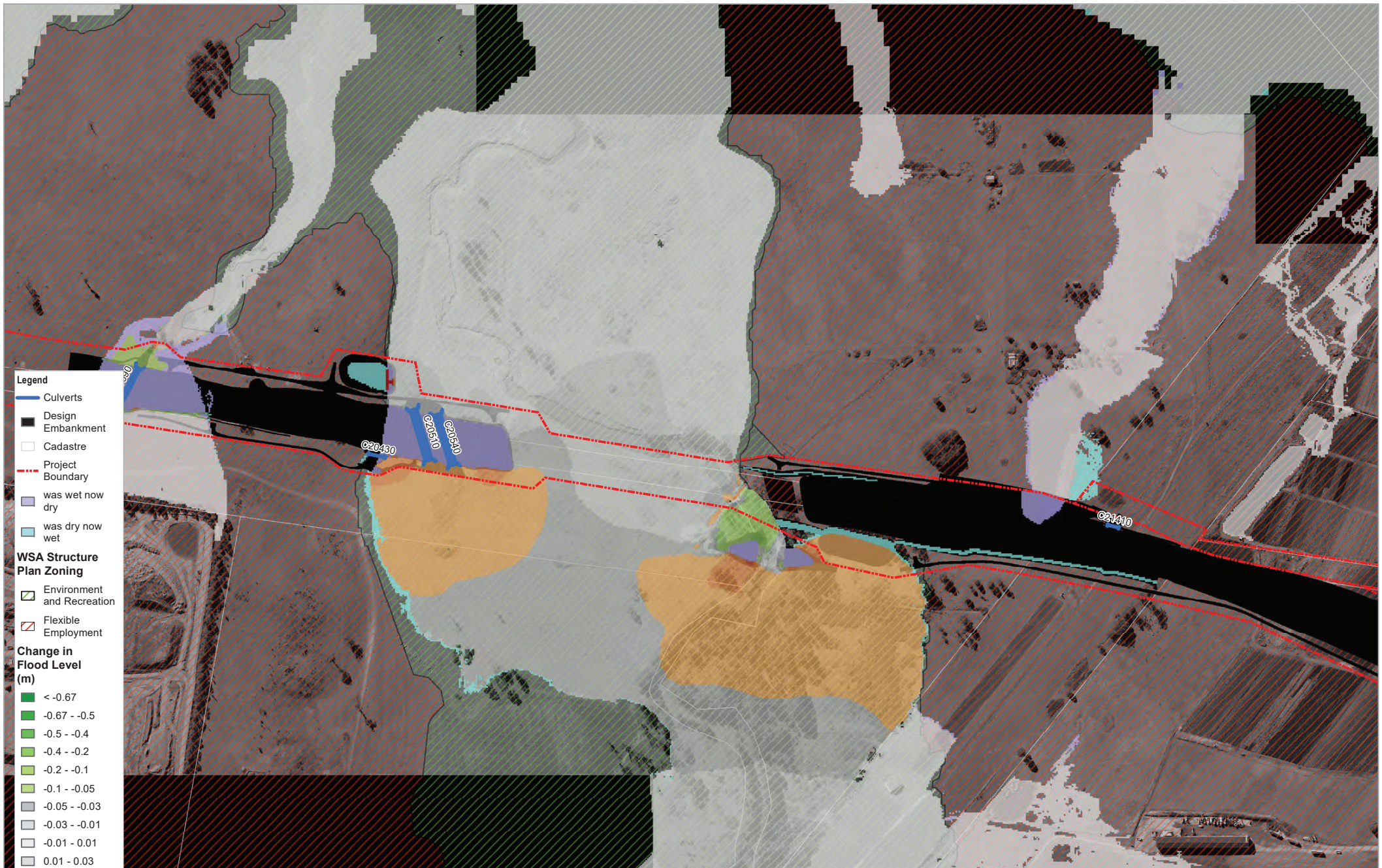
Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*.

Appendices

Appendix A

Flood mapping figures

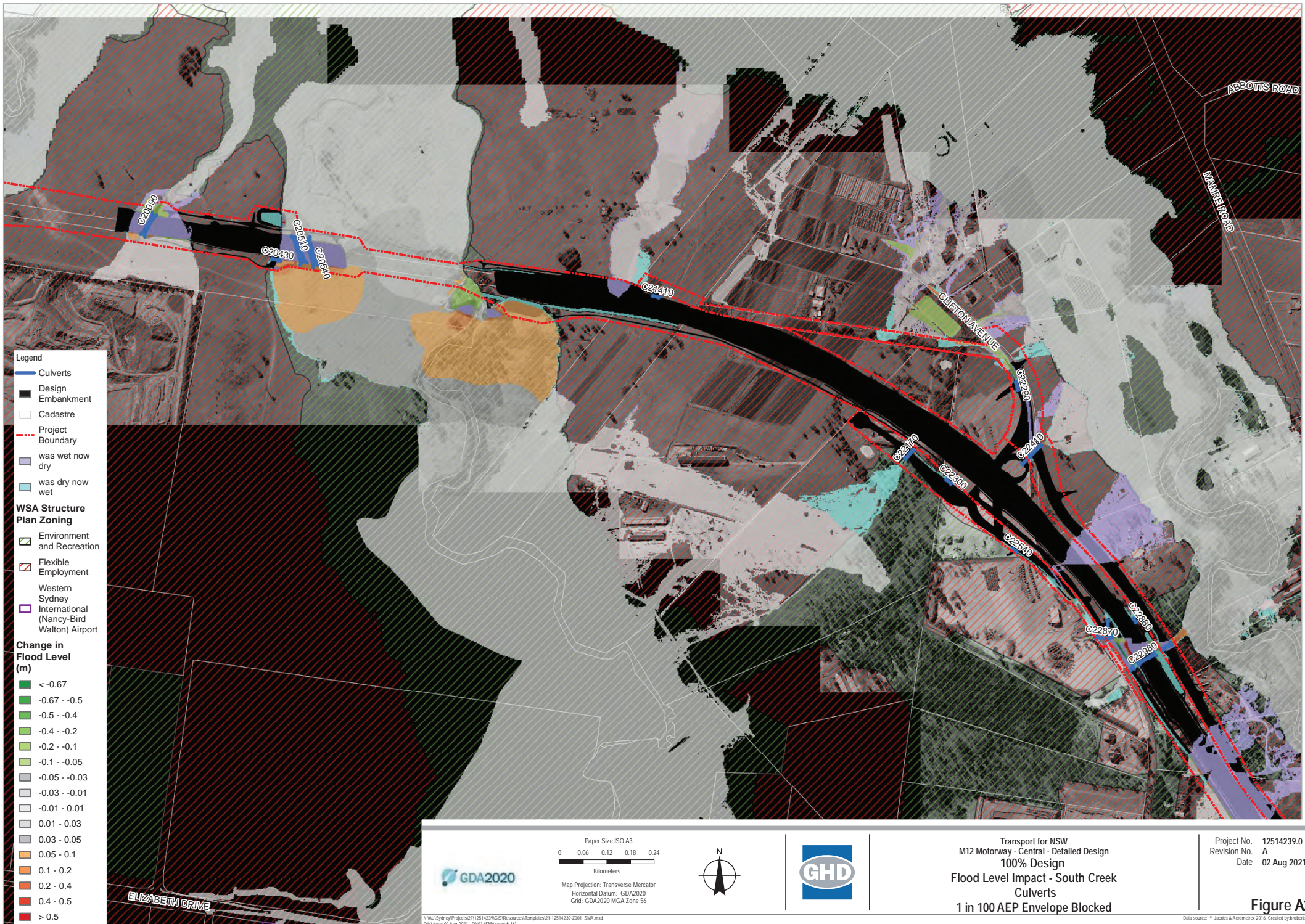




- Legend**
- Culverts
 - Design Embankment
 - Cadastre
 - Project Boundary
 - was wet now dry
 - was dry now wet
- WSA Structure Plan Zoning**
- Environment and Recreation
 - Flexible Employment
- Change in Flood Level (m)**
- <math>< -0.67</math>
 - 0.67 - -0.5
 - 0.5 - -0.4
 - 0.4 - -0.2
 - 0.2 - -0.1
 - 0.1 - -0.05
 - 0.05 - -0.03
 - 0.03 - -0.01
 - 0.01 - 0.01
 - 0.01 - 0.03
 - 0.03 - 0.05
 - 0.05 - 0.1
 - 0.1 - 0.2
 - 0.2 - 0.4
 - 0.4 - 0.5
 - > 0.5

	Paper Size ISO A3 0 0.03 0.06 0.09 0.12 Kilometers			Transport for NSW M12 Motorway - Central - Detailed Design 100% Design	Project No. 12514239.0 Revision No. A Date 01 Aug 2021
	Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56			Flood Level Impact - South Creek 12 Spans @ 33m 1 in 100 AEP 12 hour TP 5 Blocked	Figure A1 <small>Data source: © Jacobs & Aerometrex 2016. Created by Ironborton</small>

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 Print date: 01 Aug 2021 - 23:58 (SMA record: 13)



- Legend**
- Culverts
 - Design Embankment
 - Cadastre
 - Project Boundary
 - was wet now dry
 - was dry now wet
- WSA Structure Plan Zoning**
- Environment and Recreation
 - Flexible Employment
 - Western Sydney
 - International (Nancy-Bird Walton) Airport
- Change in Flood Level (m)**
- <math>< -0.67</math>
 - 0.67 - -0.5
 - 0.5 - -0.4
 - 0.4 - -0.2
 - 0.2 - -0.1
 - 0.1 - -0.05
 - 0.05 - -0.03
 - 0.03 - -0.01
 - 0.01 - 0.01
 - 0.01 - 0.03
 - 0.03 - 0.05
 - 0.05 - 0.1
 - 0.1 - 0.2
 - 0.2 - 0.4
 - 0.4 - 0.5
 - > 0.5



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 Kilometers
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56



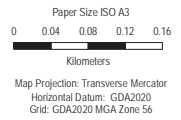
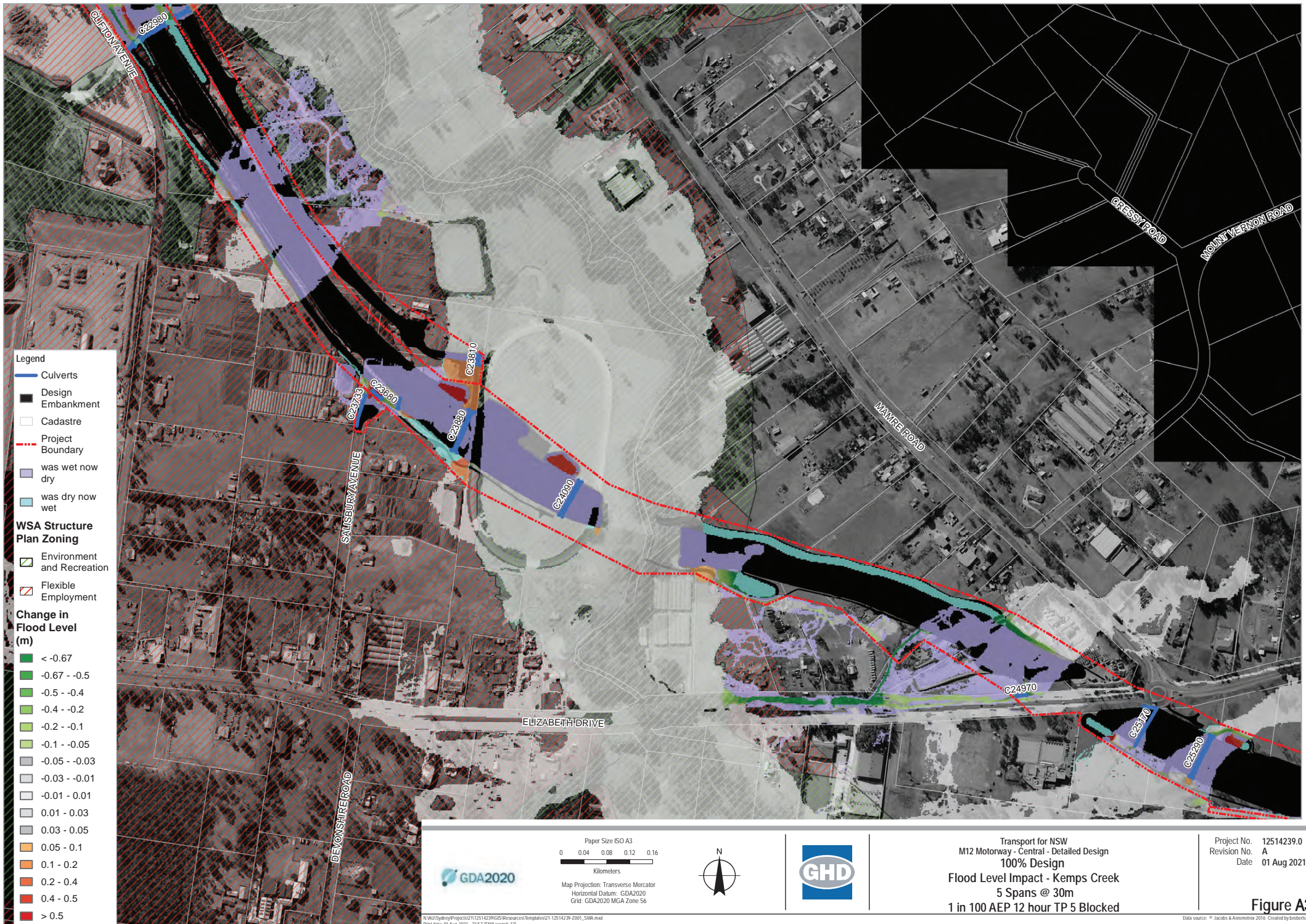
Transport for NSW
 M12 Motorway - Central - Detailed Design
 100% Design
 Flood Level Impact - South Creek
 Culverts
 1 in 100 AEP Envelope Blocked

Project No. 12514239.0
 Revision No. A
 Date 02 Aug 2021

Figure A2

Data source: © Jacobs & Aecom/rev 2016. Created by Imbertson

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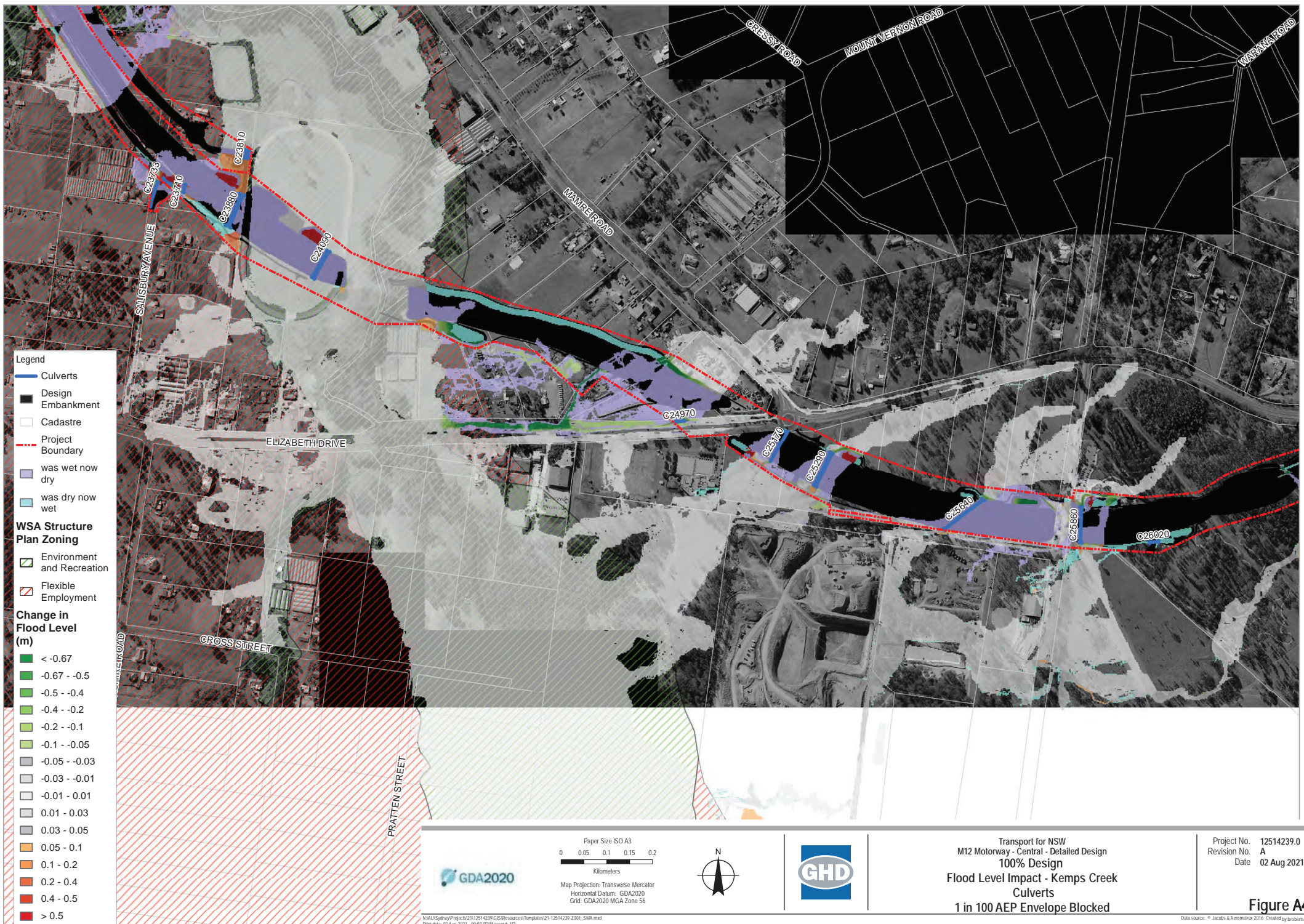


Transport for NSW
M12 Motorway - Central - Detailed Design
100% Design
Flood Level Impact - Kemps Creek
5 Spans @ 30m
1 in 100 AEP 12 hour TP 5 Blocked

Project No. 12514239.0
Revision No. A
Date 01 Aug 2021

Figure A3

Data source: © Jacobs & Associates 2016. Created by Imbertson



Legend

- Culverts
- Design Embankment
- Cadastre
- Project Boundary
- was wet now dry
- was dry now wet

WSA Structure Plan Zoning

- Environment and Recreation
- Flexible Employment

Change in Flood Level (m)

- < -0.67
- 0.67 - -0.5
- 0.5 - -0.4
- 0.4 - -0.2
- 0.2 - -0.1
- 0.1 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- 0.01 - 0.01
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.5
- > 0.5

Paper Size ISO A3

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

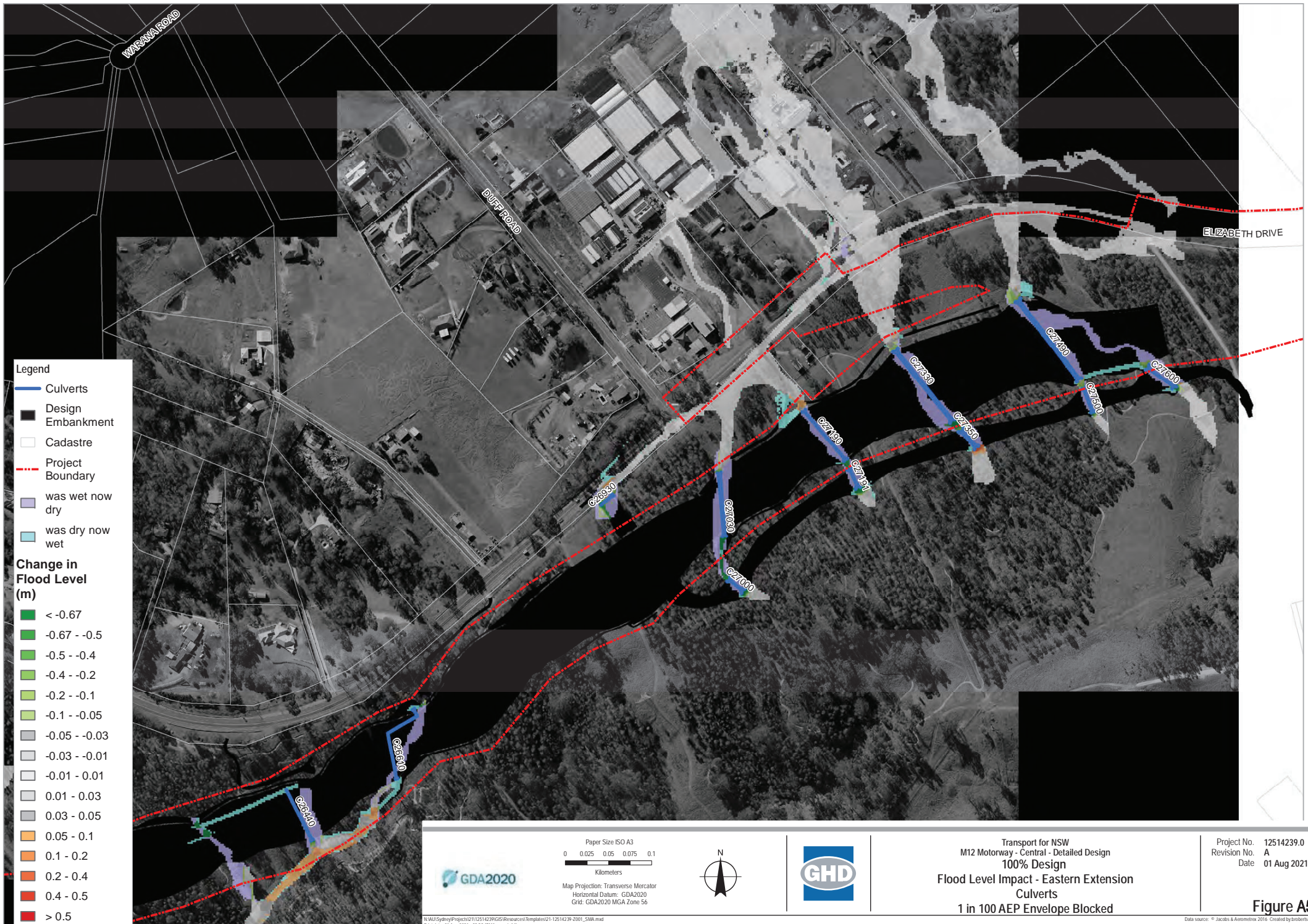


Transport for NSW
M12 Motorway - Central - Detailed Design
100% Design
Flood Level Impact - Kemps Creek
Culverts
1 in 100 AEP Envelope Blocked

Project No. 12514239.0
Revision No. A
Date 02 Aug 2021

Figure A4

Data source: © Jacobs & Associates 2016. Created by Robertson



Legend

- Culverts
- Design Embankment
- Cadastre
- Project Boundary
- was wet now dry
- was dry now wet

Change in Flood Level (m)

- < -0.67
- 0.67 - -0.5
- 0.5 - -0.4
- 0.4 - -0.2
- 0.2 - -0.1
- 0.1 - -0.05
- 0.05 - -0.03
- 0.03 - -0.01
- 0.01 - 0.01
- 0.01 - 0.03
- 0.03 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.4
- 0.4 - 0.5
- > 0.5

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 Kilometers
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56

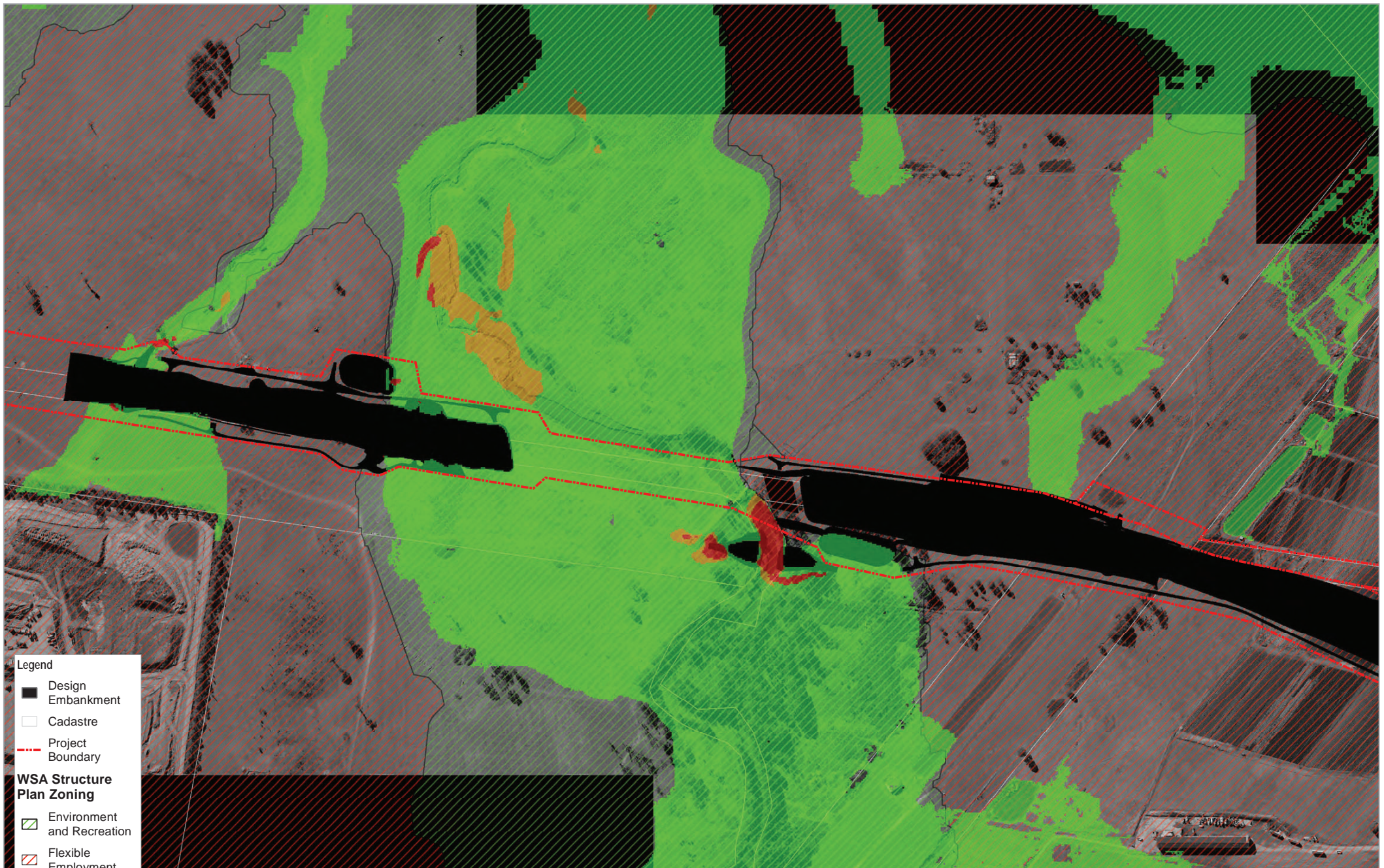


Transport for NSW
 M12 Motorway - Central - Detailed Design
 100% Design
 Flood Level Impact - Eastern Extension
 Culverts
 1 in 100 AEP Envelope Blocked

Project No. 12514239.0
 Revision No. A
 Date 01 Aug 2021

Figure A5

Data source: © Jacobs & Aecom/rev 2016. Created by Amberson



Legend

- Design Embankment
- Cadastre
- Project Boundary

WSA Structure Plan Zoning

- Environment and Recreation
- Flexible Employment

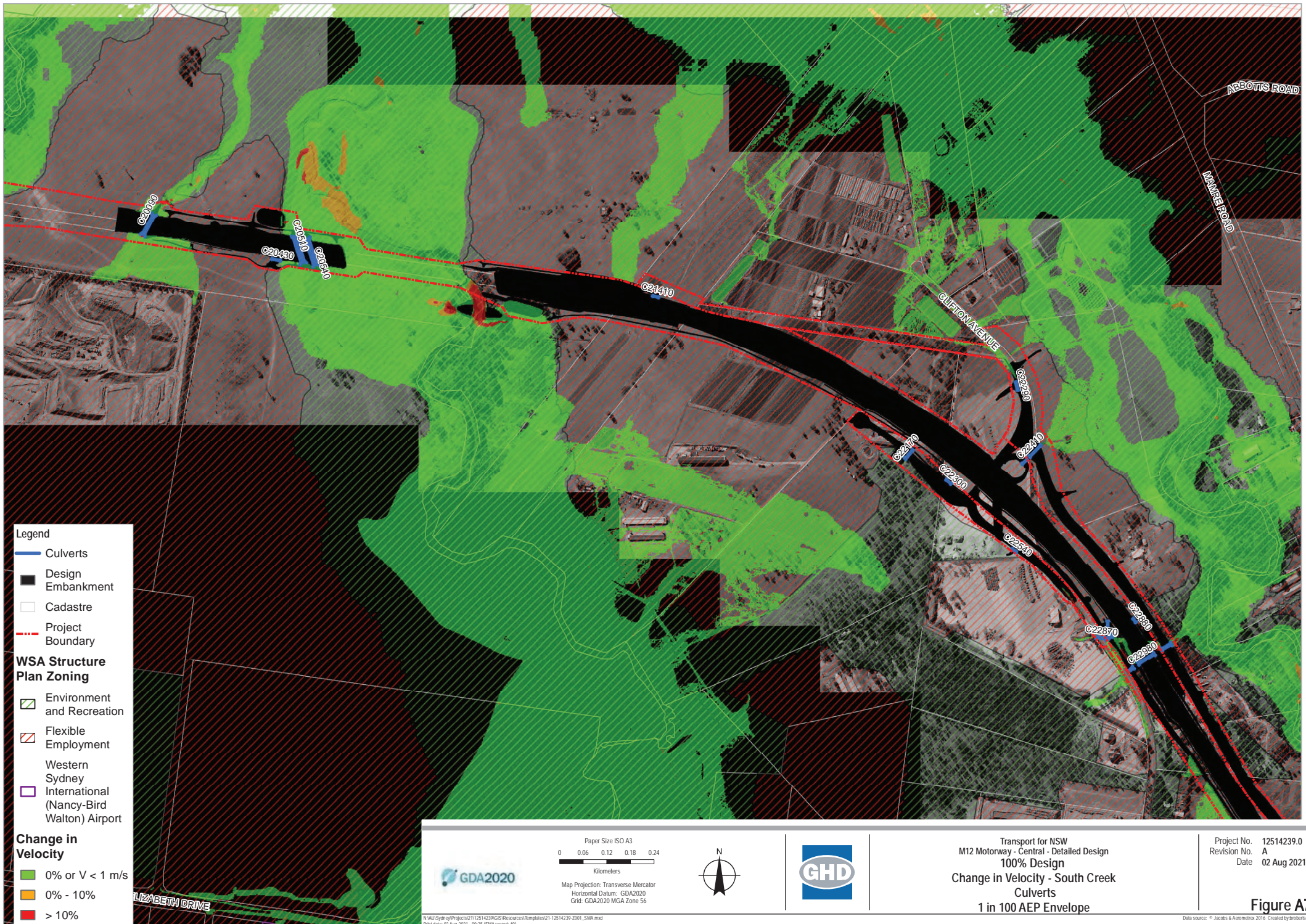
Change in Velocity

- 0% or $V < 1$ m/s
- 0% - 10%
- > 10%

	<p>Paper Size ISO A3</p> <p>0 0.03 0.06 0.09 0.12</p> <p>Kilometers</p> <p>Map Projection: Transverse Mercator Horizontal Datum: GDA2020 Grid: GDA2020 MGA Zone 56</p>			<p>Transport for NSW M12 Motorway - Central - Detailed Design 100% Design Change in Velocity - South Creek 12 Spans @ 33m 1 in 100 AEP Envelope</p>	<p>Project No. 12514239.0 Revision No. A Date 02 Aug 2021</p>
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Figure A6

Data source: © Jacobs & Aecom/rev 2016. Created by Amberson



Legend

- Culverts
- Design Embankment
- Cadastre
- Project Boundary

WSA Structure Plan Zoning

- Environment and Recreation
- Flexible Employment
- Western Sydney International (Nancy-Bird Walton) Airport

Change in Velocity

- 0% or $V < 1$ m/s
- 0% - 10%
- > 10%

Paper Size ISO A3

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

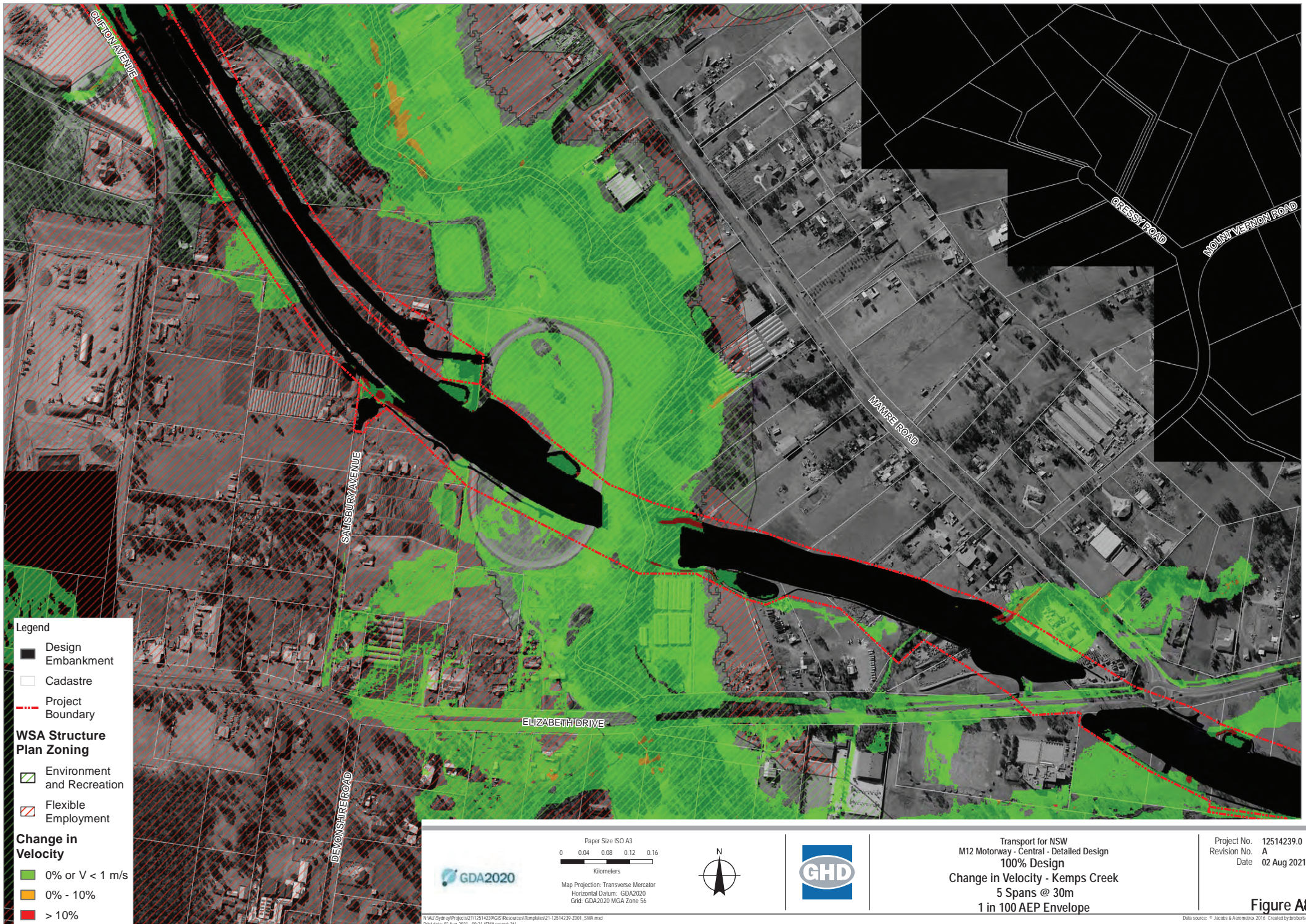


Transport for NSW
M12 Motorway - Central - Detailed Design
100% Design
Change in Velocity - South Creek
Culverts
1 in 100 AEP Envelope

Project No. 12514239.0
Revision No. A
Date 02 Aug 2021

Figure A7

Data source: © Jacobs & Associates 2016. Created by Imbertson



Legend

- Design Embankment
- Cadastre
- Project Boundary

WSA Structure Plan Zoning

- Environment and Recreation
- Flexible Employment

Change in Velocity

- 0% or $V < 1$ m/s
- 0% - 10%
- > 10%

Paper Size ISO A3
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 Kilometers
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56

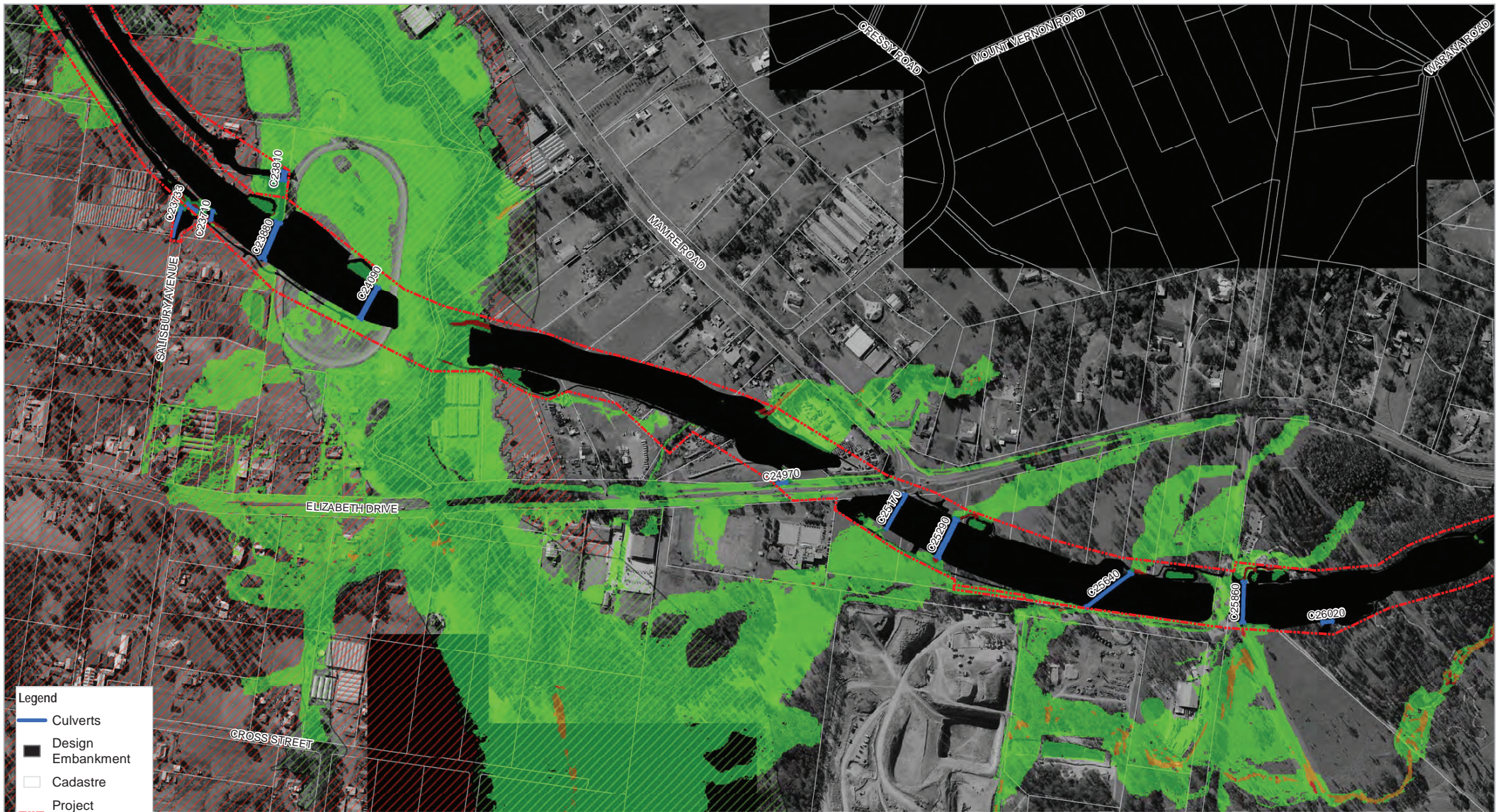


Transport for NSW
 M12 Motorway - Central - Detailed Design
 100% Design
 Change in Velocity - Kemps Creek
 5 Spans @ 30m
 1 in 100 AEP Envelope

Project No. 12514239.0
 Revision No. A
 Date 02 Aug 2021

Figure A8

Data source: © Jacobs & Associates 2016. Created by Imbertson



- Legend**
- Culverts
 - Design Embankment
 - Cadastre
 - Project Boundary

- WSA Structure Plan Zoning**
- Environment and Recreation
 - Flexible Employment

- Change in Velocity**
- 0% or $V < 1$ m/s
 - 0% - 10%
 - > 10%

Paper Size ISO A3

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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

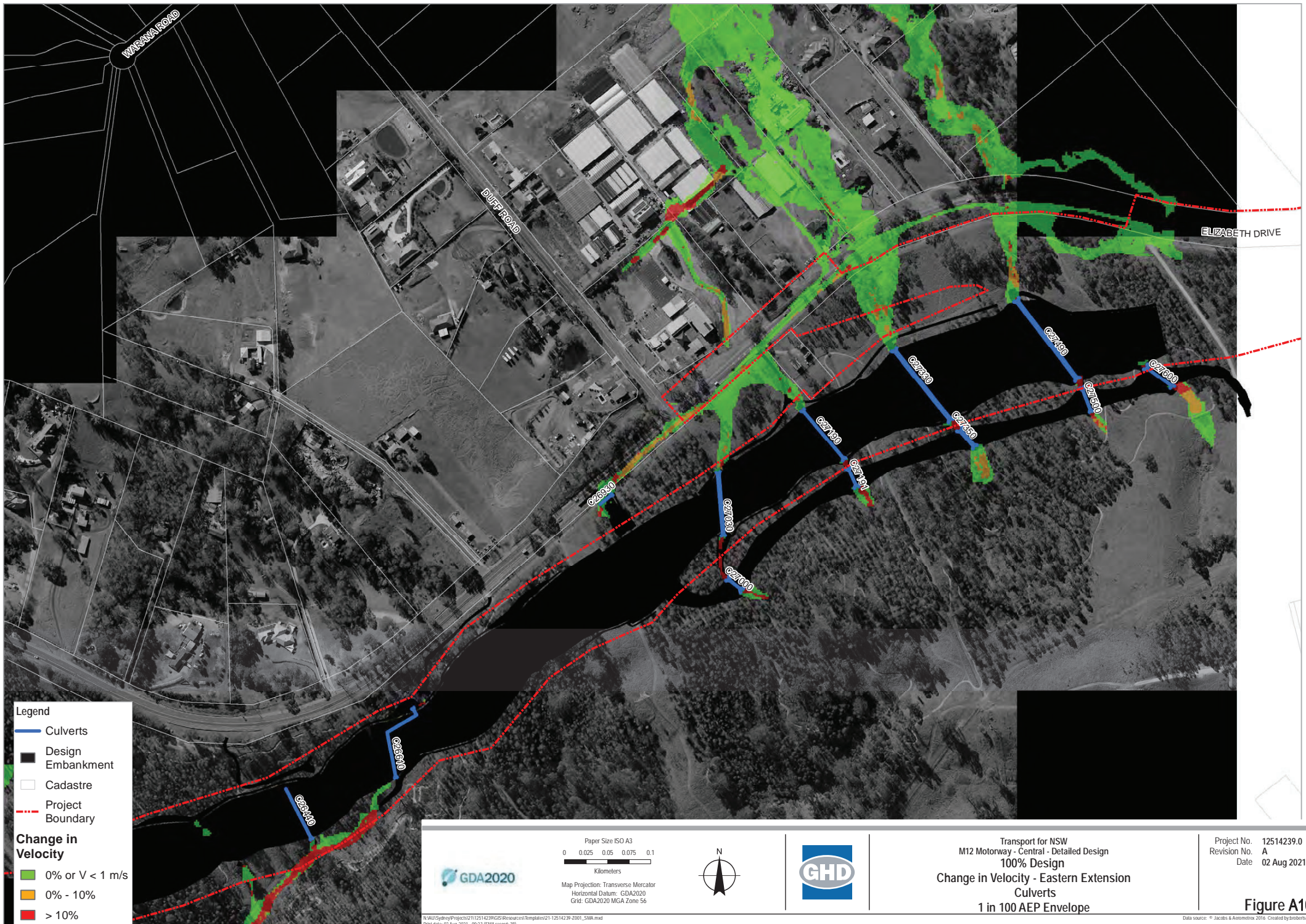


Transport for NSW
M12 Motorway - Central - Detailed Design
100% Design
Change in Velocity - Kemps Creek
Culverts
1 in 100 AEP Envelope

Project No. 12514239.0
Revision No. A
Date 02 Aug 2021

Figure A9

Data source: © Jacobs & Aecom/2016. Created by Imbertson



Legend

- Culverts
- Design Embankment
- Cadastre
- Project Boundary

Change in Velocity

- 0% or $V < 1$ m/s
- 0% - 10%
- > 10%

Paper Size ISO A3

0 0.025 0.05 0.075 0.1

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56

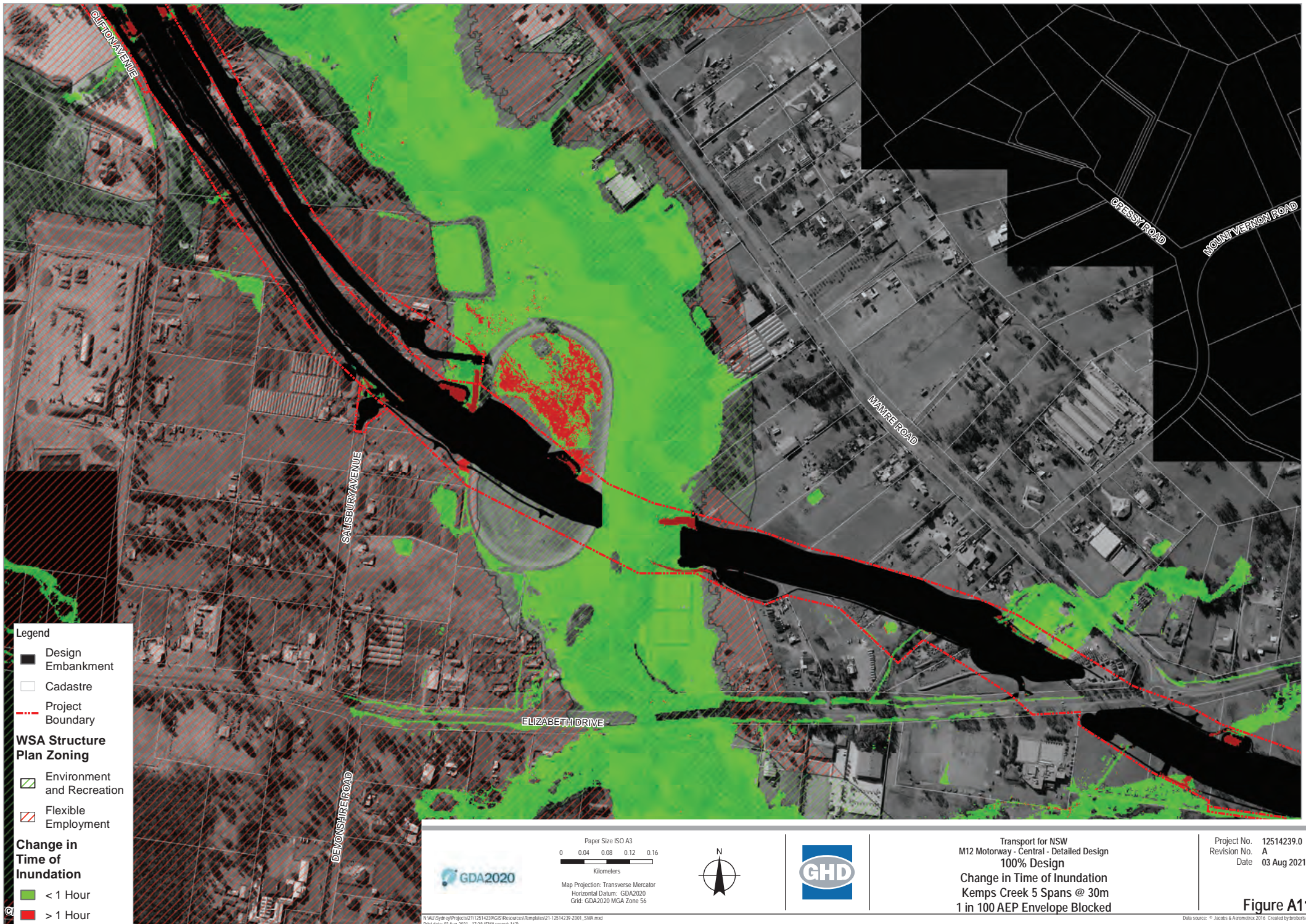


Transport for NSW
M12 Motorway - Central - Detailed Design
100% Design
Change in Velocity - Eastern Extension
Culverts
1 in 100 AEP Envelope

Project No. 12514239.0
Revision No. A
Date 02 Aug 2021

Figure A10

Data source: © Jacobs & Associates 2016. Created by Imbertson



Legend

- Design Embankment
- Cadastre
- Project Boundary

WSA Structure Plan Zoning

- Environment and Recreation
- Flexible Employment

Change in Time of Inundation

- < 1 Hour
- > 1 Hour

Paper Size ISO A3

0 0.04 0.08 0.12 0.16

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 56



Transport for NSW
M12 Motorway - Central - Detailed Design
100% Design
Change in Time of Inundation
Kemps Creek 5 Spans @ 30m
1 in 100 AEP Envelope Blocked

Project No. 12514239.0
Revision No. A
Date 03 Aug 2021

Figure A11

Data source: © Jacobs & Associates 2016. Created by Imberston

Appendix F

Groundwater impact assessment

Technical Memorandum

Issued by	Stuart Gray – Technical Director Hydrogeology, GHD
Subject	M12 Motorway Central Section Consistency Assessment – Groundwater Technical Memorandum
Client	Transport for New South Wales
Project	M12 Motorway Central Section
Date	October 2021
Document reference	M12CDD-GHDA-ALL-EV-MEM-000005

1. Background

The new M12 Motorway will provide direct access to the Western Sydney International Airport at Badgerys Creek and connect to Sydney's motorway network. The Motorway's east-west alignment consist of 16-kilometres of dual carriageway between the M7 Motorway at Cecil Hills and The Northern Road at Luddenham.

The Motorway will be built as a four-lane divided road and designed to be readily widened to six lanes to meet future demand. It will be designed to 110km/h and posted at 100km/h. The Motorway will provide increased road capacity and reduce congestion and travel times in line with future needs. It will also improve the movement of freight in and out of Western Sydney while serving the Western Sydney Priority Growth Area and the Western Sydney Employment Area.

The M12 is being delivered in three sections. This report covers the central section of the M12 shown within the red area marked in Figure 1.



Figure 1 M12 central section extents

Within the central section, the project comprises:

- A four lane dual-carriageway motorway, designed to facilitate widening to six lanes in the future
- Seven bridge locations as detailed below:
 - BR06 – M12 twin bridges over South Creek
 - BR07 – Clifton Avenue bridge over M12
 - BR08 – M12 twin bridges over Kemps Creek
 - BR09 – M12 twin bridges over Elizabeth Drive
 - BR10 – M12 twin bridges over Range Road
 - BR11 – Water Tower Access Road bridge over M12
 - Private property access bridge to Sydney University land

- Miscellaneous structures including retaining walls, ITS gantries, sign supports, noise barriers and culverts
- Road drainage, comprising pits, pipes, channels and water quality facilities
- Culverts to convey existing or diverted watercourses
- Separate shared user path, including connections to existing networks
- Relocation and/or protection of existing utilities
- ITS infrastructure to support future smart motorways operation
- Signage, line marking, safety barriers and related road furniture
- Urban design including landscaping and public art.

2. Project approvals

The project (SSI-9364) has been approved under Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* and has been assessed under the bilateral agreement between the NSW and Commonwealth Governments, an accredited assessment process (EPBC ID:2018/8286). The project received approval from the NSW Minister for Planning and Public Spaces on 23 April 2021 and conditions of approval (CoA) were subsequently issued. The project received approval from the Minister for Commonwealth Department of Agriculture, Water and the Environment Minister on 3 June 2021 and conditions were subsequently issued. The projects environmental impacts and commitments were presented in the following Approval Documents:

- Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement* (the EIS)
- Transport for NSW (2020, August) *M12 Motorway, Amendment Report* (the amendment report)
- Transport for NSW (2020, August) *M12 Motorway, Submissions Report* (the submissions report).
- Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report* (the AR submissions report)
- Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*.

3. Purpose of this assessment

The purpose of this groundwater consistency assessment is to:

- Describe the proposed changes to the project that have been developed during detailed design relative to the Division 5.2 Approval and the EPBC Approval
- Assess changes to the environmental impacts associated with the detailed design of the project relative to the Division 5.2 Approval and the EPBC Approval
- Determine if the detailed design is consistent with the Division 5.2 Approval or whether further approval is required either for a modification application or a new project
- Determine if the detailed design is consistent with the EPBC Approval or whether a variation to the conditions of approval or a new referral is required
- Determine if the proposed change is consistent with the CoA.

This assessment considers impacts of the proposed change to groundwater levels (quantity) and groundwater quality, and whether these impacts are consistent with the project approvals.

4. Description of the proposed changes

The principal design changes to the central section of the M12 Motorway that are considered in this assessment are outlined below:

- Main carriageway vertical alignment – lowering of the main carriageway by about 2.0 m for a length of about 1.2 km in the area of Clifton Avenue (also in the vicinity of Cut 9 as defined in the Geotechnical Interpretive Report, cited below, and shown in Figure 2).
- Culverts for Sydney Water infrastructure – installation of three culverts extending to a depth of around 5.0 m from the existing ground surface at locations near the South Creek and Kemps Creek crossings, with widths ranging from 1 to 40 m.

A review of the design changes for both operation and construction of the project, including minor boundary changes, has not identified other changes that would alter the impacts as assessed in the approved groundwater assessment.

5. Assessment methodology

This assessment has reviewed the approval documents listed in Section 2 and the following technical report:

- Transport for NSW (2021) *M12 Motorway Central Package Detailed Design, Geotechnical Interpretive Report* (the Geotechnical Report).

The groundwater assessment methodology adopted for the EIS is outlined in Section 7.10.2 of the EIS. The methodology for this assessment is generally consistent with the EIS methodology, although excludes additional site investigations. The following tasks have been undertaken:

- Desktop assessment to confirm existing groundwater environment.
- Identification of additional areas of groundwater interception due to the proposed changes and analytical calculations of groundwater dewatering and drawdown.
- Groundwater impact assessment for both the construction and operation phases of the project to confirm whether impacts from the proposed changes are consistent with the project approvals and are in accordance with the NSW Aquifer Interference Policy.
- Assessment of suitability of mitigation measures proposed in the approval documents.

6. Existing environment

The existing environment relevant to groundwater is outlined in Section 4 of Appendix N of the EIS, including licensed groundwater bores (refer Figure 4-3) and Groundwater Dependent Ecosystems (GDEs) (Figure 4-2).

The following potential changes to the existing environment were reviewed as part of this assessment:

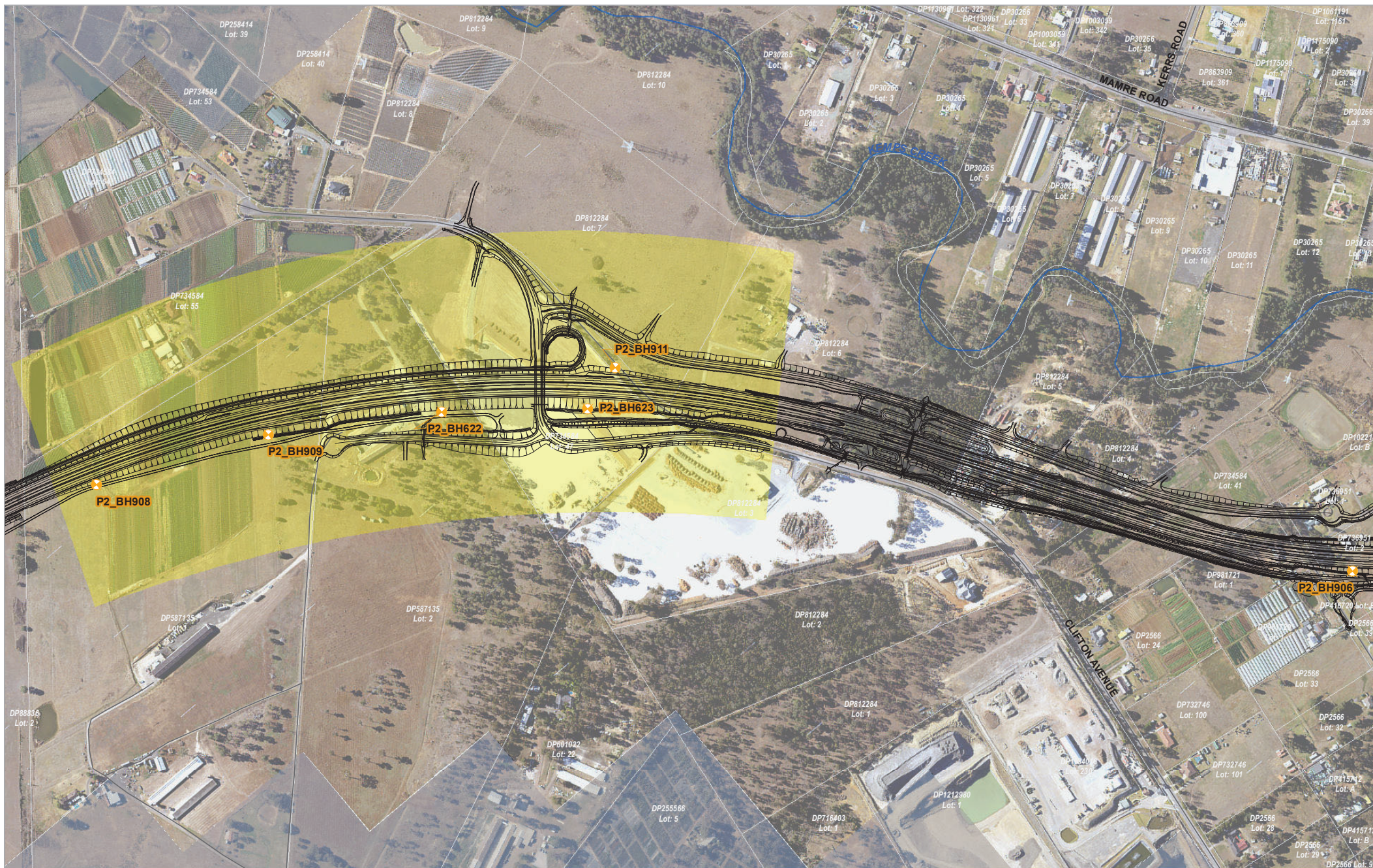
- Location of licensed bores in the vicinity of the proposed changes to the project
- Groundwater levels in the vicinity of the proposed changes to the project.

An updated search of the Bureau of Meteorology's (BOM) Australian Groundwater Explorer was undertaken and compared to the results of the search presented in the EIS. It was found that there have been no changes to the number or location of registered bores in the vicinity of the project changes (i.e. in the South Creek to Kemps Creek area). Figure 7-137 of the EIS (and Figure 4-3 of Appendix N of the EIS) is correct for this area.

Updated groundwater level data (up to end June 2021) for groundwater monitoring bores between South Creek and Kemps Creek, including the Cut 9 area around Clifton Avenue, were reviewed. Groundwater

level data from additional monitoring bores installed since the completion of the EIS and presented in the Geotechnical Report, were also reviewed as part of this assessment. This includes bores P2-BH622, P2-BH623, P2-BH906, P2-BH908, P2-BH909 and P2-BH911. The locations of the additional bores are shown in Figure 2.

The Geotechnical Report indicates that maximum groundwater elevations in the Cut 9 area range from 41.2 to 49.5 m AHD. Based on available data, the maximum groundwater elevation in the South Creek alluvium is approximately 36 to 37 m AHD while the maximum groundwater elevation in the Kemps Creek alluvium is approximately 45.5 m AHD.



LEGEND

- New borehole
- Roads
- M12 Road Design (28/07/2021)
- Watercourse
- Cut 9 Study Area
- Cadastre



Paper Size ISO A3
 0 50 100 150
 Meters
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 56



Transport for NSW
**M12 Motorway Central Package
 Consistency Assessment**
 Project No. 21-12514239
 Revision No. -
 Date 9/09/2021

Location of new boreholes **FIGURE 2**

© 21/11/2021 14:29:03: \\mapsgis\elw\ables\21_12514_239_2067_Consistency_NewBores.mxd
 Print date: 09 Sep 2021 1:09:19
 Whilst every care has been taken to prepare this map, GHD make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: General Topo and Aerial Imagery - Sixmaps 2021 © Department of Customer Service 2020. Created by: ebberton

7. Assessment of potential impacts

Groundwater impacts during construction have been assessed by calculating potential dewatering rates and drawdown from excavations associated with the proposed changes. Construction impacts are detailed below. Operational impacts to groundwater are likely to be similar to or less than construction impacts. This is consistent with the assessment presented in the EIS and amendment report.

7.1 Groundwater interception

The lowered carriageway design level in the area of Clifton Avenue (Cut 9) was compared to the maximum groundwater levels reported at each monitoring bore within the Cut 9 area. It is considered that groundwater interception of up to 1 m within the bedrock groundwater system (siltstone) is possible along Cut 9, between chainages 21800 and 22300. The floor elevation of Cut 9 ranges from 43.95 to 49.55 m AHD, compared to the groundwater elevation of 41.2 to 49.5 m AHD.

In addition, the excavations for the proposed culverts, which will extend up to 5 m below the existing ground surface level, may intercept alluvial groundwater. The predicted depth of interception is as follows:

- 1 m wide culvert west of South Creek (chainage 20800) – up to 5 m.
- 40 m wide culvert east of South Creek (chainage 21100) – up to 2 m.
- 10 m wide culvert west of Kemps Creek (chainage 23800) – up to 5 m.

7.2 Dewatering rates and radius of drawdown

Dewatering rates and the radius of drawdown for Cut 9 and the largest culvert excavation (40 m wide culvert located 200 m east of South Creek) have been calculated. The calculation methodologies outlined in Sections 3.6.2 and 5.1 of Appendix N of the EIS were adopted for this assessment.

Results for Cut 9 are presented in Table 1. For the dewatering calculations, a seepage area of 600 m² was adopted based on a length of potential groundwater interception of 500 m, width of 100 m and average seepage depth of 0.5 m. Flow into the excavation was assumed to be predominantly horizontal with minimal vertical flow through the cut floor. For the radius of drawdown calculations, a storage value (S) of 0.03 was adopted and transmissivity was based on a saturated thickness of 1 m.

Calculated dewatering rates (Q) for the various hydraulic conductivity (K) and hydraulic gradient (i) values range from 0.1 to 16.2 m³/day (or < 0.1 to 5.9 ML/year). A dewatering rate at the lower end of this range (< 1 m³/day) is more likely, since the groundwater seepage within the cut will come from the bedrock groundwater system (siltstone) which has a hydraulic conductivity in the order of 0.005 m/day.

The calculated radius of drawdown (r) extends up to 111 m after five years for the highest hydraulic conductivity scenario. Again, a value at the lower end of the range is more likely. The values presented in Table 1 are generally consistent with values presented in the EIS and amendment report.

Table 1 *Dewatering rates and drawdown radius for Cut 9*

K (m/day)	i	Q (m³/day)	Q (ML/year)	r (m), 1 year	r (m) 5 years
0.005	0.04	0.1	0.0	12	26
0.005	0.1	0.3	0.1	12	26
0.005	0.3	0.9	0.3	12	26
0.04	0.04	1.0	0.4	33	74
0.04	0.1	2.4	0.9	33	74
0.04	0.3	7.2	2.6	33	74
0.09	0.04	2.2	0.8	50	111
0.09	0.1	5.4	2.0	50	111
0.09	0.3	16.2	5.9	50	111

Results for the 40 m wide culvert excavation are presented in Table 2. For the dewatering calculations, a seepage area of 560 m² was adopted based on excavation dimensions of 100 m by 40 m and average seepage depth of 2.0 m. Again, flow into the excavation was assumed to be predominantly horizontal with minimal vertical flow through the cut floor. For the radius of drawdown calculations, a storage value (S) of 0.03 was adopted and transmissivity was based on a saturated thickness of 4.0 m.

Table 2 *Dewatering rates and drawdown radius for 40 m wide culvert*

K (m/day)	i	Q (m³/day)	Q (ML/year)	r (m), 1 year	r (m) 5 years
0.005	0.04	0.1	0.0	23	52
0.005	0.1	0.3	0.1	23	52
0.005	0.3	0.8	0.3	23	52
0.04	0.04	0.9	0.3	66	148
0.04	0.1	2.2	0.8	66	148
0.04	0.3	6.7	2.5	66	148
0.09	0.04	2.0	0.7	99	222
0.09	0.1	5.0	1.8	99	222
0.09	0.3	15.1	5.5	99	222

Calculated dewatering rates (Q) for the various hydraulic conductivity (K) and hydraulic gradient (i) values range from 0.1 to 15.1 m³/day (or < 0.1 to 5.5 ML/year). A dewatering rate at the lower end of this range is most likely (say 1-2 m³/day), based on the hydraulic conductivity of the alluvium reported in Table 4-7 in Appendix N of the EIS (0.023 m/day). The dewatering rates for the other smaller culvert excavations are expected to be similar to this since they would have similar seepage areas to the 40 m culvert (i.e. smaller width excavations but larger seepage depth).

The calculated radius of drawdown (r) for the 40 m wide culvert excavation extends up to 222 m after five years for the highest hydraulic conductivity scenario. Again, a value at the lower end of the range is more likely for all culverts. As for Cut 9, the values presented in Table 2 are generally consistent with values presented in the EIS and amendment report.

7.3 Impact assessment

Groundwater drawdown at Cut 9 is expected to be greatest (approximately 1 m) in the vicinity of the cut, with some drawdown impact (< 1 m) extending in the order of tens of metres from the excavation. For the culvert excavations, drawdown of up to 2-5 m is expected in the vicinity of the excavation, with some drawdown impact extending over 100 m from the excavation.

Based on the locations of potential GDEs and licensed bores presented in Figure 4-2 and Figure 4-3 of Appendix N of the EIS, no GDEs or licensed bores are within the radius of drawdown of any of these groundwater interference activities associated with the proposed changes to the project.

In addition, the beneficial use of the groundwater to be intercepted by these excavations is limited based on the poor (saline) groundwater quality, as reported in the EIS. Therefore, the beneficial use category of the groundwater is unlikely to be reduced as a result of these minor groundwater interference activities.

Overall, the groundwater impacts from construction and operation of the project associated with the proposed changes to the project are considered to meet the minimal impact considerations of the NSW Aquifer Interference Policy and are consistent with the current project approvals. There will be an increase to the total groundwater take of the project (from both the alluvium and bedrock groundwater sources) due to the additional groundwater interception, however licensing of the groundwater take is not required as outlined in the EIS.

Risks associated with groundwater quality such as from accidental spills or mobilisation of contaminants during earthworks, would remain unchanged from the approved project and would continue to be managed through the Construction Environmental Management Plan (CEMP).

7.4 Assessment of the detailed design against project commitments

Table 3 assesses the M12 central section detailed design against the project's Revised Environmental Management Measures (REMMs) as outlined in Section 7 of the AR submissions report. The management measures outlined in this report are relevant to the M12 central section only. Two additional REMMs have been added (GW05 and GW07) and are outlined in section 8 of this report.

Table 3 Assessment of the updated design against relevant REMMs in the M12 Environmental Assessment Documents

No.	Commitment	Discussion	Consistent
B21	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through detailed design.	Based on the locations of potential GDEs, none are within the radius of drawdown of any of these groundwater interference activities associated with the proposed changes to the project.	Yes
GW01	Groundwater monitoring will be carried out as part of the construction water quality monitoring program for the project. The groundwater monitoring will be based on the water quality monitoring methodology, water quality indicators and the monitoring locations presented in the Groundwater quality and hydrology assessment report (Appendix N of the EIS and Table 7-1 in the groundwater supplementary technical memorandum (Appendix J of amendment report). Baseline groundwater monitoring will be carried out at least monthly for at least six months before construction. Monitoring will also be carried out at least monthly during construction and will continue for at least six months of operation to verify that there are no groundwater impacts, and that management measures are adequate.	Baseline groundwater monitoring has been carried out at 12 sites. Wet weather event sampling (>22 mm rain at Badgerys Creek as outlined in EIS) being undertaken three times every six months where possible. Monitoring results reported monthly from July 2020 (to continue for 24 months).	Yes
GW02	Potential impacts on groundwater flows will be reconsidered as the detailed design for the project progresses, particularly in relation to the projects vertical alignment and extent of road cuttings. The aim of this will be to ensure that the groundwater controls proposed for the design as set out in this	A review of groundwater controls has been carried out and are considered effective in mitigating potential impacts. Overall, the groundwater impacts associated with the detailed design are considered to meet the minimal	Yes

No.	Commitment	Discussion	Consistent
	<p>document would remain effective in mitigating groundwater impacts.</p> <p>In the instance that, during detailed design it cannot be demonstrated that the groundwater controls would be effective in mitigating potential impacts, or if observed groundwater inflow rates into the western cut or airport interchange northern and southern cuts are higher than estimated, additional measures will be implemented to minimise potential impacts on groundwater flows due to road cuttings or other sub-surface components of the project.</p>	<p>impact considerations of the NSW Aquifer Interference Policy and are consistent with the current project approvals.</p>	

8. Environmental management measures

The detailed design will likely result in additional groundwater interception compared to that reported in the EIS and amendment report. However, the impacts of this additional interception is expected to be minor and localised for both construction and operation and meet the minimal impact considerations of the NSW Aquifer Interference Policy. Therefore the groundwater impacts of the proposed changes to the project are consistent with the current project approvals.

No changes to the existing mitigation measures in the approval documents are required as a result of the M12 central detailed design, however two additional measures relevant to M12 central are recommended and detailed in Table 4. Additional monitoring bores included in the Geotechnical Report may be considered for inclusion in the groundwater monitoring program. This comprises bores P2-BH622, P2-BH623, P2-BH906, P2-BH908, P2-BH909 and P2-BH911.

Table 4 Additional groundwater revised environmental management measures (REMM's)

No.	Commitment	Discussion
GW05	<p>Groundwater quality, levels and inflows will be monitored at Clifton Avenue (Cut 9) and the location of the Sydney Water culverts during construction and operation as outlined in the M12 Central consistency assessment report (GHD, 2021).</p> <p>The groundwater indicators to be monitored will be as per Section 7.2.5 of Appendix N of the EIS. Groundwater inflows are to be monitored at monthly intervals. As part of observing inflows at the identified cuts, the groundwater inflow rate is to be estimated and the areas where groundwater inflow is occurring noted.</p> <p>During construction, if groundwater inflow rates are observed from the cuts identified through the detailed design of the M12 Motorway – Central including Cut 9 and at the Sydney Water culvert excavations, the groundwater quality from the cut is to be sampled.</p> <p>Operational phase groundwater quality sampling, including the quality sampling of Cut 9 inflows and at the Sydney Water culvert excavations, is to occur at monthly intervals for at least six months.</p>	<p>This new requirement has been proposed as a result of potential additional impacts from the detailed design, however overall the impacts remained consistent with the approved project.</p>
GW07	<p>Prior to construction commencing, the Construction Contractor will use their earthworks methodology to estimate the potential groundwater inflows that are expected in the first year of construction in order to confirm the inflows expected and if the proposed mitigation measures are sufficient to manage higher inflows that are likely during early earthworks activity.</p> <p>The estimate of groundwater inflows is to be undertaken for Cut 9 and at the Sydney Water culvert excavations. The estimate is to include groundwater inflow from both the walls and base of the cuts, and will take into account the construction methodology and staging for each cut. In addition, the estimate will utilise the maximum observed</p>	<p>This new requirement has been proposed as a result of potential additional impacts from the detailed design, however overall the impacts remained consistent with the approved project.</p>

No.	Commitment	Discussion
	<p>groundwater levels (as sourced from M12 Central groundwater monitoring data).</p> <p>The Construction Contractor will assess the results of the estimated groundwater inflows to confirm whether evaporation will be sufficient to mitigate the potentially higher inflows likely to be expected during early earthwork activities. If evaporation is determined not to be a sufficient mitigation measure, the Construction Contractor will identify and implement additional mitigation measures and these will be documented in the Construction Contractor's CEMP and Construction Soil and Water Management Plan.</p>	

9. References

BOM (2021). *Australian Groundwater Explorer*, Australian Government Bureau of Meteorology, viewed online July 2021 from <http://www.bom.gov.au/water/groundwater/explorer/map.shtml>

NSW Department of Primary Industries, Office of Water (2012). *NSW Aquifer Interference Policy*.

Roads and Maritime Services (2019, October) *M12 Motorway, Environmental impact statement*

Transport for NSW (2020, August) *M12 Motorway, Amendment Report*

Transport for NSW (2020, August) *M12 Motorway, Submissions Report*

Transport for NSW (2020, December) *M12 Motorway, Amendment Report Submissions Report*

Transport for NSW (2021, March) *The M12 Motorway Amendment Report Submissions Report - Amendment*.

Transport for NSW (2021, April) *M12 Motorway Central Package Detailed Design, Geotechnical Interpretive Report* (the Geotechnical Report).

