Technical Report – Flood Mitigation Strategy
WS – Temporary Works
Final Design (FD)

Project M4 East – Design and Construct
Contract No. 15.7105.1373
Document No. M4E-AEH-TR-40-120-100001_D_00
Revision Date 5/05/2016

Document Approval

<table>
<thead>
<tr>
<th>Rev</th>
<th>Date</th>
<th>Prepared by</th>
<th>Reviewed by</th>
<th>Approved by</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>C_01</td>
<td>21/04/16</td>
<td>J. Beck (AEH)</td>
<td>L. Segundo</td>
<td>T. Dias</td>
<td>CDR for FD Issue</td>
</tr>
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<td>D_00</td>
<td>05/05/16</td>
<td>J. Beck (AEH)</td>
<td>L. Segundo</td>
<td>T. Dias</td>
<td>FD Issue</td>
</tr>
</tbody>
</table>
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1 Executive Summary

This technical report addresses the Planning Minister’s Conditions of Approval B14 (Flood Mitigation Strategy). To facilitate the proposed construction program, the Flood Mitigation Strategy Report has been split into five (5) stages, which will be covered under separate technical reports:

- Flood Mitigation Strategy Report – Permanent Works: M4E-AEH-TR-00-120-100001

The content of this report relates specifically to the Zone 40 construction sites: Northcote Tunnel Site (C7), Parramatta Road Ventilation Facility (C8) and Wattle Street Civil Site (C9).

Details of Condition B14 are listed in Table 6, which also identifies the relevant sections of this report that deal with each individual clause of that Condition.

This Flood Mitigation Strategy Report provides a summary of the flood assessments undertaken for the temporary works in Zone 40 as well as a discussion on proposed mitigation measures to meet Condition B14. Details of the development and validation of the hydrological and hydraulic models that were used to undertake the assessments are discussed in detail in the M4E Hydrology and Flooding Design Report (Document No M4E-AEH-TR-00-120-053001).

The flood impact assessment considers both the temporary site access works as well as construction staging. The flood risk assessment is documented in Section 4.

The Northcote Tunnel Site (C7) is not flood affected in events up to and including the PMF and no flood mitigation measures are required.

The Parramatta Road Ventilation Facility (C8) is not flood affected in events up to and including the PMF and no flood mitigation measures are required.

The eastern end of the Wattle Street site (C9) is flood affected through both flooding from Iron Cove Creek, as well as overland flows from the catchment to the south of Wattle Street/Dobroyd Parade. The western end of the site is not flood affected except for a small overland flow path that runs to the west of Allum Street, and crosses Wattle Street at Ash Lane. A local drainage system runs north along Ash Lane. Wattle Street/Dobroyd Parade was assessed as having low flood immunity, with the low point near Waratah Street overtopping in as little as a 1-2 year ARI storm event.

The flood impact assessment as documented in this report has considered both the temporary site access works as well as Traffic Staging Stage 1. Gaps in the temporary traffic barriers or alternatives to solid traffic barriers have been proposed in some areas to minimise flood impacts. Gaps or flaps in temporary noise walls are also proposed. The proposed G-Loop through Reg Coady Reserve would need to be built up no higher than the existing road level on Wattle Street, preferably as close to existing ground level as possible.

Mitigation measures developed for the construction sites in Zone 40 are documented in Section 5.
2 Introduction

The WestConnex M4 East Project is being designed and constructed by the CPB Contractors (ABN 98 000 893 667) Samsung (ABN 49 160 079 470) John Holland (ABN 11 004 282 268) Joint Venture (CSJ JV). The purpose of this report is to document the flood impact assessments and to provide supporting information which has been applied during the development of the design.

This report has been prepared by AECOM Hyder Joint Venture (AEH) on behalf of CSJ JV.

2.1 Description of the Project Works

The M4 East Project will comprise two new, three lane carriageways (Main Carriageway, Eastbound or Eastbound Carriageway and Main Carriageway Westbound or Westbound Carriageway), generally beneath Parramatta Road (together the “Main Carriageways”). The Main Carriageways will be constructed between the eastern end of the M4 West Motorway near Homebush Bay Drive and the City West Link and Parramatta Road at Haberfield.

1 The Main Carriageway Eastbound will be provided with:
   a A connection from the M4 West Motorway eastbound
   b A western tunnel portal between Homebush Bay Drive and Concord Road
   c Access from Homebush Bay Drive
   d A ramp from Concord Road
   e A ramp to the City West Link (Wattle Street / Dobroyd Parade) northbound
   f A ramp to Parramatta Road eastbound with the ramp portal located between Wattle Street and Dalhousie Street
   g Provisions for a future, uninterrupted, three lane connection to the future M4 South, located in the vicinity of Parramatta Road and Wattle Street at Haberfield.

2 The Main Carriageway Westbound will be provided with:
   a Provisions for a future, uninterrupted, three lane connection from the future M4 South, located in the vicinity of Parramatta Road and Wattle Street at Haberfield
   b A ramp from Parramatta Road westbound with the ramp portal located between Wattle Street and Dalhousie Street
   c A ramp from City West Link (Wattle Street / Dobroyd Parade) southbound
   d A ramp to Concord Road
   e A direct connection to the M4 Motorway westbound near Parramatta Road
   f Access to the Homebush Bay Drive
   g A connection to the M4 West Motorway westbound between Homebush Bay Drive and Concord Road.

The project has been split into five geographical zones for delivery purposes. The zones are split as follows and shown below:

- Zone 00 (General Project Wide)
- Zone 10 – Tunnels
- Zone 20 – Homebush Bay Drive Interchange
- Zone 30 – Concord Road Interchange
- Zone 40 – Wattle Street Interchange
- Zone 50 – Parramatta Road Interchange
• Zone 60 (Mechanical and Electrical)

Figure 1: Schematic showing M4 East Project zones

2.2 Scope of this Report

This Technical Report has been prepared in accordance with the WestConnex M4 East Design and Construction Deed Clause 13 and SWTC Appendix C.2 Clause 3 and in accordance with CSJ Design Management Plan M4E-LSJ-00-000-MP-001003_B_00.

The scope of works covered by this technical report relates specifically to the Planning Minister’s Conditions of Approval B14 (Flood Mitigation Strategy). To facilitate the proposed construction program, the Flood Mitigation Report has been split into five (5) stages, which will be covered under separate technical reports:

• Flood Mitigation Strategy Report – Permanent Works: M4E-AEH-TR-00-120-100001
• Flood Mitigation Strategy Report - HBD Temporary Works: M4E-AEH-TR-20-120-100001
• Flood Mitigation Strategy Report - PR Temporary Works: M4E-AEH-TR-50-120-100001

This technical report describes the assessment of flood risk and development of mitigation measures undertaken for the proposed temporary works in Zone 40, and includes the lot numbers listed in Table 1.

Table 1: Design Lots

<table>
<thead>
<tr>
<th>Lot Number</th>
<th>Description</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-120-100</td>
<td>Flood Mitigation Strategy</td>
<td>Flood mitigation strategy for Wattle Street (Zone 40) temporary works</td>
</tr>
</tbody>
</table>
2.3 Differences between the Draft and the Final Stages

Table 2 describes the differences between the SDD and FD Report.

<table>
<thead>
<tr>
<th>Location</th>
<th>Difference</th>
<th>Reason for the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A - Not issued at SDD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.4 Definitions and Abbreviations

Table 3: Definitions used within this Report

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Contractor</td>
<td>CPB Samsung John Holland Joint Venture</td>
</tr>
<tr>
<td>Project Company</td>
<td>WCX M4 Pty Limited</td>
</tr>
<tr>
<td>Existing Conditions</td>
<td>Conditions representing the pre-M4 upgrade (also referred to as Base Case)</td>
</tr>
<tr>
<td>Design Conditions</td>
<td>Conditions representing the post-M4 upgrade (also referred to as Design Case)</td>
</tr>
<tr>
<td>Afflux</td>
<td>The rise in water level on the upstream side of a constriction in a stream or channel relative to the water level on the downstream side (Austroads Glossary of Terms, 2015)</td>
</tr>
<tr>
<td>Floodplain</td>
<td>Area of land which is subject to inundation by floods up to and including the probable maximum flood event.</td>
</tr>
<tr>
<td>Temporary Works</td>
<td>Any temporary physical works required for the purpose of the carrying out of the Contractor's Activities, but which does not form part of the Project Works including any such works specified in Section 3.4A of the SWTC and including, to the extent relevant to such works, Changes directed in accordance with the Project Deed.</td>
</tr>
</tbody>
</table>

Table 4: Abbreviations used within this Report

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEH</td>
<td>AECOM Hyder Joint Venture</td>
</tr>
<tr>
<td>AEP</td>
<td>Annual Exceedance Probability</td>
</tr>
<tr>
<td>AHD</td>
<td>Australian Height Datum</td>
</tr>
<tr>
<td>ARI</td>
<td>Average Recurrence Interval</td>
</tr>
<tr>
<td>BoM</td>
<td>Bureau of Meteorology</td>
</tr>
<tr>
<td>CDR</td>
<td>Cross Discipline Review</td>
</tr>
<tr>
<td>CEMP</td>
<td>Construction Environment Management Plan</td>
</tr>
<tr>
<td>CH</td>
<td>Chainage</td>
</tr>
<tr>
<td>CR</td>
<td>Concord Road</td>
</tr>
<tr>
<td>CSJ JV</td>
<td>CPB Samsung John Holland Joint Venture</td>
</tr>
<tr>
<td>DxV</td>
<td>Depth-Velocity Product</td>
</tr>
<tr>
<td>EB</td>
<td>Eastbound</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>EY</td>
<td>Exceedances per Year</td>
</tr>
</tbody>
</table>
It should be noted that this report uses the Average Recurrence Interval (ARI) terminology when discussing design flood events. The latest draft of the new edition of Australian Rainfall and Runoff (AR&R) recommends the use of the Annual Exceedance Probability (AEP) and Exceedances per Year (EY) terminology. However, the term ARI was used for simpler comparison to older flood studies in particular for minor storm events. The two terms are defined as follows:

- **Annual Exceedance Probability (AEP)** - the probability of an event occurring or being exceeded within a year.
- **Average Recurrence Interval (ARI)** – the average period between occurrences equalling or exceeding a given value.

The relationship between ARI and AEP is summarised in Table 5.
Table 5: Relationship between ARI and AEP

<table>
<thead>
<tr>
<th>ARI (years)</th>
<th>AEP (%)</th>
</tr>
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<tbody>
<tr>
<td>5</td>
<td>18.13</td>
</tr>
<tr>
<td>10</td>
<td>10.00</td>
</tr>
<tr>
<td>20</td>
<td>5.00</td>
</tr>
<tr>
<td>50</td>
<td>2.00</td>
</tr>
<tr>
<td>100</td>
<td>1.00</td>
</tr>
</tbody>
</table>
3 Design Criteria and Performance Requirements

3.1 Design Performance Criteria

The design described in this report has been prepared in accordance with the Project Deed and the SWTC.

The Planning Minister’s Conditions of Approval (MCoA) include several conditions related to flooding. This report relates specifically to Condition B14, with details as summarised in Table 6.

Table 6: Planning Minister’s Conditions of Approval – Condition B14

<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of requirement</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>B14</td>
<td>The Flood Mitigation Strategy must be designed to ensure that the SSI, where feasible and reasonable, does not worsen existing flooding characteristics in the vicinity of the SSI during construction and operation. The Flood Mitigation Strategy must include but not be limited to:</td>
<td>This report</td>
</tr>
</tbody>
</table>
| B14 (a)| the identification of flood risks to the SSI and adjoining areas, including further modelling and the consideration of local drainage catchment assessments, and climate change implications on rainfall and drainage characteristics. This must consider blockages of waterway structures from floating debris in its flood level modelling;  
Refer to Sections 4.2 for assessment of flood risk.  
Refer to Section 4.3 for climate change assessment.  
Refer to Section 4.4 for blockage assessment. | |
| B14 (b)| the identification of design and mitigation measures that would be implemented to protect proposed operations and not worsen existing flooding characteristics within and in the vicinity of the SSI boundary during construction and operation, including soil erosion and scouring; | Refer to Section 5 |
| B14 (c)| consideration of limiting flooding characteristics to the following levels:  
(i) a maximum increase in inundation time of one hour in a 100 year ARI rainfall event;  
(ii) a maximum increase of 10 mm in inundation at properties where floor levels are currently exceeded in a 100 year ARI rainfall event;  
(iii) a maximum increase of 50 mm in inundation at properties where floor levels would not be exceeded in a 100 year ARI rainfall event; and  
(iv) no inundation of floor levels which are currently not inundated in a 100 year ARI rainfall event, or else provide alternative flood mitigation solutions consistent with the intent of these limits; | Refer to Section 4.2 |
<p>| B14 (d)| the processes and actions committed to in the mitigation measures referred to in conditions A2(b) and A2(c) | Refer to Section 5.5 |</p>
<table>
<thead>
<tr>
<th>Clause</th>
<th>Description of requirement</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>B14 (e)</td>
<td>the identification of measures to be implemented to minimise scour and dissipate energy at locations where flood velocities are predicted to increase as a result of the SSI and cause localised soil erosion or scour;</td>
<td>Refer to Section 5.3</td>
</tr>
<tr>
<td>B14 (f)</td>
<td>identification of drainage system upgrades including those upgrades considered as mitigation measures and identified during the process outlined in condition B20</td>
<td>Refer to Section 5.4</td>
</tr>
<tr>
<td>B14 (g)</td>
<td>identification of the timing and maintenance requirements responsibility of any necessary works</td>
<td>Refer to Section 5.6</td>
</tr>
<tr>
<td>B14</td>
<td>The Flood Mitigation Strategy must be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, Sydney Water, OEH and relevant councils.</td>
<td>Refer to Section 6.2.1</td>
</tr>
<tr>
<td>B14</td>
<td>The Flood Mitigation Strategy must be peer reviewed and confirmed as meeting the requirements of this condition by a suitably qualified and experienced independent hydrological engineer.</td>
<td>Refer Section 3.1.1 and Annexure C</td>
</tr>
</tbody>
</table>

Conditions A2(b) and A2(c) refer to:

- A2(b): M4 East Environmental Impact Statement (EIS) – Volumes 1A, 1B, 2A, 2B, 2C, 2D, 2E, 2F, 2G and 2H prepared by AECOM Australia Pty Ltd and GHD Pty Ltd, dated September 2015

Condition B20 refers to Stormwater Drainage:

The Proponent must undertake further hydrological and hydraulic modelling based on the detailed design of the SSI (State Significant Infrastructure) to determine the ability of the receiving drainage systems to effectively convey pavement drainage from the SSI. The modelling must be undertaken in consultation with relevant council(s) and the outcomes documented in a Stormwater Drainage Report. The Stormwater Drainage Report must:

(a) confirm the location, size and capacity of all drainage basin structures associated with the operation of the SSI;

(b) assess the potential impacts of pavement drainage discharges from the SSI drainage systems on the receiving environment including the hydrology (water quality and quantity) of receiving waterways, riparian vegetation, aquatic ecology and property;

(c) identify all feasible and reasonable mitigation measures to be implemented where pavement drainage from the SSI drainage systems is predicted to adversely impact on the receiving environment;

(d) where pavement drainage from the SSI flows to a council stormwater drainage system, confirm the location of the cross drainage point and, where available, use drainage information obtained from the relevant council, to -

   i. confirm the capacity of the council’s drainage system and its ability to receive and convey the flows,

   ii. identify any consequent upstream and downstream impacts on cross drainage infrastructure capacity,

   iii. assess the 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
iv. identify all feasible and reasonable mitigation measures to be implemented where increased flows through cross drainage systems adversely impact on council drainage infrastructure and the receiving environment; and

(e) set out a clear time frame for the implementation of mitigation measures.

The Stormwater Drainage Report must be submitted to the Secretary at least four weeks prior to the commencement of any new drainage works, modifications to existing drainage works, or construction of hard surfaces that would result in runoff to existing stormwater drainage systems, unless otherwise agreed by the Secretary.

3.1.1 Peer Review

The Planning Minister’s Conditions of Approval Condition B14 requires “The Flood Mitigation Strategy must be peer reviewed and confirmed as meeting the requirements of this condition by a suitably qualified and experienced independent hydrological engineer”.

AEH have nominated a suitably qualified and independent hydrological engineer from AECOM who has not been involved in the design development for this Project to undertake this review.

3.2 Standards, Codes and Guidelines

The Design has as a minimum been designed in accordance with the Codes and Standards referred to in Section 3.16 of the SWTC and in accordance with the order of precedence set out in SWTC Section 2.4.

Additional Design Standards and Codes, Technical Publications and Guidelines not referenced as above and relevant to this design package are listed in Table 7.

Table 7: Additional Codes, Standards, Technical Publications and Guidelines

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BoM GSDM</td>
<td>The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method</td>
</tr>
</tbody>
</table>

3.3 Agreed Exceptions

In some cases SWTC requirements have required exception or clarification via RFIs. These have been agreed with the Project Company and this section of the report identifies those relevant to this design package. For this package there are no agreed exceptions or clarifications at this design stage.

A number of exceptions have been agreed during the tender evaluation process and have been included in SWTC Appendix B.1. Agreed exceptions from Appendix B.1 specific to this design lot are listed in Table 8.

Table 8: Additional Codes, Standards, Technical Publications and Guidelines

<table>
<thead>
<tr>
<th>Item</th>
<th>SWTC App B.1 Item</th>
<th>Reference</th>
<th>Agreed Exception</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>SWTC Appendix B.7, (Drainage), section 5</td>
<td>Location: Wattle Street For this item, amend SWTC Appendix B.7, (Drainage),</td>
</tr>
</tbody>
</table>
### Item 1

**Item Reference**

(Pavement Surface Drainage)

**Agreed Exception**

section 5 (Pavement Surface Drainage) delete the existing item (a) and replace with the new words as follows:

Drainage of the pavement wearing surface at Wattle Street is designed for a 10 year ARI event as the existing roadway is inundated during storm frequencies less than 10 year ARI event due to insufficient capacity of existing transverse drainage systems.

**Locations:**

- Wattle Street low points
- Parramatta Road low points

Both within Wattle Street and Parramatta Road large amount of runoff from external source approaches the project work areas inundating the roadway low point during heavy rainfall events.

For this item, amend SWTC Appendix B.7 (Drainage), Section 5 (Pavement Surface Drainage), item (b) as follows:

Add the words

"except within the Wattle Street and Parramatta Road low points"

after

"more than 1metre"

### Item 2

**Item**

2

**Item Reference**

SWTC Appendix B.7, (Drainage), section 5 (Pavement Surface Drainage)

**Locations:**

- Wattle Street low points
- Parramatta Road low points

### Item 3

**Item**

12

**Item Reference**

SWTC Appendix B.7, (Drainage), section 5 (Pavement Surface Drainage)

**Location:** Wattle Street

For this item, amend SWTC Appendix B.7 (Drainage), Section 5 (Pavement Surface Drainage), item (f) (iii) as follows:

Add the words

"except for Wattle Street where the existing roadway is inundated during storm frequencies less than 10 year ARI event due to insufficient capacity of existing transverse drainage systems"

after

"10 year ARI event"

### 3.4 Safety Requirements

In addition to the safety requirements derived from the Project Deed and SWTC, a number of risk workshops and Safety in Design (SiD) workshops have been carried out on the design to date. The subsequently generated safety requirements have been analysed and addressed through the SiD process and actions arising are identified in the M4E Hydrology and Flooding Report (M4E-AEH-TR-00-120-053001). Verification and validation of these safety requirements will be incorporated into the Matrix as works progress.
3.5 Design Life

All assets designed as part of this package are in accordance with the minimum design life specified in SWTC Appendix B.13 and as per the Durability Report (M4E-AEH-RP-00-120-050001).
4 Identification of Flood Risk

4.1 Introduction

The M4 Motorway and connecting roads cross various creeks and their associated floodplains as well as numerous council drainage lines and Sydney Water stormwater trunk mains (refer Figure A.1 in Annexure B for a map of the study area). The flood behaviour in these areas affects the design, particularly around the proposed tunnel portals. Hydrologic and hydraulic models have been developed for those areas of the SSI that are flood affected during both construction and operation of the SSI. The development and validation of the hydrologic and hydraulic models is discussed in detail in the M4E Hydrology and Flooding Design Report (Document No M4E-AEH-TR-00-120-053001). That technical report informs the design development of temporary and permanent works and documents the flood impact assessment associated with the works. The Flood Mitigation Strategy Reports provide a summary of the flood assessments documented in the Hydrology and Flooding Report as well as a discussion on proposed mitigation measures to satisfy Condition B14.

There are nominally 10 temporary construction sites (C1 to C10) for this project (refer Table 9), some of which comprise both tunnel and civil sites. Flood impact assessments have been undertaken for all sites. This particular Flood Mitigation Strategy Report covers the temporary works within Zone 40 (ie sites C7, C8 and C9) which extends from Parramatta Road to Loudon Ave (refer Figure A.2). Within that zone there are works adjacent to Iron Cove Creek.

The Northcote Street tunnel site is strictly speaking part of Zone 10 – Tunnels, but has been included in this design package due to its geographical location.

<table>
<thead>
<tr>
<th>Site ID</th>
<th>Site Name</th>
<th>Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Homebush Bay Drive civil site</td>
<td>20</td>
</tr>
<tr>
<td>C2</td>
<td>Pomeroy Street civil site</td>
<td>20</td>
</tr>
<tr>
<td>C3</td>
<td>Underwood Road (tunnel ** and civil compound)</td>
<td>20</td>
</tr>
<tr>
<td>C4</td>
<td>Powells Creek civil site</td>
<td>30</td>
</tr>
<tr>
<td>C5</td>
<td>Concord Road (tunnel ** and civil compound)</td>
<td>30</td>
</tr>
<tr>
<td>C6</td>
<td>Cintra Park tunnel site **</td>
<td>30</td>
</tr>
<tr>
<td>C7*</td>
<td>Northcote Street tunnel site **</td>
<td>40</td>
</tr>
<tr>
<td>C8*</td>
<td>Parramatta Road ventilation facility (PRVF)</td>
<td>40</td>
</tr>
<tr>
<td>C9*</td>
<td>Wattle Street civil site</td>
<td>40</td>
</tr>
<tr>
<td>C10</td>
<td>Parramatta Road civil site</td>
<td>50</td>
</tr>
</tbody>
</table>

*: Subject of this report; **: Part of Zone 10 – Tunnels, but included in Zone 20/30/40 design package due to its geographical location

4.1.1 Temporary Site Access Works

The flood impact assessment covers the temporary site access works, which include features such as site access and haul roads, hardstand areas (eg for laydown and parking), acoustic sheds, noise walls, sediment control basins and drainage infrastructure. These features will be in place for most of the duration of the construction activities (2 to 3 years). Temporary Site Access Design packages have been developed for each of the construction sites. Summaries of the flood impact assessments have been included in those design packages and mitigation measures have been incorporated into the design. The design package for Northcote Street Tunnel Site (C7) has been issued for IFC. The Parramatta Road Ventilation Facility Temporary Site Access Works (C8) have been combined with the Wattle Street Civil Site Temporary Site Access Works (C9) and these are currently at Substantial Detailed Design (SDD) stage. The flood impact assessment has been based on the SDD/IFC designs for these packages.
4.1.2 Construction Staging

The construction staging works were still under development at the time of submission of this report, except for the Stage 1 works which is currently at SDD design phase. An assessment of the traffic staging for Stage 1 for Wattle Street has been undertaken and is summarised in this report.

As the staging works are being developed further flood impact assessments will be undertaken to identify flood risks and appropriate mitigation measures. Flood mitigation measures identified for the staging works will be documented in the Construction Staging Temporary Works Design packages. The individual stages will typically be in place for a relatively short duration (less than one year). Therefore the probability of a major flood event occurring during each construction stages is less compared to the longer duration site access works and permanent works. A preliminary assessment of the flood impacts associated with the construction staging is included in this submission of the report, including the Stage 1 works.

4.2 Assessment of Flood Risk

The three construction sites in Zone 40 are located in the Iron Cove Creek catchment. Wattle Street runs parallel to Iron Cove Creek.

The catchment draining to Parramatta Road at Iron Cove Creek is approximately 630 ha and the critical storm duration is estimated to be 60 minutes. The sites in Zone 40 generally experience short duration flooding (i.e., hours, not days), but would also have relatively short flood warning times.

4.2.1 Northcote Street Tunnel Site (C7)

The Northcote Street Tunnel Site (C7) is not flood affected in events up to and including the PMF and no flood mitigation measures are required.

4.2.2 Parramatta Road Ventilation Facility (C8)

The Parramatta Road Ventilation Facility (C8) is not flood affected in events up to and including the PMF and no flood mitigation measures are required.

4.2.3 Wattle Street Civil Site (C9)

4.2.3.1 Existing Conditions

The eastern end of the Wattle Street site is flood affected through both flooding from Iron Cove Creek, as well as overland flows from the catchment to the south of Wattle Street/Dobroyd Parade (refer to Figure B.1). Flows in Iron Cove Creek are reasonably confined up to Parramatta Road, but start breaking out between Parramatta Road and Ramsay Street. Downstream of Ramsay Street, flows break out of the channel, flooding Reg Coady Reserve and Wattle Street/Dobroyd Parade on the right bank and Timbrell Park on the left bank. The creek then discharges to Iron Cove approximately 400 m downstream of the extent of works.

Under existing conditions a low point on Wattle Street exists just north of the intersection with Waratah Street, with the road crest at 2.0 m AHD, which is only about 1 m above the High High Water Solstices Springs (HHWSS) tide level of 1 m AHD. Further east, Dobroyd Parade is generally also low lying, with the road frequently inundated by both creek and overland flows.

The catchment runoff generally follows a natural drainage line from the southeast heading towards Wattle Street between Martin and Waratah Streets. The Sydney Water trunk mains (a 2.59 m x 1.37 m box culvert and a single 1,050 mm diameter pipe turning into twin 900 mm diameter pipes) cross Wattle Street at this location to discharge into Iron Cove Creek.
Overland flow surcharges from the upstream drainage system to the south of Wattle Street and local runoff ponds up behind the footpath on Wattle Street. Flows are pushed east along Wattle Street towards Waratah Street before it starts overtopping the road.

Another smaller drainage line runs down Waratah Street towards Wattle Street. This contributes to flooding at this intersection. In larger flood events a third drainage line running down Loudon Avenue further east pushes more flows towards Waratah Street when the drainage system surcharges.

The western end of the site is not flood affected except for a small overland flow path that runs to the west of Allum Street, and crosses Wattle Street at Ash Lane. A local drainage system runs north along Ash Lane.

Wattle Street/Dobroyd Parade was assessed as having low flood immunity, with the low point near Waratah Street overtopping in as little as a 1-2 year ARI storm event.

4.2.3.2 Flood Risk Associated with the Proposed Temporary Site Access Works

The temporary site access works proposed for the Wattle Street site that could potentially affect flooding include:

- Noise walls and hoarding
- Temporary traffic barriers

The site can be divided into three different zones: Wattle Street South, Wattle Street North and the Walker Avenue compound. The Walker Avenue compound is located towards the western end of the site near Parramatta Road adjacent to the PRVF and is not flood affected (refer Figure B.1). Site facilities would be located at the Walker Avenue compound.

The Wattle Street South site is located to the south of Wattle Street from the Walker Avenue compound to just east of Martin Street. This site is generally not flood affected except for a minor overland flow path around Allum Street and Ash Lane (refer Figure B.1). This flow path would be managed through local stormwater management during construction. The proposed noise wall/hoarding along the southern side of the site also has the potential to cause flooding impacts on properties. Gaps or flaps similar to the permanent noise wall design would need to be provided.

The Wattle Street North site is located to the north of Wattle Street between Martin Street and Loudon Avenue and mainly runs through Reg Coady Reserve. This site is flood affected through break-outs from Iron Cove Creek and overland flows from the catchments to the south of Wattle Street. Temporary barriers will be placed along Wattle Street during the temporary site access works. These potentially affect flow paths. To mitigate potential impacts either gaps in the barriers or alternative permeable temporary fencing/hoarding will be required, provided working restrictions and appropriate clear zone restrictions are enforced (refer Figure C.1).

Along the pedestrian pathway to the north of Wattle Street around Waratah Street, chain mesh type fencing will be used rather than solid safety barriers where required.

The proposed temporary site access works layout would not lead to adverse flood impacts to adjoining properties (refer Figure C.1). No floor levels were checked for inundation as there would be no flood impacts at buildings on adjoining properties. Some minor flood impacts are estimated to occur on Walker Avenue and Parramatta Road near the PRVF. However, these impacts are less than the allowable maximum limit of 0.05 m.

Minor reductions in flood levels are estimated around Waratah Street to the south of Wattle Street (refer Figure C.1). The temporary traffic barriers on Wattle Street prevent some of the flow breaking out from Iron Cove Creek from overtopping onto Wattle Street. This leads to a minor reduction in flood levels to the south of the barriers and a slight increase in flood levels to the north of the barriers. These increases do not affect floor levels and are less than the allowable 0.05 m limit.
Minor reductions in flood levels are also estimated to occur around Ash Lane and Ramsay Street to the north of Wattle Street (refer Figure C.1). These reductions are due to the stormwater being trapped behind the temporary traffic barriers along Wattle Street.

Inundation times have been checked as the proposed works affect overland flows. In particular the inundation times on properties to the south of Wattle Street along the temporary noise walls were investigated but the provision of gaps in the noise walls would maintain flow paths similar to existing conditions. This would mean that inundation times in the 100 year ARI would only marginally increase but no more than the allowable one hour (refer Figure 2).

![Inundation time, temporary site access works (Ramsay Street)](image)

**Figure 2: Inundation time, temporary site access works (Ramsay Street)**

### 4.2.3.3 Flood Risk Associated with the Proposed Temporary Traffic Staging

Most of the traffic staging works for the construction of the Wattle Street interchange was still under development at the time of submission of this report. The design of the Stage 1 works was at SDD stage at the time of submission of this report and the flood impact assessment associated with those works is discussed in this section.

In addition to the temporary site access works, the construction works proposed for the Wattle Street site during Temporary Traffic Staging - Stage 1 that could potentially affect flooding include:

- Temporary site access works such as the G-Loop located in close proximity to the creek
- Temporary traffic barriers

Through Wattle Street North a ‘G-loop’ facility is planned at the intersection of Wattle Street and Waratah Street (refer Figure C.2). This will enable a turnaround facility for construction traffic servicing both Northcote Street Tunnel Site and Wattle Street Site reducing the impact of construction on the local road network. The proposed G-Loop and temporary traffic barriers through Reg Coady Reserve have the potential to block flows. This G-Loop would be built as close to existing ground level as possible.
Similar to the site access works, safety barriers, noise walls and hoarding between Martin Street and Loudon Avenue along Wattle Street affect flow paths. To mitigate potential impacts either gaps in the barriers or alternative permeable temporary fencing/hoarding will be required, provided working restrictions and appropriate clear zone restrictions are enforced (refer Figure C.2).

The proposed temporary site access works layout would not lead to adverse flood impacts to adjoining properties (refer Figure C.2). No floor levels were checked for inundation as there would be no flood impacts at buildings on adjoining properties. Some minor flood impacts are estimated to occur on Walker Avenue and Parramatta Road near the PRVF. However, these impacts are less than the allowable maximum limit of 0.05 m.

Minor reductions in flood levels are estimated around Waratah Street to the south of Wattle Street (refer Figure C.2). These reductions are as a result of the temporary traffic barriers on Wattle Street preventing breakouts from Iron Cove Creek from overtopping onto Wattle Street as well as the G-loop being in cut near Waratah Street. This leads to a minor reduction in flood levels to the south of the barriers.

Inundation times have been checked as the proposed works affect overland flows. The inundation times were found to be very similar to those estimated under the temporary site access works (see Figure 3).

Figure 3: Inundation time, temporary traffic staging Stage 1 (Ramsay Street)

4.2.3.4 Flood Risk Associated with Construction Works near Iron Cove Creek

In addition to the temporary site access works and the traffic staging, the following construction activities in the vicinity of Iron Cove Creek have been identified that could affect flooding:

- Internal supports for the Sydney Water box culvert during construction, leading to a reduced flow capacity
- Soil treatment associated with soft soils
Internal Supports for Sydney Water Box Culvert

As discussed in Section 4.2.3.1 an existing Sydney Water box culvert and a single 1,050 mm diameter pipe cross Wattle Street between Martin Street and Waratah Street before connecting into Iron Cove Creek. As part of the proposed permanent design a new stormwater pipe would be connected to the creek just upstream of the box culvert connection.

Assessments are currently being undertaken to confirm whether the box culvert has the structural capacity to carry construction traffic. If it is found that the culvert does not have the required capacity, the culvert may require internal supports which would reduce the conveyance capacity of the box culvert. A flood impact assessment has been undertaken to determine the potential flood impact associated with the partial blockage of the culvert. A blockage of 10% has been assumed (based on a single internal support). The reduced culvert conveyance capacity has been assessed and the results indicate potential flood impacts of up to 0.015 m at four (4) properties between Wattle Street and Martin Street (refer Figure 4 and Table 10). All four have floor levels above the existing 100 year ARI flood level and therefore flood impacts of up to 0.05 m are allowed. An increase in flood level of up to 0.015 m would not lead to above floor level inundation at these four properties.

Soft Soil Treatments

Soft soils associated with alluvial deposits near Iron Cove Creek have been identified between Martin Street and Waratah Street. These require treatment prior to the construction of the permanent works to minimise settlement during the design life of the works. One treatment option that is often adopted in these situations is pre-loading the area with surcharge embankments prior to construction. These embankments would be located between Wattle Street and Iron Cove Creek. In that location they would not only block flow paths but would also take up floodplain storage. An initial flood assessment showed that these surcharge embankments would lead to widespread flood impacts along Iron Cove Creek. As an alternative unreinforced Controlled Modulus columns (CMCs) are being considered. These would not require any build-up above existing surface/design surface level and would therefore have no impact on flooding.

Table 10: Effect of reduced Sydney Water culvert capacity on properties (floor level checks, 100 year ARI)

<table>
<thead>
<tr>
<th>Address</th>
<th>Surveyed Floor Level (m AHD)</th>
<th>Peak Flood Level – Existing (m AHD)</th>
<th>Above Floor Level Inundation (m)</th>
<th>Relative Impact (m)**</th>
<th>Condition of Approval B14 allowable limit (m)***</th>
</tr>
</thead>
<tbody>
<tr>
<td>222 Alt Street</td>
<td>3.31</td>
<td>2.93</td>
<td>N/A</td>
<td>0.015</td>
<td>0.05</td>
</tr>
<tr>
<td>220 Alt Street</td>
<td>3.93</td>
<td>3.60</td>
<td>N/A</td>
<td>0.012</td>
<td>0.05</td>
</tr>
<tr>
<td>13 Martin Street</td>
<td>3.91</td>
<td>3.72</td>
<td>N/A</td>
<td>0.012</td>
<td>0.05</td>
</tr>
<tr>
<td>11B Martin Street</td>
<td>3.83</td>
<td>3.54</td>
<td>N/A</td>
<td>0.014</td>
<td>0.05</td>
</tr>
</tbody>
</table>

*: Highest flood level in the vicinity of buildings; **: On property; ***: At buildings
4.3 Implications of Climate Change

Condition B14 requires an assessment of the risk of climate change to the project. The assessment of two climate change scenarios has been prescribed in the SWTC. Considering the short-term nature of the temporary works (duration of construction up to 3 years) and the planning horizon for climate change (greater than 10 years), a climate change impact assessment for temporary works is not deemed applicable.
Climate change assessments for permanent works are documented in the Flood Mitigation Strategy Report for the permanent works (M4E-AEH-TR-00-120-100001).

4.4 Consideration of Waterway Structure Blockage

Condition B14 requires the consideration of blockage of waterway structures from floating debris. Potential blockage at the Wattle Street site is discussed below.

4.4.1 Wattle Street Civil Site (C9)

Condition B14 requires the consideration of blockage of waterway structures from floating debris. As part of the temporary works there would be no new waterway crossings over Iron Cove Creek. Therefore blockage of the existing bridges/culverts in the vicinity of the works was considered.

AR&R Project 11 provides recommendations for the assessment of waterway blockage due to floating debris. Based on those recommendations, considering the size of the bridges compared to the size of the channel as well as the size and availability of potential floating debris, a blockage of 10% has been applied to bridges in close proximity to the different construction sites:

- Wattle Street site: Ramsay Street bridge, pedestrian bridge at Waratah Street and Timbrell Drive bridge over Iron Cove Creek

The flood level impacts associated with the potential blockage of the existing bridges/culverts would lead to very similar flood impacts to those under the no blockage scenario. Flood levels would not increase to such an extent to pose a risk to the works.

While there are no new waterway crossings proposed over Iron Cove Creek there could be construction works in the creek associated with the new stormwater connections outletting to the creek. These works could include temporary scaffolding placed around the banks of the creek. While the scaffolding itself would likely not cause a significant obstruction to flows in the creek, debris could become trapped in the scaffolding during a flood event. The creek is quite wide through Reg Coady Reserve (approximately 21m). It has been estimated that scaffolding and flood debris could block up to 10% of the creek width.

The reduced channel width has been assessed and the results indicate potential flood impacts of just over 0.01 m within Reg Coady Reserve and along Henley Marine Drive (refer Figure 5). These are within the maximum allowable limit of 0.05 m.

The channel upstream of the construction site is generally fenced off and therefore the chances that large debris washing off upstream properties during flood events would end up in the channel are considered low. A lot of debris would also be caught at the upstream bridges, the closest being Ramsay Street which is located approximately 350 m upstream of the proposed stormwater connection points. Building materials on the construction site will need to be managed carefully to prevent those from getting washed into the channel through local runoff.
Figure 5: Relative flood level impacts at Wattle Street associated with Iron Cove Creek blockage (100 year ARI)
5  Flood Mitigation Measures

Possible flood mitigation measures for the temporary work sites have been identified based on the flood model results for the temporary works sites in Zone 40. These are discussed in more detail below.

The design measures listed in Section 5.1 have been included in the design package drawings associated with each site. Management measures such as clearing of waterways or storage material outside of flood zones will be implemented in the Contractor’s Construction Environmental Management Plan (CEMP) and Incident Response Plan (refer Section 5.2).

5.1 Site Specific Flood Mitigation Measures

5.1.1 Northcote Street Tunnel Site (C7)

The Northcote Street site is not flood affected in events up to and included the PMF. As such, no flood mitigation measures are required for this site. Temporary stormwater drainage measures have been proposed to meet drainage requirements.

5.1.2 Parramatta Road Ventilation Facility (C8)

The Parramatta Road Ventilation Facility is not flood affected in events up to and included the PMF. As such, no flood mitigation measures are required for this site. Temporary stormwater drainage measures have been proposed to meet drainage requirements.

5.1.3 Wattle Street Civil Site (C9)

The proposed mitigation measures to manage potential impacts and the risk of flooding at the Wattle Street site for the temporary access works include:

- The proposed site facilities will be located at the Walker Street compound. This area is not flood affected.
- Between Waratah Street and Loudon Avenue alternative permeable temporary fencing/hoarding are required to minimise flood impacts, provided working restrictions and appropriate clear zone restrictions are enforced to minimise blockage of flow paths that would otherwise be caused by solid concrete traffic barriers.
- A minimum 15 m opening/section without safety barriers is required between Waratah Street and Loudon Avenue along the northern side of Wattle Street to maintain overland flow paths.
- Use of chain mesh type fencing along the pedestrian pathway north of Wattle Street.
- The proposed G-Loop would need to be built-up no higher than the existing road level on Wattle Street, preferably as close to existing ground level as possible.
- Gaps or flaps in the temporary noise wall along the southern boundary of the site would need to be provided.
- The Iron Cove Creek channel will be checked regularly and cleared if required to ensure that it is free from any debris or building material. This will ensure that the capacity of the channel is not reduced and the potential for blockage will be kept to a minimum.
- Scaffolding within the creek should be removed as soon as works are completed.

5.2 Emergency Response and Evacuation

Weather conditions in the vicinity of site C9 will need to be monitored with sufficient warning disseminated to all construction personnel on site of impending flood producing rain, they can implement precautionary
measures and relocate any mobile equipment stored on site outside the flood extent/overland flow paths where possible. A flood emergency response procedure is being developed based on the five Flood Mitigation Strategy reports to remove construction materials, such as mobile equipment and scaffolding, where required/possible when severe weather warnings are issued for the area and to provide staff evacuation plans. This will be documented in the Contractor's Incident Response Plan (M4E-LSJ-00-000-MP-001011).

Flood warning times would likely be short as the catchment response is fast (the critical storm duration is estimated to be 60 minutes for Iron Cove Creek). This would limit how much equipment could be moved out of the floodplain during an event and could have implications for safety of construction staff and the public in the vicinity of the works. Therefore emphasis should be on implementing some precautionary actions based on the flood warning rather than responding during the actual events.

Monitoring weather conditions is covered in the Construction Environmental Management Plan (CEMP) Soil and Water Management Plan (M4E-ES-PLN-PWD-00242) currently under review by the Department of Planning and Environment.

5.3 Scour and Energy Dissipation

Clause (e) of Condition B14 requires the identification of mitigation measures to reduce scour where flood velocities are estimated to be increased as a result of the SSI. This assessment is detailed in the sections below. Temporary sediment and erosion controls on constructions sites to manage site runoff do not form part of this assessment. These are documented in the CEMP and Temporary Site Access Works packages.

5.3.1 Wattle Street Civil Site (C9)

Existing velocities in Iron Cove Creek are relatively high (in the order of 3 m/s in the 100 year ARI). Overland flow velocities are less than 0.5 m/s in the 100 year ARI, but at the low point at Waratah Street the overtopping velocities are as high as 1.5 m/s under existing conditions.

The velocities in the creek would not be changed as a result of the temporary works. Overland flow velocities would generally only be changed through the construction sites as a result of changes to overland flow paths and potential erosion within the construction sites will be managed through the temporary sediment and erosion controls. No additional scour measures are considered necessary or proposed.

5.4 Drainage System Upgrades

Condition B20 requires the assessment of potential impacts where the proposed pavement drainage systems would connect to council’s existing drainage system. Assessments for Condition B20 will be documented as part of the Temporary Site Access Works packages for construction works and Drainage Design Reports for permanent works.

For the temporary access site works in Zone 40 there would be adjustments to the local drainage system required at C7 (Northcote) along Northcote Street and Parramatta Road. The proposed temporary drainage system has been designed to generally convey flows to the Parramatta Road drainage system. Under existing conditions the runoff from the site also drains towards Parramatta Road and therefore the existing drainage patterns are mostly being maintained

As part of the traffic staging works, adjustments to the drainage systems along Wattle Street are required which mainly involve the progressive construction of the permanent drainage infrastructure. The permanent drainage systems will connect either to Iron Cove Creek towards the eastern end of the site or to Parramatta Road drainage system at the western end. The exception is a small drainage line that connects to the local council drainage system at Ash Lane. This is not expected to be built as part of the early traffic staging and would only be built in conjunction with the proposed permanent on-site detention basin to mitigate impacts.

No drainage system upgrades are required for flood mitigation due to temporary works.
5.5 Mitigation Measures Identified in Environmental Documents

Conditions B14 Clause (d) requires the consideration of the processes and actions documented in Condition A2(b) and A2(c), which refer to the M4 East Environmental Impact Statement (EIS) and the M4 East Submission Report. These documents outline flood mitigation measures for permanent and temporary works. Condition A2(c) is the most recent document and provides the revised environmental management measures for the Project in Chapter 8 of that report. The relevant flood related management measures have been extracted from the M4E Submissions Report and are summarised in Table 11 together with mitigation measures developed as part of the M4E detailed design process. The mitigation measures that have been developed for the Zone 40 construction works are generally in line with mitigation measures identified in Condition A2(c).

Table 11: Mitigation Measures referred to in Table 8.1 of Condition A2(c)

<table>
<thead>
<tr>
<th>Ref *</th>
<th>Location</th>
<th>Possible Mitigation Measures Identified in Condition A2(c)</th>
<th>Proposed Mitigation Measures Developed as Part of the Detailed Design Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>FD01</td>
<td>Management of flood and stormwater - General</td>
<td>A flood management strategy (FMS) will be prepared to manage flooding and stormwater related issues and will include:</td>
<td>The Flood Mitigation Strategy deals with flooding issues only. Stormwater issues are documented in the individual Temporary Site Access Works design packages for temporary works and Drainage Design packages for permanent works.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(i) The layout of construction ancillary facilities</td>
<td>(i) Provided in figures in Annexure B</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) Location of amenities buildings and equipment outside high flood hazard areas</td>
<td>(ii) Stationary equipment not included. Site amenities will be located outside flood affected areas (refer Section 4.2.3.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) Controlled diversion of overland flow either through or around work areas</td>
<td>(iii) Refer Section 4.2.3.2, 4.2.3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iv) Staging construction to limit the extent and duration of temporary works on the floodplain</td>
<td>(iv) Refer Section 4.2.3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(v) Monitoring weather conditions</td>
<td>(v) Refer to Section 5.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(vi) Ensuring construction equipment and materials are removed from floodplain areas at the completion of each work activity, or upon issuing of a weather warning of impending flood producing rain</td>
<td>(vi) Construction equipment and materials will be removed as soon as practical after completion of works in an area. Refer also Section 5.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(vii) Provision of temporary flood protection for properties identified as being at risk of adverse flood impacts during any stage of construction of the project</td>
<td>(vii) Refer Section 5.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(viii) Development of flood emergency response procedures to remove temporary works during periods of heavy rainfall and staff evacuation plans</td>
<td>(viii) Refer Section 5.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(ix) Refer Section 5.2</td>
</tr>
<tr>
<td>Ref *</td>
<td>Location</td>
<td>Possible Mitigation Measures Identified in ConditionA2(c)</td>
<td>Proposed Mitigation Measures Developed as Part of the Detailed Design Process</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------------------------</td>
<td>----------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ix) For site facilities located within the floodplain, the FMS will identify how risks to personal safety and damage to construction facilities will be managed.</td>
<td>(i) Refer M4E Flooding and Hydrology Report (M4E-AEH-TR-00-020-053001)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(ii) Refer Sections 4 and 5. Assessments of impacts during events larger than the 100 year ARI event are not applicable for construction works. That assessment will be undertaken for permanent works (Flood Mitigation Strategy M4E-AEH-TR-00-120-100001).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(iii) Refer Section 4.2.3.2, 4.2.3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(iv) Refer Section 5</td>
</tr>
<tr>
<td>FD02</td>
<td>Flooding impacts on adjacent development</td>
<td>Adverse flood impacts on existing development will be managed through the FMS. This may include: (i) A detailed hydrologic and hydraulic assessment into flooding behaviour and mitigation measures required during detailed design</td>
<td>(i) Refer M4E Flooding and Hydrology Report (M4E-AEH-TR-00-020-053001)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(ii) Design of works within the floodplain to minimise adverse impacts on surrounding development for flooding up to the 100 year ARI event. Assessment will also be made of impacts during flooding in excess of the 100 year ARI event up to the PMF, in the context of impacts on critical infrastructure and flood hazards</td>
<td>(ii) Refer Sections 4 and 5. Assessments of impacts during events larger than the 100 year ARI event are not applicable for construction works. That assessment will be undertaken for permanent works (Flood Mitigation Strategy M4E-AEH-TR-00-120-100001).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(iii) Floor level survey will be carried out at all properties at risk (where there is a potential increase in flood levels) to confirm whether construction activities will increase flood damages. Where flooding potential is confirmed, management measures for construction works and operational design will be incorporated.</td>
<td>(iii) Refer Section 4.2.3.2, 4.2.3.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(iv) Refer Section 5</td>
</tr>
<tr>
<td>FD04</td>
<td>Impacts of future climate change on flooding behaviour</td>
<td>The project will be designed to manage the potential impacts due to climate change in accordance with the Practical Considerations of Climate Change – Floodplain Risk Management Guideline (DECC 2007).</td>
<td>Refer Section 4.3</td>
</tr>
<tr>
<td>FD18</td>
<td>Scour prevention</td>
<td>Measures will be implemented and maintained to intercept concentrated flow and divert it in a controlled manner to prevent scour of disturbed surfaces and transportation of sediment and</td>
<td>This is covered in the individual Temporary Site Access Works packages for each construction site</td>
</tr>
</tbody>
</table>
**5.6 Timing and Maintenance Requirements**

### 5.6.1 Timing

The mitigation measures identified in this report for the Zone 40 construction sites would need to be implemented during the establishment of the temporary site access works.

### 5.6.2 Maintenance

Whilst the temporary construction sites are operational it is recommend that a visual inspection of the temporary stormwater system is undertaken. It is paramount that the drainage systems are maintained especially before a major storm, to allow them function efficiently.

Maintenance activities would include:

- Removing any debris from pit grates
- Keeping swale and catch drains free from vegetation and debris
- Removing any debris that will stop the flaps functioning at the bottom of noise walls
- Assessing any structural damage to pits during construction
- Keeping open channels free from vegetation and debris
- Inspections and clean up after storms.
6 Design Integration

6.1 Cross Discipline Review

A cross discipline review (CDR) has been undertaken on this design package by design and construction team discipline leaders to verify appropriate integration of other disciplines design components prior to submission to IC and the Project Company.

6.2 Integration with Other Stakeholders

Design integration will be presented in the individual design packages.

6.2.1 Consultation

Consultation commenced in late February 2016 with meetings with councils to discuss staging of the Flood Mitigation Strategy Reports and requests for council flood study information. These meetings were held on:

- 10 March 2016 – City of Canada Bay Council
- 16 March 2016 – Council of the Municipality of Ashfield

The draft report will be provided for comment to:

- City of Canada Bay Council and Council of the Municipality of Ashfield
- Sydney Water
- Office of Environment and Heritage (OEH)
- Roads and Maritime Services

At the time of submission of this report there are no properties identified that would experience flood impacts greater than the allowable maximum criteria. As further assessments are being carried out on the construction staging works any affected landowners will be consulted where required.
7 Design Compliance

7.1 Non-Conformances

The design has been developed to comply with the SWTC; however in some instances the design may not satisfy all design criteria.

Design Non-Conformances are summarised in Table 12 below to identify the details of design departures from the SWTC, the reason for the departure or proposed action to mitigate these departures and the current status of approval.

The design departures are to be reviewed and discussed with the Project Company and Independent Certifier during the detailed design with the objective of gaining acceptance prior to seeking formal approval to amend the SWTC prior to issue of the final design.

Table 12: Identified Non-Conformances

<table>
<thead>
<tr>
<th>Details of Non-conformance</th>
<th>Reason for Non-conformance</th>
<th>Proposed action</th>
<th>Status (open/closed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil at this stage</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
8 Approvals and Certifications

The following design approval(s) and certification(s) have been identified for this package (refer Table 13).

Table 13: Design Approval and Certification Requirements

<table>
<thead>
<tr>
<th>Design stage</th>
<th>Required party to approve</th>
<th>Design Approval Required</th>
<th>Status of Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil at this stage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.1 Internal Verification Process

All design outputs are subject to informal internal verification that may take the form of general overview, spot checking, compliance with the brief, or a detailed check. The form of verification is relevant to the risk presented by the design activity, and the degree to which risk can be effectively mitigated by the form of verification.

8.2 Independent Verification and Assurance

The design has been internally verified by independent design team members. We have addressed the verification comments where possible prior to this submission. Any outstanding comments will be addressed during the next design stage.

8.3 Independent Certifier, Project Company and RMS

Comments made by the IC, PC and RMS and evidence of closure from previous design package submissions are included in Annexure A – Comments and Responses Register.
9 Outstanding issues

9.1 ‘Hold’ Schedule

There are a number of areas on ‘Hold’ for various design lots (road geometry, structures, drainage, etc) that in turn affect the flood assessment and development of proposed flood mitigation measures. These ‘Hold’ areas are expected to be resolved as the design progresses, and the flood impact assessment will be updated accordingly.

9.2 Other Issues

At the time of this report submission there are no additional stakeholder issues that are still to be addressed before the design can progress to the next stage.
10  Sustainability Targets and Initiatives

Details of the sustainability targets and initiatives as set out in the SWTC Appendix D.5 Sustainability Requirements are being addressed in the individual design packages.
11 References


Department of Infrastructure, Planning and Natural Resources (2005). *NSW Floodplain Development Manual – The Management of Flood Liable Land*

Engineers Australia (1987, with 1998 updated Book VI). *Australian Rainfall and Runoff, 3rd Edition*


Annexure A  Comments and Responses Register

Not applicable at this stage.
## Annexure B  Figures

<table>
<thead>
<tr>
<th>Figure Number</th>
<th>Figure Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure A.1</td>
<td>Location Map</td>
</tr>
<tr>
<td>Figure A.2</td>
<td>Construction Sites</td>
</tr>
<tr>
<td>Figure B.1</td>
<td>Iron Cove Creek - Existing Conditions Flood Extents</td>
</tr>
<tr>
<td>Figure C.1</td>
<td>Northcote (C7), PRVF (C8) and Wattle Street (C9) Temporary Site Access – 100 Year ARI Relative Flood Impacts</td>
</tr>
<tr>
<td>Figure C.2</td>
<td>Northcote (C7), PRVF (C8) and Wattle Street (C9) Temporary Traffic Staging Stage 1 – 100 Year ARI Relative Flood Impacts</td>
</tr>
</tbody>
</table>
Legend

Relative Flood Impact (m)

- < -0.5
- 0.5 to -0.1
- 0.1 to -0.05
- 0.05 to -0.01
- 0.01 to 0.01
- 0.1 to 0.05
- 0.5 to 0.1
- > 0.1

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Flood model results presented on these maps have been specifically prepared for the WestConnex M4E Project and should not be used for any other purposes.
Annexure C  Peer Review
4 May 2016

CPB Samsung John Holland Joint Venture
Level 3
85 Harrington Street
THE ROCKS NSW 2000
Attention: Don Johnson

WestConnex M4 East Flood Mitigation Strategy - Zone 40 Temporary Works Peer Review

Dear Don,

We refer to NSW Government Planning & Environment Approval for the WestConnex M4 East Project. Under Condition B14 this approval requires the Flood Mitigation Strategy to be peer reviewed and confirmed as meeting the requirements of Condition B14.

AEH confirm that this review has been undertaken by a suitably qualified and experienced independent hydrological engineer, Bruce Withnall, who has not been involved in the design development for this Project. We confirm that the Flood Mitigation Strategy for Zone 40 Temporary Works meets the requirements of Condition B14 subject to the flood impact assessments for the construction staging being included in the final version of the Flood Mitigation Strategy for Zone 40 Temporary Works.

Yours sincerely

Bruce Withnall
Industry Director
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M +61 403 445 720