Sydney Metro North West

Design and Construction of Surface and Viaduct Civil Works

Stormwater and Flooding Management Plan

NWRLSVC-ISJ-SVC-PM-PLN-120215

Revision 9.0

13 December 2017

Document Control

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Document Revision History

Doc No **NWRLSVC-ISJ-SVC-PM-PLN-120215**

Revision	Description	Prepared by	Reviewed by	Approved by	Date
1.0	Draft Issue	I Fergus/ W Honour WorleyParsons	Steve Fermio		31-Mar-14
2.0	Issued for Approval	W Honour	Steve Fermio	Graeme Tait	14-Oct-14
3.0	Amendment to sections 5.2.3, 5.2.4, 5.2.5	W Honour	Steve Fermio	Graeme Tait	19-Nov-14
4.0	OEH Consultation included,	T. Austin	Tim Clarke	Ian Stuart	14-Mar-16
5.0	Updated Appendix D, Section 5.2, general revision	T. Austin	Tim Clarke	Ian Stuart	14 – Mar-16
6.0	General update	B Tucker	J Burgin	G Perdikaris	19 Sept 17
7.0	General update	B Tucker		G Perdikaris	9 Nov 17
8.0	Updated to address comments	B Tucker	B Tucker	G Perdikaris	16 Nov 17

9.0	General update	B Tucker	B Tucker	G Perdikaris	13 Dec 17
Signature					

Plan Compliance

CL.	Requirement	Where Addressed
Project Planning Approval		
C7	The SSI in relation to Application No: SSI-5100 shall be designed, to the extent that it is feasible and reasonable, to not worsen existing flood characteristics in the vicinity of the SSI. Not worsen is defined as: (a) a maximum increase in flood levels of 20mm in a 100 year Average Recurrence Interval (ARI) flood event; and (b) a maximum increase in flood levels of 50mm in a probable maximum flood; and (c) a maximum increase in time of inundation of one hour in a 100 year ARI flood event; and (d) any increase in flow velocity in a 100 year ARI flood event should not increase the potential for soil erosion and scouring.	Section 2.2.1
Project Planning Approval		
C33	The SSI will also consider the conditions of Application No: SSI-5414-Construction Works for the North West Rail and Operation of the railway, and wider precincts, service facilities, and rail infrastructure systems, where condition C33 of the Project Planning Approval states that " to the extent that it is feasible and reasonable, to not worsen existing flood characteristics in the vicinity of the SSI where not worsen is defined as: (a) a maximum increase in flood levels of 50mm in a 100 year Average Recurrence Interval (ARI) flood event; and (b) a maximum increase in time of inundation of one hour in a 100 year ARI flood event; and (c) any increase in flow velocity in a 100 year ARI flood event should not increase the potential for soil erosion and scouring." .	Section 2.2.1

CL.	Requirement	Where Addressed
C8	A Stormwater and Flooding Management Plan(s) in relation to Application No: SSI-5100 shall be prepared in consultation with the Department (Strategies and Land Release), OEH, and relevant Councils during detailed design of the SSI and prior to relevant construction, or as otherwise agreed by the Director General. The Plan shall identify actions to ensure that the SSI addresses existing flooding characteristics within the vicinity of the SSI for a full range of flood sizes up to and including the PMF. The Plan(s) shall be prepared by appropriately qualified person(s) and facilitate a holistic approach to detailed hydrologic assessment and stormwater management, which gives consideration to the impacts associated with construction and operation, and shall include but not be limited to:	This Plan, Appendix B
	(a) the design of temporary works and compensatory measures that would be implemented during construction to not worsen, to the extent that it is feasible and reasonable, existing and known future flooding characteristics;	Section 5 and Appendix D
	(b) the identification of flood risks to the SSI and adjoining areas, including the consideration of local drainage catchment assessments, and climate change implications on rainfall and drainage characteristics;	Section 4 & 5
	(c) identification of design and mitigation measures that would be implemented to protect proposed construction activities and not worsen existing flooding characteristics during construction, including soil erosion and scouring;	Section 5 and Construction Soil and Water Management Plan
	(d) identify flood risk, potential for inflows, potential consequences and required mitigation measures for each tunnel entrance; and	Section 5
	(e) a flood emergency response management plan.	Section 6
	For surface components of the SSI located on floodplains, flood impacts shall be confirmed in accordance with the Floodplain Development Manual (2005), and other relevant NSW Government Guidelines.	Section 2.3
C34	In relation to Application No: SSI-5414 (Condition C34),the Stormwater and Flooding Management Plan(s) shall take into consideration the cumulative impacts of the SSI associated with its construction and operation, and include but not be limited to:	
	(a) the design of temporary works, compensatory and management measures that would be implemented during construction to not worsen, to the extent that it is feasible and reasonable, existing and known future flooding characteristics;	Section 5

CL.	Requirement	Where Addressed
	(b) the identification of flood risks to the SSI and adjoining areas, including the consideration of local and regional drainage catchment assessments, strategies and guidelines; and climate change implications on rainfall and drainage characteristics;	Section 4 & 5
	(c) the design and layout of each station precinct and rail service facility to not worsen, to the extent that it is feasible and reasonable, existing and known future flooding characteristics;	Section 5 and Construction Soil and Water Management Plan
	(d) identification of design and mitigation measures that would be implemented to protect proposed construction activities and operational activities and not worsen existing flooding characteristics during construction, including soil erosion and scouring. Design of mitigation measures should consider more frequent floods besides flood of design; and	Section 5
	(e) identify flood risk, potential for inflows, potential consequences and required mitigation measures for each tunnel entrance;	Section 5
	(f) specific information related to flood risk in larger floods (for example PMF) and incorporation of management measures in the flood emergency response planning required under condition F4.	Section 6

Contents

1 INTRODUCTION

1.1 Purpose

The purpose of this Stormwater and Flooding Management Plan (this Plan) is to describe how ISJV will minimise and manage impacts on stormwater and flooding during the design and construction (D&C) of the Stage 1 Surface and Viaducts Civil Works (SVC) contract for the Sydney Metro North West Project (the Project) and also following construction of the civil works.

Transport for NSW (TfNSW) is delivering the Project on behalf of the NSW Government.

This Plan has been prepared to address the requirements of relevant Minister for Planning's Conditions of Approval (CoA), the Revised Environmental Mitigation Measures (REMMs), applicable legislation, the EIS for Stage 1: Major Civil Construction Works (EIS 1) and contractual requirements including the Surface and Viaducts Civil Works Project Deed and Scope of Work and Technical Criteria (SWTC).

1.2 Scope

The SVC construction scope is as described in Section 1.6 of this Plan. The waterways traversed by the SMNW construction sites and those impacted by SVC works are identified in Table 1-1.

Table 1-1 Major Waterway Catchments and Construction Sites

Catchment	Construction Site	Sites Applicable to this Plan
Devlins Creek	1. Epping Services Facility	NA
	2. Epping Decline	NA
	3. Cheltenham Services Facility	NA
Pyes Creek	4. Cherrybrook Station	NA
Cattai Creek	5. Castle Hill Station	NA
	6. Hills Centre Station	NA
Strangers Creek	7. Norwest Station	NA
Elizabeth Macarthur Creek	8. Bella Vista Station	NA
	9. Balmoral Road (including in the Bella Vista Dive)	Applicable
	10. Memorial Ave (including in the Bella Vista Dive)	Applicable
	11. Kellyville Station	Applicable
Caddies Creek (including Tributaries 3, 4 and 5)	12. Windsor Road/Old Windsor Road	Applicable
	13. Old Windsor Road/White Hart Drive	Applicable
	14. Rouse Hill Station	Applicable
	15. Windsor Rd Viaduct	Applicable
Second Ponds Creek	16. Windsor Road Viaduct to Cudgegong Road	Applicable
First Ponds Creek	17. Cudgegong Road and Tallawong Stabling Yard	NA

1.3 Definitions and Abbreviations

Abbreviation	Definition
ALS	Airborne Laser Survey
AR&R	Australian Rainfall and Runoff
ARI	Average Recurrence Interval
BoM	Bureau of Meteorology
CEMF	Construction Environmental Management Framework (Submissions Report, Section 3)
CEMP	Construction Environmental Management Plan
CM	Construction Manager(s) (ISJV)
COA	Conditions of Approval
DP&I	Department of Planning and Infrastructure
EIS	Environmental Impact Statement
EM	Environment Manager (ISJV)
EMS	Environmental Management System
EP&A Act	Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ER	Independent Environmental Representative
ERP	Emergency Response Plan
GPT	Gross Pollutant Traps
IC	Independent Certifier
IMP-BMS	Impregilo S.p.A. (Australia) – Business Management System
Incident	Any unplanned or undesired event which results in or has potential to result in injury, ill healt damage, to or loss of property, interruption to operations or environmental impairment. A incident also includes a near miss, breach of procedure, quality failure, injuries to employee contractors or members of the public and any other statutorily reportable occurrence.
ISJV	Impregilo S.p.A. (Australia) and Salini (Australia) Joint Venture / Principal Contractor
Mitigation Measures	Measures employed to reduce (mitigate) an impact
NOW	NSW Office of Water, Department of Primary Industries
OEH	Office of Environment and Heritage
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PMS	Project Management System
POEO Act	Protection of the Environment Operations Act 1997
Pollution	The alteration of air, soil, or water as a result of human activities such that it is less suitable for any purpose for which it could be used in its natural state
REMM	Revised Environmental Mitigation Measures (Submissions Report, Section 7)
RMS	Roads and Maritime Service (formerly RTA)
SE	Site Engineer
SES	State Emergency Services
SMNW	Sydney Metro North-west
SSI	State Significant Infrastructure
SVC Works	Surface Viaducts and Civil Works for the North West Rail Link Project
SWMP	Soil and Water Management Plan
SWTC	Scope of Work and Technical Criteria
TfNSW	Transport for New South Wales
TSC Works	Tunnels and Stations Civil Works for the North West Rail Link Project
WBNM	Watershed Bounded Network Model
WSUD	Water Sensitive Urban Design

1.4 Plan Preparation and Review

The Stormwater and Flooding Management Plan has been prepared in consultation with the Department (*strategies and Land Release*) OEH and relevant Councils including Blacktown City Council and The Hills Shire Council.

Revision 1 of this Plan has been submitted by ISJV to key stakeholders for consultation. A summary of the key comments and how they have been addressed is provided in **Appendix B**.

The plan was prepared by Worley Parsons and was reviewed by ISJV to ensure that detailed hydrologic and hydraulic assessments were carried out, and that stormwater/flooding management measures are incorporated into the design and construction phases of this project.

This Plan will be revised:

- six monthly as required by Section 3.14 of the CEMF,
- in response to future project approvals or modifications,
- in response to changes in law, risks or accepted practices,
- in response to major changes in site conditions or work methods, or due to incidents,
- commencement of new phases or stages of design and construction,
- in response to the findings, recommendations or outcomes of a planned management review, audit or risk assessment,
- requests or requirements of DP&E, EPA or any other Authority, or
- in support of planning approvals or license variations as necessary.

The plan format is set out below:

- Section 1: An introduction to this Plan, the SVC Works, objectives, and interrelationships to other plans and management documents
- Section 2: Legal and other requirements
- Section 3: Identification of potential stormwater and flooding aspects and impacts
- Section 4: Analysis of previous studies and SVC studies
- Section 5: Site characteristics, flood assessment and required mitigation measures
- Section 6: Flood emergency response management plan
- Section 7: Conclusion
- Appendix A: Implementation Plan including Responsibilities and deliverables for:
  - Project specific environmental requirements
  - Training
  - Monitoring and reporting
  - Auditing, review and improvement
- Appendix B: Consultation Summary
- Appendix C: Flood Impact Assessment for SVC Temporary Works
- Appendix D: Works as Executed Flood Impact Assessment

1.5 Relationship to Other Plans

The position of the Stormwater and Flooding Management Plan to other plans within the ISJV Management System and overarching documentation framework is shown in Figure 1

Figure 1 - ISJV SVC Management Systems and Document Framework

The Stormwater and Flooding Management Planinterfaces with other ISJV project management plans. The relationship of this plan to the other plans is shown in Figure 2.

Project Management Plan			
Risk Management Plan	Design Plan	Construction Plan	Construction Environmental Management Plan
Technical Risk Management Plan	Engineering and Competency Management Plan	Waste Management and Recycling Plan	inputs to Compliance Tracking Procedure
Safety Assurance Plan	Engineering Plan	Earthworks Plan	Construction Compound Ancillary Facilities Management Plan

Figure 2 - Hierarchy of SVC Management Plans

1.6 Project Description

1.6.1 Description of SMNW Project

The SMNW project is a key priority for the NSW Government. The SMNW will deliver a new high frequency single deck train system initially operating as a shuttle between Cudgegong Road and Chatswood. The project includes eight new stations, approximately 15.5km of tunnels from Epping to Bella Vista, a 4.5km elevated 'skytrain' (viaduct) between Bella Vista and Rouse Hill, and conversion of the Epping to Chatswood Rail Link to deliver high frequency rapid transit services.

Stations are planned at Cherrybrook, Castle Hill, Showground, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. Bus, pedestrian, cycling and easy access facilities will be provided at all stations, with approximately 4,000 'Park and Ride' spaces spread across five sites.

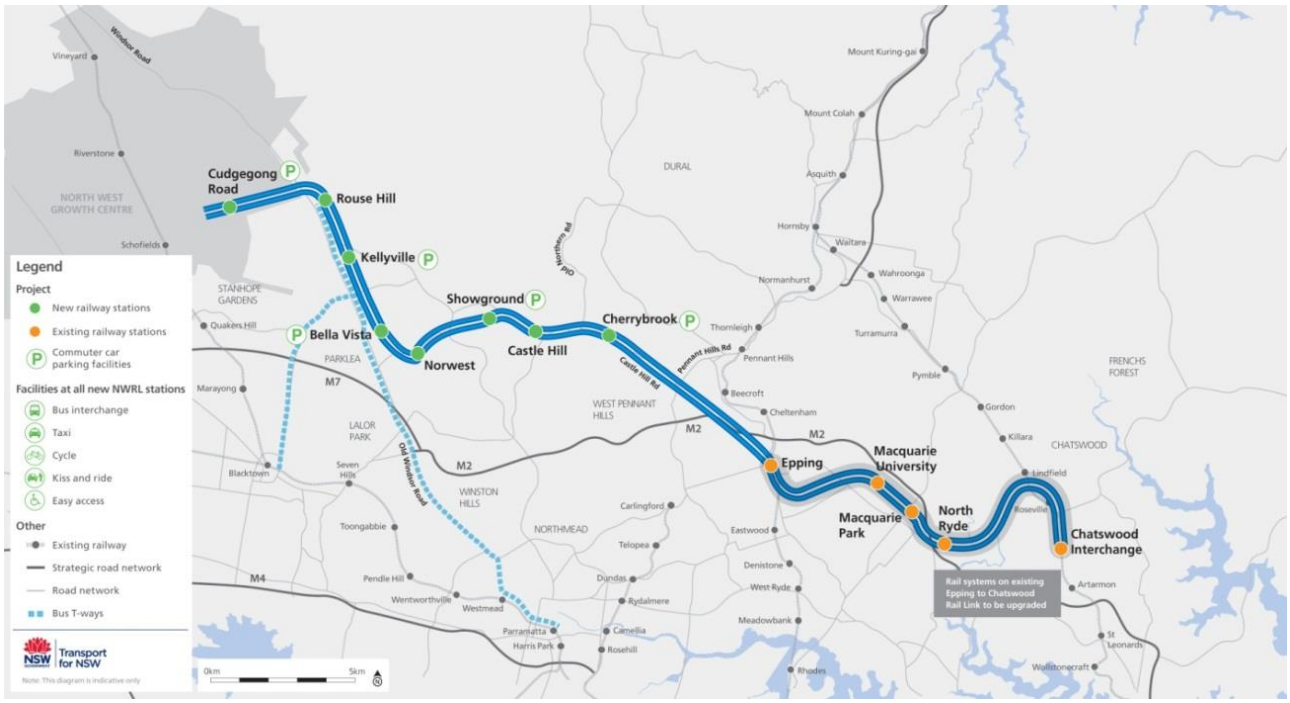

Figure 3: The North West Rail Link service proposed alignment

1.6.2 Description of the SVC Project works

The scope of the SVC Project works consists of the detailed design, construction and handover of the viaducts, bridges and associated civil works required for the SMNW between Bella Vista and Cudgegong Road and includes establishment and reinstatement of worksites, spoil removal and disposal and all required utility relocations and adjustments at construction worksites.

The permanent infrastructure to be delivered includes (*refer to Figure 4*):

- Approximately 4.5 km of viaduct between Balmoral Road and Rouse Hill Station including crossings over Memorial Avenue, Samantha Riley Drive, Windsor Road, Sanctuary Drive and White Hart Drive
- Bulk earthworks requirements including all cut, fill and embankments between Balmoral Road and Cudgegong Road
- A bridge over Windsor Road / Rouse Hill
- A bridge over Second Ponds Creek
- Allowance for station structures to be incorporated onto the viaduct at the Kellyville and Rouse Hill station sites
- Adjustments to existing infrastructure and roads within the construction site and / or otherwise affected by ISJV activities.

Activities associated with the temporary and SVC Contractor works required in order to complete construction include:

- Safe, secure personnel access / egress into site areas including necessary temporary support services and site facilities, with hoardings, fencing and the like around work sites to be left in place upon completion;

- Construction traffic and transport management including temporary and permanent traffic management works;
- Removal of all temporary work and site facilities not otherwise required for handover to subsequent contractors;
- Construction of a temporary haul road to transport construction materials;
- Construction of temporary T-way car parking at Rouse Hill and Kellyville;
- Construction, removal and transportation of the gantry along the SVC construction zone;
- Temporary changes to site personnel access/egress;
- Signage, fencing and hoarding;
- Construction environmental management activities;
- Construction traffic management activities;
- Interface and communications within SVC Contractor team and across SMNW team;
- Stakeholder liaison activities;
- Adherence to SMNW protocols and procedures.

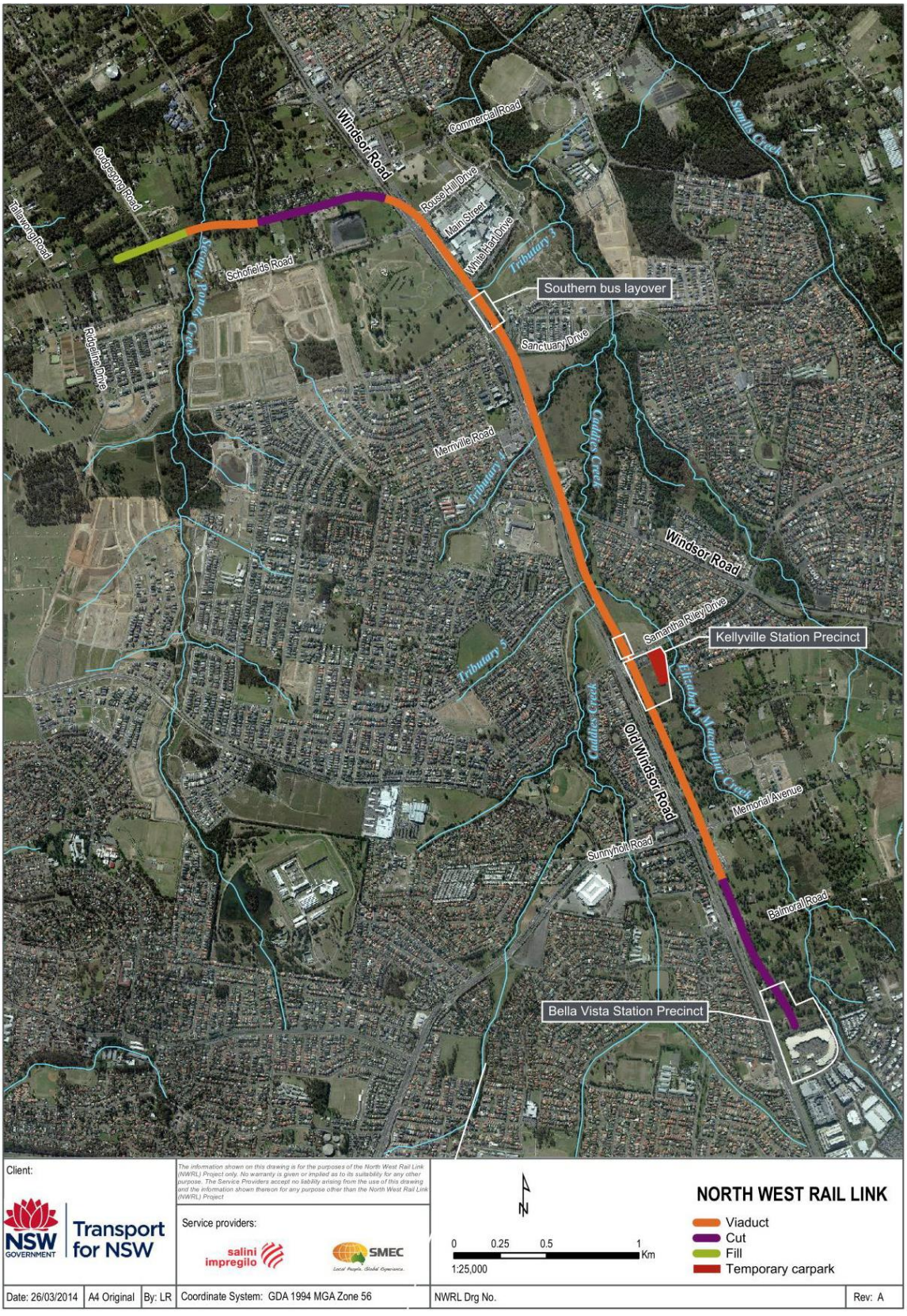

Figure 4: The North West Rail Link – Key SVC Elements (Source: SMEC 2014)

2 LEGAL AND OTHER REQUIREMENTS

2.1 Legislation

The main legislation relevant to stormwater and flood management includes:

- Protection of the Environment Operations Act, 1997 (POEO Act)
- Water Management Act 2000

Refer to the Construction Environmental Management Plan for details of other relevant legislation.

2.2 Project Compliance Requirements

Relevant planning requirements from the Conditions of Approval are summarised in the Plan Compliance section included at the beginning of this Plan.

Additional stormwater and flood management requirements from the Project Deed including SWTC, Project Planning Approval and Revised Environmental Management Measures are included in the Implementation Plan (**Appendix A** of this Plan).

2.2.1 Compliance with Planning Approval Condition C7

Project Planning Condition of Approval C7 states that the SSI shall be designed, to the extent that it is feasible and reasonable, to not worsen existing flood characteristics in the vicinity of the State Significant Infrastructure (SSI). The definition of “not worsen” is provided in the condition and is included in the compliance matrix at the start of this Plan.

Reasonable and feasible has been defined for the purposes of this condition as:

> Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community views and nature and extent of potential improvements.

Detailed hydrologic and hydraulic analysis has been completed for all of the major waterways and associated floodplains, including flood modelling where required, to assess the nature and the extent of potential impacts of the proposed SVC construction sites and works (i.e. haul roads, work platforms, viaduct piers and major earthworks). The results of this detailed analysis have identified those areas at greatest risk from potential impacts associated with the construction works and that, where necessary, the design has been configured to manage and mitigate such impacts.

The design aspects and management measures identified in this report have been modelled in detail as part of investigations undertaken by Worley Parsons and SMEC.

2.2.2 Compliance with Planning Approval Condition C8

Project Planning Condition of Approval C8 states that the a Stormwater and Flooding Management Plan (i.e. this Plan) shall be prepared in consultation with the Department (Strategies and Land Release), OEH, and relevant Councils during detailed design of the SSI and prior to relevant construction, or as otherwise agreed by the Director General.

Flood risks and any subsequent compensatory measures to be adopted during temporary construction works are identified in Section 5 of this Plan. All proposed mitigation measures have been designed to not worsen existing flood characteristics to the extent that is feasible and reasonable (as defined in Section 2.2.1 above).

Condition C8 also requires the preparation of a flood emergency response plan, which has been provided in Section 6 of this Plan.

2.2.3 Compliance with Planning Approval Conditions C33 and C34 from Application No. SSI-5414

Application No. SSI-5414 is also applicable to the SVC project. There is significant overlap between the SSI-5414 conditions C33 and C34 and C7 and C8 of the SSI 5100 conditions. It is considered that addressing the SSI-5100 C7 and C8 conditions will also meet the objectives of Condition 33 and 34 of SSI-5414.

2.3 Guidelines

Additional guidelines and standards relating to the management of stormwater and flooding include:

2.3.1 Floodplain Development Manual (2005)

The NSW Government's Floodplain Development Manual – the Management of Flood Liable Land (2005) is concerned with the management of the consequences of flooding as they relate to the human occupation of urban and rural developments. The manual outlines the floodplain risk management process and assigns roles and responsibilities for the various stakeholders.

This Plan has been prepared in accordance with this manual. Results of modelling are summarised in Section 4, mitigation measures are set out in Section 5, and an emergency response plan is provided in Section 6 of this Plan.

2.3.2 Australian Rainfall and Run-off – Volume 1 (2001)

Engineers Australia has prepared the Australian Rainfall and Run-off – A Guide to Flood Estimation to provide Australian designers with the best available information on design flood estimation. This guide contains procedures for estimating stormwater run-off for a range of catchments and rainfall events and design methods for urban stormwater drainage systems.

According to this guide, good water management Master Planning should take into account the following:

- Hydrological and hydraulic processes;
- Land capabilities;
- Present and future land uses;
- Public attitudes and concerns;
- Environmental matters;
- Costs and finances; and
- Legal obligations and other aspects.

The design for the SVC works has considered these items.

2.3.3 Managing Urban Stormwater: Soils and Construction

This Plan considers the guideline titled, *Managing Urban Stormwater – Soils and Construction* (*Volumes 1 and 2, 4th edition [Landcom 2004] – also known as the Blue Book*) to assist with the mitigation of impacts of land disturbance activities on landforms and receiving waters by focusing on the removal of suspended solids in stormwater run-off from construction sites.

The implementation of these guidelines during the construction of the SVC Works is outlined in the Construction Soil and Water Management Plan (NWRLSVC-ISJ-SVC-PM-PLN-120203).

3 ASPECTS AND POTENTIAL IMPACTS

The key aspects and potential impacts in relation to the overall management of stormwater and flooding during the SVC Works are listed in Table 3-1 below. These are the key identified risks for the overall management of stormwater and flooding during the SVC Works.

Table 3-1 Summary of overall aspects and potential impacts

Aspects	Potential Impacts
Direct Rainfall on Construction Sites	Rainfall falling into the Bella Vista Station dive portal has the potential to cause flooding in the adjoining station and tunnel network beyond that, if not appropriately managed. Rainfall on all constructions sites has the potential to cause the runoff of sediments and other pollutants into nearby watercourses.
Flooding from adjacent waterways during extreme rainfall events	Overland flows/flooding from adjacent rivers/creeks during extreme rainfall events possibly entering the construction sites or the Bella Vista dive portal, or causing scour and erosion. It is important to note that the worksites may not be experiencing rain at the time of the potential impacts.
Impacts on Mainstream Flooding	The hydrologic and hydraulic analyses have identified the potential for changes in flood behaviour (flood levels and velocities) due to major civil works, specifically the viaduct structure and the bridge crossing of Second Ponds Creek. The impacts of temporary works, such as the haul road and construction pads for the viaduct piers, have also been assessed.
Localised flow paths causing nuisance flooding on the worksite	Nuisance flooding as a result of localised overland flow paths could make the worksite untrafficable or dangerous to workers. Diversion drains and swales have been designed to control such nuisance flooding.
Alterations to in-stream flow arrangements	The construction works will involve some relatively minor adjustment of creeks in the vicinity of the haul road and pier construction sites. This has the potential to impact on local flooding characteristics, including scour potential, and on fish passage.

The stormwater and flooding management strategy detailed in Sections 5 and 6 of this Plan has been developed taking into consideration the potential environmental impacts outlined above.

Site-specific procedures for the SVC Works, including Erosion and Sediment Control Plans, are developed progressively throughout construction and will include consideration of these potential impacts.

4 ANALYSIS OF PREVIOUS STUDIES AND ADDITIONAL SVC DESIGN STUDIES

4.1 Overview

The following studies were reviewed and used in developing this Plan:

- North West Rail Link Technical Paper 6 – Surface Water and Hydrology, Major Civil and Construction Works – EIS 1, 26 March 2012, prepared by AECOM Doc Ref 60224114: NWRL EIS Volume 4
- North West Rail Link – Flood Modelling Report; Design Lot 57, 9 October 2014, prepared by SMEC Doc: NWRLSVC-ISM-SVC-DR-DRT-570100 Rev B.
- Flood Impact Assessment for Creek Diversions and Temporary Construction Works, as provided in **Appendix C** of this Plan (*prepared by WorleyParsons*).
- North West Rail Link – Viaduct Surface Drainage; Design Lot 15 for Substantial Detailed Design, 14 August 2014, prepared by SMEC Doc: NWRLSVC-ISM-SVC-DR-DRT-150100.
- North West Rail Link – Construction Environmental Management Plan, 22 September 2014, Doc: NWRLSVC-ISJ-SVC-PM-PLN-120200 Rev 5.
- North West Rail Link – Construction Soil & Water Management Plan, 2 September 2014, Doc: NWRLSVC-ISJ-SVC-PM-PLN-120203 Rev 5.
- North West Rail Link – Emergency Response Plan, 9 October 2014, Doc: NWRLSVC-ISJ-SVC-PM-PLN-120900 Rev 5.
- North West Rail Link Surface and Viaduct Civil Works – Flood Impact Assessment for Creek Channel Diversions (Works as Executed), 25 August 2017. (*prepared by WorleyParsons*) Appendix D of this plan.

This section provides a summary of these studies and addresses:

- Modelling methodology
- Design rainfall and other inputs
- Catchment details
- Modelling results

4.2 Modelling Methodology

The following items were considered in the determination of site drainage and flood effects associated with the SVC site works, and in the design of measures to mitigate any impacts.

4.2.1 General Overview

The 17 construction sites traverse eight main waterway catchments as shown in **Table 1-1**, eight of which are within the scope of the SVC works.

The surface water impacts are dependent on the site specific characteristics of these catchments and their associated floodplains in the vicinity of the sites.

Major civil works covered under the SVC works include the viaduct that spans the Elizabeth Macarthur and Caddies Creek floodplain, and the bridge crossing of Second Ponds Creek. These structures have been assessed for both temporary (construction) and the final built forms (operational).

4.2.2 Site Drainage Design

The viaduct drainage design by SMEC has involved the application of the design criteria and design requirements contained in SWTC Appendix 22 – Drainage Performance and Design Requirements. These include various requirements for design storm capacity, scour protection, and water quality management.

The 100 year ARI event has been adopted as the design storm for the viaduct drainage system. The DRAINS software has been employed to develop the hydrologic and hydraulic design of drainage works.

Water quality management structures, such as Gross Pollutant Traps (GPTs), have been designed for the 1 year ARI event. Water Sensitive Urban Design (WSUD) measures have been incorporated into the design, including bio-retention swales and vegetated channels.

Further information is provided in the SMEC Viaduct Surface Drainage report (August 2014).

4.2.3 Mainstream Flooding

During extreme rainfall events, there is potential that flow within creeks and waterways that are adjacent to, or traverse, the construction sites will overtop the creek channel and cause flooding to surrounding areas.

The assessment of the surface water catchments draining to and through the Project corridor involved:

- Hydrologic modelling using the Watershed Bounded Network Model (WBNM) run-off-routing software to determine peak flow estimates applicable for design and flood assessment;
- Hydraulic modelling has involved a combination of approaches that have been tailored to the size, complexity and nature of the floodplains that are traversed by the Project.
    - A HEC-RAS one-dimensional modelling approach was adopted to quantify flood behaviour (i.e. peak levels and velocities) for Caddies Creek Tributary 3 and Second Ponds Creek in the vicinity of the rail corridor, as well as the assessment of potential flood impacts of the permanent works.
    - Considering also the proximity of the proposed alignment to Old Windsor Road/ Windsor Road, the location of the Bella Vista dive portal in the floodplain and the associated flood risks, it was deemed appropriate to use a 2-dimensional TUFLOW model to assess flood impacts in the area at the confluence between Caddies Creek (*including Tributaries 4 and 5*) and Elizabeth Macarthur Creek;
- Quantification and assessment of flood impacts and risks associated with the civil construction works proposed;
- Assessment of scour potential at the viaduct and bridge piers; and
- Identification of appropriate mitigation measures to account for any potential impacts.

Details of the hydrologic and hydraulic modelling undertaken to assess the impact of the permanent works are presented in the SMEC Flood Modelling Report (October 2014).

The TUFLOW hydraulic model has been used by Worley Parsons to undertake an assessment of the potential impacts of the temporary works in the vicinity of the confluence between Caddies Creek (*including Tributaries 4 and 5*) and Elizabeth Macarthur Creek. This involved an iterative process to design localised creek diversions around the pier construction sites. Further details are included in the Worley Parsons impact assessment report contained in **Appendix C** of this Plan.

A temporary works impact assessment was completed using a superseded version of the TUFLOW model. The version adopted by SMEC (*documented in the Flood Modelling Report dated 9th October 2014*) incorporates a reduction in the hydraulic losses applied across the floodplain to represent the impact of the viaduct piers, which was considered appropriate. The wider extent of losses currently applied in the temporary works modelling is therefore considered to offer a conservative assessment of the impact, particularly at the confluence of Elizabeth Macarthur and Caddies Creeks.

Following completion of the permanent and temporary works by ISJV, in accordance with the approved design, modelling was undertaken on the works as executed to assess flooding impacts, compliance with this plan and MCoA C7 and C8 (refer to Appendix D). These areas have now been completed and handed over.

4.2.4 Localised Overland Flooding

Intense rainfall events have potential to exceed the capacity of the local pit and pipe networks, particularly if pipes become blocked. In these instances it is possible that overland flow paths with high velocities may be formed with little warning (separate to mainstream flooding of creeks and waterways).

For the purpose of this Plan, localised flooding is only considered where there is a significant upstream catchment and does not include minor drainage within each worksite. Localised treatments such as swales and bunding would be sufficient to direct overland flows away from the construction sites. These measures have been considered in the development of the Soil and Water Management Plan (SWMP; NWRLSVC-ISJ-SVC-PM-PLN-120203) for the SVC works.

4.2.5 Direct Rainfall

Refer to the SWMP for erosion and sediment control measures which will address impacts relating to direct rainfall on disturbed site areas during construction.

The Bella Vista dive portal drains to Bella Vista Station. The station construction includes a sump and pump system to deal with rainfall falling on the site during its construction. The sump is expected to be overwhelmed in a Probable Maximum Flood (PMF) event and therefore a flood barrier is to be used to prevent flow into the adjacent tunnel entry point. Continuation of this system will be required during the operational phase to deal with rainfall collected within the dive area.

4.3 Design Rainfall and Other Inputs

4.3.1 Design Rainfall and Climate Change Impacts

Design rainfalls and temporal patterns were calculated in WBNM based on the procedures set out in AR&R. Design rainfall coefficients for input to WBNM were obtained from the Bureau of Meteorology, (BOM) website.

The 5, 20, 50, 100 and 2000 year ARI events were investigated by SMEC as part of the flood modelling for the permanent works impact assessment, in addition to a climate change scenario of 10% increase in rainfall intensity during the 100 year ARI event.

Probable Maximum Precipitation (PMP) rainfalls were also calculated in WBNM using input parameters from 'The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method' (BOM, 2003).

The time periods for potential climate change impacts relative to the short time period for construction of the SVC major civil works is such that climate change impacts on increased rainfall intensity are not expected to have a significant bearing on the assessment of temporary works impacts.

4.3.2 Determination of Catchment Areas

The sub-catchment delineation prepared as part of the original concept design has been adopted by SMEC as part of further investigation of flood impacts.

Sub-catchment boundaries were delineated using a combination of 0.5 m and 2 m topographic contours generated from Airborne Laser Survey (ALS). Aerial photography was used to identify urban features such as roads, dams and other man made features influencing flow patterns and catchment delineation. The aerial photography was also used to identify the extent of development and proportion of impervious area. Catchment details are summarised in Table A.1 of Appendix A in the North West Rail Link Technical Paper 6 – Surface Water and Hydrology, Major Civil and Construction Works.

For the well-established areas in the south east portion of the SMNW project (including Devlins Creek Tributary and Cattai Creek) future land use is not likely to have a significant impact on catchment characteristics and run-off behaviour. However, for catchments within the North West Growth Centre at the SVC works (covering Caddies Creek, Elizabeth Macarthur Creek, Strangers Creek, First Ponds Creek and Second Ponds Creek) a considerable degree of development is underway and ongoing. To consider flow behaviour under ultimate conditions a review was made of available master planning documentation, including proposed water management strategies that include the provision of detention basins to offset potential increases in flow due to urbanisation.

Particular areas within the North West Growth Centre where significant future development has been identified include Balmoral Release area, Area 20 Precinct, Alex Avenue, Riverstone, The Ponds and Beaumont Hills. Many of these areas are all largely undeveloped under existing conditions. As such the effect of adopting future land use values in these areas can have a considerable impact on design peak flows when compared to existing undeveloped conditions.

Within the North West Growth Centre, hydrologic assessment has been undertaken for both existing and ultimate scenarios to ensure that the design is future proofed against ultimate catchment characteristics and run-off behaviour. Future land use and the proportion of impervious area have been determined based on masterplan layouts for the area precincts and associated surface water management plans. Further details of the assessment of flooding under the ultimate development scenario are contained in the SMEC flood modelling report (October 2014).

4.3.3 Calculation of Rainfall to Run-off

Mainstream Flooding: Hydrologic modelling was completed by SMEC using the WBNM software. WBNM results for the 5, 20, 50, 100 and 2000 year ARI and PMF events, and the 100 year ARI + 10% climate change scenario, were used in various combinations across the identified watercourses as part of the mainstream flooding assessments. The ultimate development scenario was also assessed as a sensitivity test on existing flood conditions.

The 2000 year ARI event was considered as part of the scour assessment for viaduct and bridge piers.

The 100 year ARI flood was considered in the assessment of impacts from temporary SVC works. Given the relatively short life span of the temporary works, it is considered that the assessment of impacts during the PMF is not required. WAE flood modelling was undertaken in August 2017, which included the PMF scenario (see Appendix D).

Minor Site Drainage and External Drainage Deviations: The DRAINS modelling software has been used to calculate the peak rainfall run-off flow rates for stormwater collected over the viaduct surfaces and to design/size the site stormwater management measures.

This software is a run-off routing software and is widely adopted both on a NSW state and local government level. For site drainage design it has been assumed that there are no infiltration losses, as is expected for impervious areas during major events.

External drainage deviations have been sized as part of the SWMP in accordance with AR&R and the 'Blue Book'.

Direct Rainfall: a similar approach to that outlined above has been employed for on-site stormwater management in sizing erosion and sediment control measures as part of the SWMP.

A volumetric analysis of rainfall-to-runoff has been completed when assessing the direct rainfall impacts onto the dive area that discharges to Bella Vista Station.

5 SITE CHARACTERISTICS, FLOOD IMPACT ASSESSMENT AND REQUIRED MITIGATION MEASURES

5.1 Permanent Works (Following Construction)

Table 5-1 provides a description of the potential flood impacts of the SVC Permanent Works and required mitigation measures.

Table 5-1 Site Specific Flood Mitigation for Permanent Works

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.1.1 **All Sites within SVC scope (i.e. to the north of Bella Vista Station)**	See descriptions provided below for each site.	**Direct rainfall** onto viaduct areas needs to be appropriately managed and discharged to receiving waters. Volumetric runoff calculations have also been undertaken for rainwater falling directly into the Bella Vista dive cutting for the PMF event (all storms up to the six hour duration storm event). The sump and trenches in the base of the station excavation do not have sufficient storage for this water. A pump system will be used to remove stormwater during rainfall events, but in extreme rainfall a flood emergency protocol will be required. Severe weather warnings will be obtained from the Australian Bureau of Meteorology's Commercial Weather Services to provide advanced notice of large rainfall events, which will alert the station managers.	Refer to SMEC Drainage Design Report for details of the drainage system design for the viaduct structure, including water quality management measures. If stormwater collected in the Bella Vista station sump approaches the invert of the adjacent tunnel, flood barriers will be placed into the tunnel opening to prevent water ingress. Submersible pumps will be used throughout and after rainfall events to minimise these risks. Details of flood protection measures are included on the station excavation Project Wide series of drawings, Drg no. NWRLTSC-THY- TSC-DN-DRG-325870

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.1.3 **Site 12** **Samantha Riley Drive to Windsor Road** **Proposed Viaduct**	Site 12 spans the broad floodplain of Caddies Creek, including its confluence with Elizabeth Macarthur Creek and Caddies Creek Tributary 5. The creek lines in this area are moderately incised with well vegetated main channel and overbank areas. Old Windsor Road lies to the west of the rail alignment while to the east of the alignment and creek is residential development. The rail alignment in this area will be a viaduct elevated above the floodplain, consisting of box section spans supported by columns and headstocks.	Potential flood impacts of the proposed viaduct structure have been assessed for a detailed design with pier sizes of 1.25m x 2.4m and with 39m spacing. Flood modelling by SMEC shows that the proposed viaduct piers/ columns would lead to flood level impacts of up to 19mm in the area between Windsor Road and the Transit-Way and within the Caddies Creek reserve. The flood modelling shows that there would be no significant impact on flow velocities during the 100 year ARI event. The scour assessment by SMEC involved simulation of the 2000 year ARI event and showed that no scour protection was required for the piers. The duration of flooding during the 100 year ARI event will be less than 2 hours and therefore, the duration of inundation would be increased by much less than 1 hour, if any at all, thereby meeting the associated requirement of Condition C7. Flood impacts for the permanent viaduct structure were also assessed for the PMF to identify any potential impacts on regional flooding during events in excess of the 100 year ARI event. The results show that there would be some localised areas of afflux up to 150mm within the Transit-way and Old Windsor Road reserves, but otherwise there would be no significant flood levels due to the works. No private properties would be affected by the PMF affluxes.	The potential flood level impacts during the PMF are considered reasonable given that residential areas are not significantly impacted. Old Windsor Road and the North-west Transit-way already experience widespread flooding under existing conditions.

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.1.4 **Site 13** **Windsor Road to White Hart Drive** **Proposed Viaduct**	Site 13 traverses Caddies Creek Tributary 4 and extends to Tributary 3 in the north. Parts of the site are flood affected in the vicinity of these creek lines. The railway in this area consists of a viaduct elevated above the floodplain, consisting of box section spans supported by columns and headstocks.	The TUFLOW flood modelling by SMEC shows that there would be no significant flood level or velocity impacts at Caddies Creek Tributary 4 during the 100 year ARI event. The modelling also shows that there will be no flood level or velocity increases along Tributary 4 during the PMF. The scour assessment by SMEC showed that no scour protection was required for the piers. The duration of flooding during the 100 year ARI event will be less than 2 hours and therefore, the duration of inundation would be increased by much less than 1 hour, if any at all, thereby meeting the associated requirement of Condition C7. Previous hydraulic studies undertaken for the Windsor Road Transit-way Project (Maunsell 2005a and 2005b) show that the Tributary 3 culvert crossing has in excess of a 100 year ARI capacity. HEC-RAS flood modelling for Tributary 3 by SMEC shows that the 100 year ARI peak flows discharging from the culverts would be contained within the downstream channel. The proposed viaduct piers will be placed outside the flood extent and therefore, no impacts are expected.	No mitigation works are required.
Item 5.1.5 **Site 14** **Rouse Hill Station**	Located north of Caddies Creek Tributary 3	As discussed for Item 5.1.4, previous hydraulic studies show that the Tributary 3 culvert crossing has in excess of a 100 year ARI capacity. Consequently, aside from run-off from the local drainage network, the precinct is not expected to be affected by flooding up to the 100 year ARI event.	No flood mitigation is required for this site.

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.1.6 **Site 16** **Windsor Road Viaduct to Cudgegong Road** **Proposed Bridge Structure** **Located within Second Ponds Creek Catchment**	Second Ponds Creek at the SMNW alignment has an upstream catchment area in the order of 620 hectares. The catchment has undergone significant urban development over recent years. Parts of the Second Ponds Creek catchment, particularly in the immediate vicinity of the SVC Project corridor, are largely undeveloped and consist mainly of rural residential land uses. Urban development in the catchment is ongoing. Existing areas of rural development are earmarked for urbanisation as part of the Area 20 Precinct. Schofields Road is located approximately 350m upstream (south) of the rail alignment. The existing waterway crossing at Schofields Road consists of a 5 cell pipe culvert structure. Existing rural residential development is located between the rail alignment and Schofields Road. Upstream (south) of Schofields Road contains new urban release areas consisting of residential and open space.	Potential flood impacts of the proposed bridge structure have been assessed for a detailed design with overall length of 390metres and 1.25m wide piers at 39m centres. The proposed bridge abutments will be located outside of the PMF extent. The results of HEC-RAS modelling by SMEC of the viaduct bridge show that the impacts are expected to be insignificant. The results are summarised in the following table, including for the 50 year and the 2,000 year ARI events, At the Cudgegong Road substation site the lowest ground levels are over 2m above the 100 year ARI flood level. Ground levels are approximately 0.7m above the PMF level. Changes in velocity resulting from the proposed bridge crossing are expected to be generally negligible given the size of the waterway relative to the area of the piers within the floodplain. Some localised hydraulic effects at the piers may lead to scour.	The predicted flood impacts are within the acceptable range specified in Condition C7 and therefore no mitigation measures are required. There may be localised increases in velocity around piers that would lead to scour. Scour assessments completed by SMEC for the 100 and 2,000 year ARI events show that the potential depth of scour would be up to 2.97m and 3.65m, respectively. These results have been considered in the design of the pier footings.

Location	50 year ARI	100 year ARI	2000 year ARI	PMF
Immediately Upstream of bridge (within rail corridor)	nil	nil	nil	nil
Upstream boundary of rail corridor	nil	nil	+10mm	nil
Adjacent to Cudgegong Road Substation	nil	nil	nil	nil
Downstream of Schofields Road	+10mm	nil	nil	nil

5.2 Temporary Works

Table 5-2, below, provides a description of the SVC Works construction sites and the associated temporary works design at each of the sites. It also provides information on the potential flood impacts and any mitigation measures that are required. Further details of the mainstream flood impact assessment are provided in **Appendix C**.

Table 5-2 Site Specific Flood Mitigation for Temporary Works

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.2.1 **All Construction Sites within SVC scope (i.e. to the north of Bella Vista Station)**	see site descriptions provided above for each site.	**Direct rainfall** on all construction sites within the scope of the SVC has the potential to cause erosion of disturbed areas. Volumetric runoff calculations have been undertaken for rainwater falling directly into the Bella Vista dive cutting for the PMF event (all storms up to the six hour duration storm event). The sump and trenches in the base of the station excavation do not have sufficient storage for this water. A pump system will be used to remove stormwater, but in extreme rainfall a flood emergency protocol will be required. Severe weather warnings will be obtained from the Australian Bureau of Meteorology's Commercial Weather Services to provide advanced notice of large rainfall events, which will alert the construction team onsite.	Refer to SWMP for mitigation of potential erosion as part of the construction works. If water levels inside the Bella Vista station sump approach the invert of the adjacent tunnel, workers inside will be evacuated and flood barriers placed into the tunnel opening to prevent water ingress. Submersible pumps will be used throughout and after rainfall events to minimise these risks. Details of flood protection measures are included on the station excavation Project Wide series of drawings, Drg no. NWRLTSC-THY- TSC-DN-DRG-325870

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.2.1 (Cont'd) **All Construction Sites within SVC scope (i.e.to the north of Bella Vista station)**	See site descriptions provided above for each site.	**Localised Overland Flooding** has the potential to impact on all construction sites. An example would be the potential for major drainage flows along the adjacent Old Windsor Road to enter construction sites.	Refer to SWMP for mitigation measures as part of the construction works. Overland flows (clean water) will need to be diverted around the construction sites using bunding or swales, either along any existing table drains beside cross streets (eg, Balmoral Road or Memorial Avenue) or through the construction sites via appropriate drainage lines. It is important that such measures are implemented around the entry to the Bella Vista dive, to avoid any local inflows to the tunnel and Bella Vista station.
Item 5.2.2 **Sites 9 to 11** **Celebration Drive to Samantha Riley Drive** **Proposed:** **Haul Road** **Platforms for Viaduct Pier Construction** **Material Stockpiles**	See site description provided above.	According to the results of detailed 2D flood modelling undertaken for Elizabeth Macarthur Creek, Sites 9 to 10 are located outside of (or above) the Probable Maximum Flood (PMF) extent. Hence, there is no predicted impact on the temporary works during construction. Nor are the works expected to impact on flood characteristics. As part of the assessment of permanent works impacts, SMEC assumed that the Kellyville Station Precinct (Site 11) would be constructed to an elevation equal to or above the 100 year ARI flood level, which means that the site was 'blocked-out' from the floodplain. The results show that the works will result in an afflux during the 100 year ARI flood of up to 23mm across the channel adjacent to the temporary car park. This increase is contained within the natural waterway area and does not impact on the adjacent residential properties or any roadways. The afflux at private properties is less than 20mm, in line with Condition C7. The final station design has not been completed, but it is expected that all temporary works will be constrained to the modelled construction footprint. Hence the temporary works are not expected to result in any additional flood impacts.	Construction material stockpiles are to be kept outside of the 20 year ARI flood extent unless they are short-term (i.e. less than 10 days) and significant rainfall is not likely. Construction machinery and equipment is also to be kept out of the 20 year ARI floodplain at these sites. Where possible, construction sites will be managed in a manner that allows for clear passage of floods over the site during events larger than the 100 year ARI.

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.2.3 **Site 12** **Samantha Riley Drive to Windsor Road** **Proposed Works:** **Haul Road** **Platforms for Viaduct Pier Construction** **Material Stockpiles**	Construction completed and handed over, see Section 4.2.3 for details		

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.2.4 **Site 13** **Windsor Road to White Hart Drive** **Proposed Works:** **Haul Road** **Platforms for Viaduct Pier Construction** **Material Stockpiles**	Construction completed and handed over see Section 4.2.3 for details		

Site Name, Location and Proposed Works	Site Description and Surrounding Characteristics	Potential Flooding Impacts	Required Flood Mitigation
Item 5.2.5 **Site 16** **Windsor Road Viaduct to Cudgegong Road** **Located within Second Ponds Creek Catchment**	See site description provided above in Section 5.1. The construction of the viaduct bridge across Second Ponds Creek will include up to 3 piers within the 100 year ARI flood extent. These will not be placed in the creek channel. However, there will be a need to gain access to the pier construction sites and to prepare suitable construction platforms for the piers.	The proposed haul road will encroach into the 100 year ARI flood extent, but it will not need to cross the creek as access will be provided from either side of the floodplain. The construction of the haul road requires that the topsoil be stripped back by 440mm depth, after which a pavement of 450mm is constructed. As a result the haul road pavement will be similar in elevation to the existing surface, thereby minimising any potential flood impacts. The pier construction platforms will typically be below the existing surface (excavations), and will only require a low-level temporary bund around the platform to protect the site from overland flows and nuisance flooding. As such, the available flow area across the floodplain will not be significantly reduced. Flood modelling has not been completed for the temporary works, but in light of the above, it is considered that the impacts on flooding during the 100 year ARI event will be insignificant. There is potential for the haul road and the pier construction platforms to be inundated during flooding. The contractor accepts that some disruption and damage to the haul road or work sites will occur during a major flood event.	Construction material stockpiles are to be kept outside of the 20 year ARI flood extent. Construction machinery and equipment stored temporarily in the 20 year ARI floodplain (e.g., the piling rig, cranes or excavators) should be removed if the forecast rainfall triggers are met (refer Section 6). No other flood mitigation measures are required. Sections of haul road that are likely to experience high flows and velocities during flood events would require appropriate stabilising works and sediment control measures to limit sediment discharging into downstream waterways.

6 FLOOD EMERGENCY RESPONSE MANAGEMENT PLAN

6.1 Overview

The following flood emergency response management measures are to be considered in conjunction with the overall Emergency Response Plan (ERP) for the SVC works (NWRLSVC-ISJ-SVC-PM-PLN-120900) and the ERPs for each construction zone.

The following flood emergency response plans have been considered:

- The Hawkesbury Nepean Flood Emergency Sub Plan (2013), which covers all evacuation and traffic management operations for flooding of the Nepean and Hawkesbury River system.
- The Hills Shire Local Flood Plan (2010), which is focused on the emergency response to flooding of the Hawkesbury River system, which primarily affects areas in the northern part of the Hills Shire LGA.
- The Blacktown City Local Flood Plan (2010), which is also focused on the emergency response to flooding of the Hawkesbury River system.

6.2 Preparing for a Flood

6.2.1 Design of the Bella Vista Station Dive

The Bella Vista Station dive will be protected from direct rainfall during the 100 year ARI and PMF events by means of temporary Flood Barriers erected at the portal to Bella Vista Station. Details of the concrete flood barriers are included in the Project Wide series of drawings, ref Drg no. NWRLSVC-THY-SVC-DN-DRG-325870.

6.2.2 Design of Sediment Basins

The sites have been designed to convey stormwater run-off to sediment basins through a series of above ground overland flow paths and sub-surface pipe networks.

In accordance with the CSWMP, sediment basins will be used as the primary end-of-line control for all construction worksites. These will be sized in accordance with standard Blue Book requirements using the Revised Universal Soil Loss Equation method and available site soil data (note that exact sizing is influenced by prevailing slope, soil, flow lengths and catchment areas, so exact figures will be determined during the preparation of Erosion and Sedimentation Control Plans for each worksite).

6.2.3 Site Inspections

In accordance with the CEMP environmental inspections will be undertaken weekly as a minimum and more frequently when required. The inspections will be recorded in the Weekly Environment Inspection Checklist and will identify actions that are to be closed-out by the Construction Team within agreed timeframes.

In addition, ISJV Site Superintendents, as part of their daily duties will conduct site inspections including subcontractor works. These inspections will involve communicating with all personnel and subcontractors regarding compliance with site specific environmental issues and co-ordinating implementation and maintenance of environmental protection measures.

6.2.4 Flood Warnings and Monitoring of Rainfall

Monitoring of rainfall will be undertaken in accordance with the Construction Air Quality Management Plan.

A forecast of 20mm rainfall (or greater) in 24 hours is adopted as 'significant rainfall' in the Soil & Water Management Plan, which triggers a response to inspect and stabilise work sites in terms of erosion and sediment control.

Onsite weather data will be supplied with daily weather conditions and forecasts obtained from the Bureau of Meteorology website (http://www.bom.gov.au).

Local SES controllers are expected to issue local flood warnings according to advice from BoM.

In the absence of electronic meteorological information, the Site Supervisor, Site Engineers and Environment Coordinators will monitor and interpret local wind conditions onsite against the Beaufort Wind Scale.

The following action and alarm levels are proposed for the sites:

Category 1: Action

- When 20mm (or greater) of rainfall is forecast over a 24 hour period (or less), sediment and erosion controls will be inspected and preparedin accordance with the Construction Soil and Water Management Plan (NWRLSVC- ISJV-SVC-PM-PLN-120203).

Category 2: Alarm

- If 50mm (or greater) of rainfall falls within a 2 hour period, Site Superintendents are to monitor flooding conditions and overland flows, and initiate flood evacuations from the site as required.

6.3 Responding During a Flood

6.3.1 Evacuation of Personnel

In the event of a flood emergency the internal evacuation requirements set out in the Emergency Response Plan (ERP) for each zone will be implemented.

Personnel will gather at the designated marshalling areas at each construction site, in accordance with the ERP. For example, the ERP for Zone 9 (Cudgegong Road) indicates that the Emergency Assembly Area will be at the corner of Cudgegong Road and the haul road.

From this point the Site Superintendent is to use the available information at hand (including flood evacuation orders from SES) to decide if evacuation from the site is required. It is proposed that evacuation be undertaken along the following routes:

- Sites 9 to 12 (Bella Vista Station to Windsor Road) – evacuate in a southerly direction along Old Windsor Road towards higher ground in the upper catchment. If access along Old Windsor Road is blocked by flooding, evacuate to the immediate west, to higher ground in the vicinity of John XXIII Catholic Primary School.

- Sites 14 to 16 (White Hart Drive to Cudgegong Road) - evacuate to higher ground at The Ponds area, south of Schofields Road and to the west of Old Windsor Road.

The evacuation arrangements for Hawkesbury Nepean River flooding incorporate major evacuation routes along Windsor Road (Windsor Road Route) and also Schofields Road

(Hawkesbury Valley Way). The evacuation routes terminate at the intersection of Windsor Road and Old Windsor Road, roughly in the middle of the SVC works area.

The arrangements contained in the Hawkesbury Nepean Flood Emergency Sub Plan were reviewed to confirm that there are no required traffic management actions within the extent of the SMNW works. They only extend as far south on Windsor Road as Annangrove Road, which is approximately 2km north of Schofields Road.

As such, it is considered that the SMNW is suitably removed from the Hawkesbury River flood threat such that local flood evacuation from construction sites or stations will not impact (or be impacted by) any evacuation from Hawkesbury River flooding.

6.3.2 Other Actions

Where it has been identified that other action is required and it has been deemed safe by the Construction Manager additional measures will be implemented.

6.4 Recovery after a Flood

6.4.1 Site Inspections

In accordance with the SVC Works CSWMP an Environmental Inspection Form is to be completed immediately following significant rainfall (i.e. > 20 mm in 24 hours). This will be undertaken by the Environment Manager/Coordinator and/ or Site Superintendent. Actions and timeframe for completion will be agreed with the Construction Team. Safety consideration will also be a factor in determining if it is safe to complete the action following significant rainfall.

6.4.2 Dewatering of Excavations

All de-watering will be undertaken in accordance with the CSWMP.

6.4.3 Discharge of Sediment Basins for all SVC Construction Sites

Water discharge from sediment basins within all the SVC construction sites will be undertaken in accordance with the CSWMP and are required to ensure that sufficient storage capacity is available in the event of wet weather. Based on a 5-day rainfall depth for the 80th percentile, should rainfall received within a 5 day period exceed 24.6mm, it is expected that sediment basins may discharge naturally over their spillway. Treatment measures would be applied to the water in the sediment basins, including settling of coarse sediments, the use of flocculants for finer sediments, and pH correction before discharge.

6.4.4 Repair of Construction Platforms and Haul Road

When it is safe to do so and does not pose further potential for erosion, any damage to the haul road or temporary construction platforms is to be repaired according to the original design specifications and geometries that have been assessed as part of flood modelling investigations.

7 CONCLUSIONS

Suitable drainage design has been completed for the Surface and Viaduct Civil works, which will manage the impacts of stormwater discharge from the completed works.

A Soil & Water Management Plan has been developed to provide appropriate measures for erosion and sediment control during the construction works.

Flood modelling investigations were undertaken for the SVC contract works as executed design which includes temporary works (refer to Appendix D). Temporary works required for ISJV construction completion were found to exceed criterion MCoA C7(a). The modelling demonstrates the exceedance is removed when temporary works are removed and can otherwise be appropriately managed.

Implementation of the mitigation works detailed in Section 5 and the Flood Emergency Response Plan set out in Section 6 will provide the necessary measures to minimise the potential impacts of flooding and stormwater drainage during and after construction of the SVC works.

Appendix A. **IMPLEMENTATION PLAN**

Element 1. Project Specific Environmental Requirements				
No.	**Requirement**	**How will we address the Requirement?**	**Responsible/ Key Contributor**	**Timing**
Project Planning Approval				
C7	The SSI shall be designed, to the extent that it is feasible and reasonable, to not worsen existing flood characteristics in the vicinity of the SSI. Not worsen is defined as: (a) a maximum increase in flood levels of 20mm in a 100 year ARI flood event for Application No:SSI5100 and a maximum increase in flood levels of 50mm in a 100 year ARI flood event for Application No: SSI5414; and (b) a maximum increase in flood levels of 50mm in a probable maximum flood; and (c) a maximum increase in time of inundation of one hour in a 100 year ARI flood event; and (d) any increase in flow velocity in a 100 year ARI flood event should not increase the potential for soil erosion and scouring.	Refer to Section 5	**Design Manager – Civil**	Design
Revised Environmental Mitigation Measures				
CC2	The detailed design for the embankments would take into account a changing climate. For example, structures would be designed to reduce water build up behind and under embankments to prevent lubrication and loss of stability. *Applicable to Sites 9 to 16	Refer to Section 5	**Design Manager – Civil**	Design

Element 1. Project Specific Environmental Requirements				
No.	**Mitigation Measure Requirement**	**How will we address the Requirement?**	**Responsible/ Key Contributor**	**Timing**
SW1	The need or extent of any obstructions required to be placed within waterway areas would be avoided in the first instance, and minimised if avoidance is not feasible or reasonable. *Applicable to Sites 9-16	Refer to Section 5	**Construction Manager - Sub-structure** **Environment Manager**	**Construction**
SW2	Programming or staging any construction associated with creek/channel works or the temporary transverse culverts would be undertaken to minimise the total time that works are undertaken in vicinity of watercourse. Applicable to Sites 9-16	Refer to Section 5 and Appendix D	**Construction Manager - Sub-structure** **Environment Manager**	**Construction**
SW3	Construction equipment (or excess material) would be removed from waterway or flood prone areas if wet weather is approaching and at the completion of each day's work activity. The extent of the flood prone area would be defined during the detailed construction planning phase. *Applicable to Sites 9-16	Refer to Sections 5 and 6	**Construction Manager - Sub-structure**	**Construction**
SW4	Temporary levees or bunds would be strategically placed to contain potential flooding impacts resulting from any temporary works on the floodplain and minimise the risk to surrounding properties which might otherwise be affected. *Applicable to Sites 9-16	Refer to Section 5	**Construction Manager - Sub-structure**	**Construction**

Element 1. Project Specific Environmental Requirements				
No.	**Mitigation Measure Requirement**	**How will we address the Requirement?**	**Responsible/ Key Contributor**	**Timing**
SW5	Entry to the Bella Vista Station dive portal would be protected against flooding by locating openings outside flood prone areas, local bunding and/or appropriate drainage. *Applicable to Bella Vista Station Dive Portal	Refer to Section 5	**Design Manager – Civil** **Construction Manager – Sub-structure**	Design and Construction
SW6	The flood standard adopted at the Bella Vista Station dive portal entry during construction would need to be developed taking into consideration the duration of construction, the magnitude of inflows and the potential risks to the project works and personal safety. *Applicable to Bella Vista Station Dive Portal	Refer to Sections 4 and 5	**Design Manager – Civil** **Construction Manager – Sub-structure**	Design and Construction
SW7	Earthworks located within the floodplain would be staged to ensure that the extent of works exposed at any one time is minimised. *Applicable to Sites 9 - 16	Refer to Section 5 and Appendix D	**Construction Manager – Sub-structure**	Construction
SW8	Construction works would be staged to ensure diversion channels are in place and stabilised to enable diversion of external catchment flows around the work site. *Applicable to Sites 9 – 11, and 16	Refer to Sections 5 and SWMP	**Construction Manager – Sub-structure**	Construction
SW9	For the Caddies Creek and Elizabeth Macarthur Creek floodplain, embankments, constructed as part of the temporary haul roads would be limited to 0.5 m maximum height for appropriate lengths of floodplain to allow controlled overtopping. Consideration may also be given to implementation of additional mitigation measures for the few properties identified as being at increased or greater risk of affectation. This could include the design of viaduct piers and local flood mitigation works such as bunding, temporary levees, regrading overbank areas or flood proofing of properties. *Applicable to any site traversed by the haul road	Refer to Section 5	**Design Manager – Civil** **Construction Manager – Sub-structure**	Design and Construction

Element 1. Project Specific Environmental Requirements (continued)				
No.	**Mitigation Measure Requirement**	**How will we address the Requirement?**	**Responsible/ Key Contributor**	**Timing**
SW11	Temporary structures, embankments, haul road and working pads would be removed as soon as feasible after serving their purpose. * Applicable to any site traversed by the haul road	Refer to Section 5	**Construction Manager - Sub-structure**	Construction
SW12	Stockpile sites would be generally located outside the 20 year ARI flood. The exact level of flood immunity provided to stockpile sites would depend on the duration of stockpiling operations, the type of material stored and the nature of the downstream waterway or any other specified requirements. This would be defined during detailed construction planning. *Applicable to 9 -16	Refer to Section 5 and SWMP	**Design Manager – Civil** **Construction Manager - Sub-structure**	Construction

* Site 8 – Bella Vista Station, Site 9 – Celebration Drive to Balmoral Road, Site 10 – Balmoral Road to Memorial Avenue, Site 11 – Memorial Avenue to Kellyville Station, Site 12 – Samantha Riley Drive to Windsor Road, Site 13 – Windsor Road to White Hart Drive, Site 14 – Rouse Hill Station, Site 15 – Windsor Road Viaduct, Site 16 – Windsor Road Viaduct to Cudgegong Road

Element 2. Training				
No.	**Requirement**	**How will we meet the Requirement?**	**Responsible/ Key Contributor**	**Deliverables**
2.1. Flood Prone Area Induction	Stormwater and flood management to be addressed in the flood prone area start up meetings	The flood prone area start up meeting will include information on: • Flood prone sites • Flood awareness and emergency response measures for the site. • Management measures and procedures • Soil and water management measures	**Environment Manager**	Start up Meeting Minutes
2.2. Tool boxing	Stormwater and flood management requirements to be regularly tool boxed	Tool boxing will be undertaken to reinforce and reiterate information from inductions and training and where procedures are amended or new procedures are introduced	**Environment Manager** **Site Superintendents**	Toolbox records

Element 3. Monitoring and Reporting				
No.	**Requirement**	**How will we meet the Requirement?**	**Responsible/ Key Contributor**	**Deliverables**
3.1. Monitoring and Site Inspections	Environmental Controls	See Section 6 regarding flood emergency response Refer to SWMP for soil and water management monitoring	**Environment Manager** **Site Superintendents**	Environment Inspection Reports Site diary entries
3.2. Reporting	Compliance record generation and management	The following compliance records will be maintained: • Dewatering forms • Environmental Inspection Forms	**Environment Manager**	Dewatering forms Environment Inspection Reports

Element 4. Auditing, Review and Improvement

We will continually improve our environmental systems and environmental performance by monitoring and reviewing their effectiveness.

No.	Requirement	How will we meet the Requirement?	Responsible/ Key Contributor	Deliverables
4.1. Audit and Review	Compliance record generation and management	This Plan will be audited within six months of the commencement of construction and thereafter at a frequency determined based on the findings of the initial audit. The Plan shall be reviewed and updated based on the findings of the audit(s) and at least once every year.	**Quality Manager**	Audit Report

Appendix B. **AGENCY RESPONSE TO CONSULTATION**

PLAN & REVISION No: Stormwater and Flooding Management Plan **NWRLSVC-ISJ-SVC-PM-PLN-120215 Rev 1**		
REVIEWER: The Hills Shire Council		
SECTION / PAGE	**COMMENT**	**HOW ADDRESSED**
Section 1.4	Has Blacktown City Council reviewed the Plan?	Yes, Blacktown City Council has reviewed the Plan and comments considered in preparing this revision
Section 1.4	Discussion of PMF modelling and risk at Bella Vista Dive	This has been considered and is documented in Section 5. Ongoing review process and timing has been updated in accordance with CEMP standard requirements
Section 2.2	Compliance with Conditions C33 and C34	This has been discussed in an additional section in this revision of the Plan
Section 4.2	Report not complete as SMEC was preparing their impact assessment during the time of issue	The findings of the subsequent SMEC flood modelling report have been incorporated into this revision of the Plan
Section 4.2.2	Overland flows to be addressed in Flood Emergency Response Plan, especially at Bella Vista	Given the design of the Bella Vista Dive, overland flows are not expected to enter the dive and hence the station will not be impacted. Mainstream flooding is the focus of the emergency response plan, but Site Superintendents will monitor general conditions including overland flows.
Section 4.3.3	Comment on Council's design guidelines for drainage systems	The SMEC drainage design for the viaduct surfaces has been based on the SWTC Appendix 22, including the adoption of the 100 year ARI storm as the design storm.
Section 5	Comments that temporary works flood impacts are greater than Condition C7 requirements	The haul road design has been reconfigured since the previous revision of the Plan
Section 6	Has the PMF been considered as part of the FERMP?	The extent of flooding in the PMF has been considered in the designation of flood evacuation routes. Flood monitoring is triggered when flooding of between 5 and 20 year ARI is expected, based on rainfall.

Section 6	FERMP is generic and requires additional directions and actions for specific personnel	Additional information and actions have been incorporated into the FERMP

PLAN & REVISION No: Stormwater and Flooding Management Plan **NWRLSVC-ISJ-SVC-PM-PLN-120215 Rev 1**		
REVIEWER: Blacktown City Council		
SECTION / PAGE	**COMMENT**	**HOW ADDRESSED**
Section 2.3 and 4.2.2	The Plan does not incorporate stormwater quality management measures	Water quality management measures for the viaduct structure have been designed by SMEC and reference is made to the report. The SWMP otherwise is to address measures for erosion and sediment control.
Section 4.3.1	Climate Change impacts on rainfall	The impacts of climate change have been considered by SMEC as part of the permanent works design for the viaduct and drainage systems. Consideration of climate change impacts for temporary works is not considered to be required given the relatively short timeframe of the works.
Section 4.3.3	Assessment of full range of design flood events	This section has been updated to refer to additional design events that SMEC has considered as part of the works design, including the 5 year and 2000 year ARI floods.
Table 5.1	Haul road option for Second Ponds Creek	The method of construction has been selected and is documented in this revision of the Plan. Temporary works impact has been considered for the 100 year ARI only, but given the scale of the works they are unlikely to impact on lesser or larger events.
Table 5.2	Impact of permanent works for Second Ponds Creek	Impact assessment has been updated in light of latest modelling
Section 6	Impact of sediment basin failure on surrounding properties	Covered in the SWMP

PLAN & REVISION No: Stormwater and Flooding Management Plan NWRLSVC-ISJ-SVC-PM-PLN-120215 Rev 1		
REVIEWER: Department of Planning and Environment		
SECTION / PAGE	**COMMENT**	**HOW ADDRESSED**
Site 16 – Cudgegong Road	Impact of temporary access works	Addressed in Section 5. Impacts are less than previously estimate. No mitigation works are required.
	Potential for cycle/ pedestrian crossing of Second Ponds Creek at the railway bridge	This has not been considered at this stage, not part of ISJV scope.
	Impact on Cudgegong Road substation	Impacts are less than previously assessed. No mitigation works are required.
	Impact on Schofields Road	Impacts are less than previously estimate. No mitigation works are required.

PLAN & REVISION No: Stormwater and Flooding Management Plan NWRLSVC-ISJ-SVC-PM-PLN-120215 Rev 2		
REVIEWER: Office of Environment and Heritage		
SECTION / PAGE	**COMMENT**	**HOW ADDRESSED**
	Inconsistent with C7(b) of planning approval	Kellyville station is not part of SVC works but was been included in flood model to provide information of its effects for OTS works. Table 6-2 shows the updated results. The model results have been improved by reducing the model instabilities. Current results show excessive afflux occurring at localised spots and the general flood area is conforming. It is unreasonable to say that the whole site is non-conforming due to localised afflux.
	Consult relevant Councils and RMS re affluxes	Outcome of consultation with local councils given above.

	contained in public and road reserves including the Transit-Way	
	Consult SES (State Emergency Services) on Flood Emergency Management Plan	Plan sent to SES for review

NSW GOVERNMENT Office of Environment & Heritage

Our reference: DOC14/262112

Ms Rhonda Pollard
Environmental Advisor
salini impregilo

rhonda.pollard@isjv.com.au

Dear Ms Pollard

I refer to your email dated 4 November 2014, consulting the Office of Environment and Heritage (OEH) on the most recent version of the *North West Rail Link - Design and Construction of Surface and Viaduct Civil Works - Stormwater and Flooding Management Plan* (Version 2.0, 14 October 2014).

The proposed works on sites 9 to 12 cause minor afflux 150mm up to 300 mm in the PMF, which is inconsistent with Condition C7 (b) of the project planning approval 'Application No: SSI-5100'. It is also mentioned that these affluxes are contained within public and road reserves including the Transit-Way and are not expected to impact on any residential buildings. OEH recommends that relevant councils and Roads and Maritime Services should be consulted in this regard.

A Flood Emergency Management Plan is proposed in section 6, to identify flood warning, actions and response during flood and evacuation. It is not clear in the report if the SES have had an opportunity to comment on the proposed Plan. Consultation with the SES is considered prudent.

OEH notes that the Stormwater and Flooding Management Plan concludes that the potential impact of the Surface and Viaduct Civil works on flooding are within the acceptable limits provided by the Minister's conditions of approval, or can otherwise be appropriately managed.

If you have any queries please call me on 9995 6864.

Yours sincerely

S. Harrison 24/11/14

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Appendix C. **TEMPORARY WORKS FLOOD IMPACT ASSESSMENT**

WorleyParsons
resources & energy

EcoNomics

MEMORANDUM

TO	Brad Tucker
FROM	Joshua Atkinson / Warick Honour
DATE	1st February 2016
PROJECT	NWRL Construction Works Flood Impact Assessment
SUBJECT	NWRL Surface and Viaduct Civil Works – Flood Impact Assessment of Creek Diversions and Temporary Construction Works

1 INTRODUCTION

As you are aware, AECOM have undertaken flood modelling for Caddies Creek and its tributaries, Tributary 4 and Tributary 5 across the site of the North West Rail Link (NWRL) viaduct. SMEC has then modified and used this modelling to assess the flood impacts of the proposed viaduct as part of the Environmental Impact Assessment (EIS) prepared for the NWRL. This included 2-Dimensional modelling of overland flow paths and also pipe flows through the sub-surface trunk drainage system.

Various temporary works are required in order to construct the viaduct within Sydney Water land. These works include:

- Demarcation of the site boundary and erection of security fencing around the site.
- Clearing the site of vegetation and noxious weeds, and stripping the site of topsoil and material unsuitable for construction.
- Installation of erosion and sediment control measures.
- Construction of a haul road on which to transport the pre-cast viaduct segments.
- Piling and localised excavations to construct the viaduct piers, including piling works and construction of a pile cap.
- Construction of the gantry supports, permanent piers and the viaduct from a mobile gantry which will run over the site.
- Materials storage areas.

Refer to **Section 3** for further details on the works for Stage 1.

Where the above items are to be located within the floodplain there is the potential for existing flooding to be impacted. There are three locations where the viaduct is required to cross over the existing waterways:

- At the confluence of Caddies Creek, Caddies Creek Tributary 5 and Elizabeth Macarthur Creek (between Samantha Riley Drive and Windsor Road);
- A small drainage line feeding into Caddies Creek upstream from Windsor Road;
- Caddies Creek Tributary 4, near Merriville Road;

For the location of the above sites refer to **Figure 1.1**. At these locations the haul road and viaduct piers will be located within the floodplain.

WorleyParsons has been engaged to investigate the potential impacts of the proposed temporary works required for the construction of the NWRL viaduct using the detailed flood modelling developed by SMEC as a base. Creek diversions have been designed as part of this work to minimise any flood (and ecological) impacts. Detailed flood modelling of the final temporary works design has been undertaken and the results discussed below.

Note for the purposes of this report, the term 'creek' is considered interchangeable with 'stream'.

2 EXISTING FLOOD CHARACTERISTICS AT THE SITE

Flood Modelling Background

The TUFLOW modelling used to determine the existing (base) flooding conditions, as well as the flood impacts as a result of the proposed permanent works required for the viaduct, are documented in SMEC (2014). The main points to note with respect to the modelling are:

- The hydrology of Caddies Creek and its tributaries has been modelled using WBNM software. The catchment extends as far south as the Westlink M7 and Northwest Boulevard, approximately 4 km south of the confluence of Caddies Creek and Elizabeth Macarthur Creek.
- The TUFLOW hydrodynamic model incorporates a 3 m x 3 m grid size for the computation of overland flows. TUFLOW further divides each grid into four smaller squares in order to perform its hydraulic calculations. Therefore, the topography is effectively sampled at 1.5 metre intervals.
- The TUFLOW model incorporates the sub-surface trunk drainage beneath Windsor Road, Old Windsor Road and the T-Way.
- For the proposed permanent viaduct works, the viaduct piers have been simulated by applying energy losses that represent the effect of the piers on the flow. These energy losses are based on the *Austroads* guidelines.

Flood Modelling Results for Existing Conditions

The existing flood characteristics at the site have been documented in SMEC (2014). Peak flood depths and velocity for the existing (base) conditions at the confluence of Caddies Creek and Elizabeth Macarthur Creek during the 20 year ARI and 100 year ARI floods are shown in **Figure 2.1** and **Figure 2.2,** respectively. **Figure 2.3** shows the peak flood depths and velocity during the 20 year ARI event at the Tributary 4 crossing near Merriville Road, while **Figure 2.4** shows peak flood depths and velocity during the 100 year ARI flood. The small drainage line upstream of Windsor Road is not within the Caddies Creek floodway or floodplain (*refer* **Figure 1.1**) and has not been modelled in the existing TUFLOW model.

Validation of Flood Modelling Results Using HEC-RAS

To validate the operation of the operation off the TUFLOW model, a 1-Dimensional HEC-RAS model of the channel system was established to simulate the "in-channel" hydraulics in greater detail. At most locations the water levels simulated by the two models are within 100 mm for comparable conditions in the floodway. For example, in the parkland reserve bounded by Old Windsor Road, Newbury Avenue, Folkestone Terrace and Ludlow Street, a peak flood level of 46.20 m AHD is predicted by TUFLOW during the 100 year ARI flood, while HEC-RAS predicts a level of 46.30 m AHD. Similarly, at the inlet to the Tributary 4 culvert under Windsor Road, the TUFLOW model predicts a 100 year ARI level of 43.71 m AHD, while the HEC-RAS model predicts a level of 43.69 m AHD.

3 IMPACT OF TEMPORARY SITE WORKS

Post-Works Modifications to the Flood Model

The proposed arrangement for the temporary works at the confluence of Caddies Creek and Elizabeth Macarthur Creek is shown in **Figure 3.1**, while the works required for Tributary 4 are shown in **Figure 3.2**. The plans for construction of the temporary works required to facilitate the NWRL viaduct are described in ISJV (2015b). The flood model has been modified to incorporate the following:

- The haul road alignment and work platforms for the construction of the viaduct piers were incorporated into the model using terrain modifications (TUFLOW *zsh* layers). The proposed haul road elevations are shown in the design drawings provided in **Attachment A** (*NWRLSVC-IWP-SVC-DN-DWG-850203 [D]*). This includes the provision of a work platform sufficiently large to facilitate the construction of the piles, pile cap, and viaduct pier, and support the delivery of the viaduct segments.

- Excavation drawings for the pile caps (*refer* **Attachment B**) show that the works required to construct the pile caps are below the haul road level, and therefore will not have additional impacts on flood behaviour.

- The construction of piers 47 to 52 and 72 to 76 require some work to divert the creek around the base of the construction activities. This requires the excavation of an alternative creek channel adjacent to the viaduct work platforms (*refer* **Figures 3.1** and **3.2**). The detailed design plans for these works are included in **Attachment C**.

- Additional energy losses have been applied in the model to two select piers to represent the extra resistance to flow as a result of the temporary gantry supports, which are wider in the direction of flow than the viaduct piers. The construction sequence plan (*refer* **Attachment D,** *NWRLSVC-ISM-BVR-CS-DRG-015051[01]*) shows that only two gantry supports are required and that these supports will be moved along the viaduct alignment to support the gantry as required.

- Security fences are to be installed at the site. The location of the fences is shown in **Attachment E**. These fences are made of chain link mesh approximately 1.8 m high. There is no shade cloth or other material attached to the fences. Where security fences are proposed in the floodplain these have been simulated as an extra energy loss to represent the resistance that these fences would have on the flow. A blockage factor of 25% has also been applied to the fences to represent the debris that may accumulate on the fence. This is considered to provide a reliable representation of the impediment to flow given that the majority of fencing is oriented parallel to the direction of flow.

- Erosion and sediment control measures are not expected to contribute to overall flood impacts. A small diversion bund is proposed to divert sediment from the haul road to sediment sumps (*refer* **Attachment F,** *ESCP 4A Rev4*). This bund is not expected to be greater than 500 mm high and 2500 mm wide, and has been incorporated into the model using additional terrain modifications (TUFLOW *zsh* layers). Other features, such as sediment basins, sediment fences or geotextile surface coverings are also not expected to have a measurable impact on flooding.

- Materials stockpiles are expected to be located outside of the floodplain (*refer* **Attachment F,** *ESCP 4A Rev4*). The impact on flooding of materials stored at this location is expected to be minimal.

- Vegetation clearing is expected to take place only within the haul road area (*refer* **Attachment A,** *NWRLSVC-IWP-SVC-DN-DWG-850203 [D]*). These areas have been assigned a Manning's roughness co-efficient of 0.025, which corresponds to a smooth compacted earth pavement.

Areas not shown as shaded green on the haul road plans are not expected to be cleared, and hence the roughness co-efficient is unchanged from those used in SMEC (2014).

- Roughness values in the Tributary 4 channel have been revised to reflect the present operational condition of the channel in the base case model. This includes a co-efficient of 0.08 to reflect the reeds and grass in the existing channel. For the model of the proposed creek diversions, the roughness has been revised to reflect the likely operational conditions in the channel. This includes a coefficient of 0.02 to reflect the portion of the channel that will have a concrete slab for the base.

In other respects the TUFLOW model is the same as the SMEC model for the proposed permanent works assessment, including allowances for energy losses at piers associated with the viaduct.

Impact of the Temporary Works

The impact of the temporary works, in conjunction with the proposed permanent works, on peak flood levels at the confluence of Caddies Creek and Elizabeth Macarthur Creek are shown in **Figure 3.3** for the 20 year ARI, and **Figure 3.4** for the 100 year ARI event**.**

During the 20 year ARI event, within the corridor between the confluence of Caddies Creek and Elizabeth Macarthur Creek and Windsor Road the maximum increase in flood level would be up to 95 mm. During the 100 year ARI event an increase of up to 115 mm could be expected. However, as shown in **Figures 3.3** and **3.4**, this increase occurs within the Caddies Creek floodplain corridor and will have reduced impact adjacent to the residential area on the east side of the floodplain.

The levels of the properties at the end of Fitzroy Place, Swann Place, Austen Place and Lycett Avenue, as taken from available topographic data, have been checked against the results of the temporary works flood modelling to confirm that a freeboard of more than 500mm above the 100 year ARI level will be preserved at these properties. These houses are elevated above the floodplain by a retaining wall or earth embankment, providing a freeboard typically between 1 and 1.5m above the 100 year ARI floodplain. Accordingly, the modelled impacts are not expected to manifest as a measurable impact on these properties.

Some greater increases in flood levels are noted within the construction site due to water impacting on the shoring structures; for example, a flood level impact of 152 mm is noted against Pier 48 for the 20 year ARI event, and 204 mm during the 100 year ARI event; however, the impacts will be largely contained within the creek corridor.

Upstream of Old Windsor Road increases of 28 mm are observed in the parkland reserve bounded by Old Windsor Road, Newbury Avenue, Folkestone Terrace and Ludlow Street during both the 20 year ARI event and the 100 year ARI event. This increase in flood levels is similar to the impact of the proposed permanent works alone (*SMEC 2014*), which would be approximately 19 mm in this reserve.

However, the increase in flood levels would not result in any significant expansion in the peak flood extents. The properties that front the creek reserve or parkland reserve bounded by Old Windsor Road, Newbury Avenue, Folkestone Terrace and Ludlow Street are not expected to be affected by the 20 year ARI or the 100 year ARI flood as a result of construction of the temporary works.

There are expected to be some minor increases in flood levels across the north-bound lanes of Old Windsor Road during the 100 year ARI event; however, the extent of flooding is not increased significantly compared to existing conditions and the overall depth of inundation is expected to be less than 200 to 300mm, meaning that the trafficability of the road will not be significantly impacted.

At the confluence of Caddies Creek and Elizabeth Macarthur Creek, the impacts of the temporary works on peak flood velocities are shown in **Figure 3.5** for the 20 year ARI flood, and **Figure 3.6** for the 100 year ARI event. Over the majority of the site velocities are not altered in any significant way.

However, there are some localised areas in which velocities do show a significant increase. For example, a velocity increase of 1.5 m/s is observed where the flooding is forced on to the western overbank area in the vicinity of the confluence between Elizabeth Macarthur and Caddies Creeks during the 20 year ARI event. Similar increases in velocity are also noted during the 100 year ARI. The largest velocity impacts are associated with the construction of the haul road and features on the site such as the sediment containment bund that runs around the site. The construction of the creek diversion channels has limited impact on velocities outside of the site. As such, there is only limited potential for additional scour to occur, and the creek should be monitored and remediated following any major rainfall as necessary.

Where the haul road crosses Caddies Creek Tributary 4, only minor increases in peak flood level are observed in the model results during the 20 year ARI flood (*refer* **Figure 3.7**). The maximum increase will be 43 mm at the exit from the Tributary 4 culvert where it passes under Windsor Road. During the 100 year ARI event (*refer* **Figure 3.8**) there is an increase in flood levels of up to 125 mm at this location. This increase can be attributed to the necessary realignment of the waterway downstream from the outlet to accommodate the haul road for the viaduct construction. Any significant change to the flood extents are the direct result of the localised creek diversion around the temporary works, and will not impact surrounding properties.

Upstream of Windsor Road peak flood levels are largely unchanged, and flood level increases of more than 20 mm are only expected in a localised area within the creek channel at the entrance to the Tributary 4 culvert under Windsor Road.

Velocity impacts at the Tributary 4 crossing are shown in **Figure 3.9** and **Figure 3.10** for the 20 year ARI and 100 year ARI events, respectively. These velocity increases are the result of the localised redistribution of flows due to the channel works. As such, it is unlikely that scour or erosion of the existing banks will be exacerbated by the works and this will be managed with the use of appropriate channel stabilisation measures.

Comparison to HEC-RAS Modelling Results

The impacts of the 100 year ARI flood were also tested with HEC-RAS in order to simulate the “in-channel” hydraulics in greater detail. The channel cross-sections for the existing conditions were modified to incorporate the filling required for the construction of the haul road, the excavation of creek diversions where required, and adjustments to the Manning’s roughness co-efficients where the channel will incorporate scour protection, such as a concrete slab.

In the parkland reserve bounded by Old Windsor Road, Newbury Avenue, Folkestone Terrace and Ludlow Street, a peak flood level impact of 4 mm is predicted using HEC-RAS during the 100 year ARI flood event. This compares with an impact of 28 mm predicted by TUFLOW. As the TUFLOW model considers the 2D floodplain hydraulics in greater detail, it is likely to provide the more reliable results in this area.

At the outlet from the Tributary 4 culvert under Windsor Road, the HEC-RAS model predicts a flood level impact of 440 mm during the 100 year ARI event, as compared to TUFLOW which predicts an impact of 125 mm. At other locations, such as upstream of the culvert and downstream of the construction in the channel past Pier 73, only minor flood impacts are predicted by both HEC-RAS and TUFLOW. As such, it is possible that TUFLOW is underestimating the flood impacts associated with the constriction of the channel at Pier 73 and the impacts may be greater than indicated by the TUFLOW model. However, the effects of this constriction are not expected to impact any existing properties or increase the extent of inundation across Windsor Road or the T-Way. Furthermore, it is proposed to restore the capacity of the Tributary 4 channel following the construction of the viaduct (*refer below*).

Reinstatement of Flood Conveyance Following Construction

Following the viaduct construction it is proposed that shoring boxes be removed at Piers 47 and 48. Shoring will also be removed or cut-down to below the surface level at the other locations shown in the permanent works drawings contained in **Attachment G**. In the vicinity of Pier 49 a section of the haul road will also be excavated to create a shelf/bench in the overbank area to increase conveyance. In the vicinity of Pier 51 the shoring will be removed to below the bed level and the bank will be graded back to reinstate some in-channel capacity. The bank will be protected by rock rip-rap.

Although not modelled in TUFLOW, it is expected that these works will act to reduce the impact on flood levels shown for the temporary works (*refer* **Figures 3.3** *and* **3.4**). This includes the increases noted in the vicinity of Piers 47 to 49 that extend upstream into the reserve bounded by Old Windsor Road, Newbury Avenue, Folkestone Terrace and Ludlow Street. It is expected that the increase in 100 year ARI flood levels at this location will be reduced to less than 20mm. Furthermore, removal of the haul road and site fencing is expected to reduce the flood level increases noted at the northern end of Swann Place, Austen Place and Lycett Avenue.

Despite the details shown in the current Revision 2 of the permanent works drawings (*refer* **Attachment G**), it is proposed that the shoring at Pier 50 and Pier 74 will also be cut-back to below ground level as part of the permanent works. In these locations the channel bank will be graded back towards the piers to reinstate conveyance capacity.

In the vicinity of Pier 73 the proposed haul road and pier construction footprint is expected to constrict the creek channel (*refer* **Figure 3.2**) as the available space for the proposed channel is also constrained by the Sydney Water property boundary. This constriction will have a localised impact on flooding, and reduce the flood conveyance capacity of the Tributary 4 channel. It is proposed that once the viaduct has been completed in this area, the haul road will be partially demolished to restore the channel cross-section, and hence the conveyance capacity of the channel (*refer to design drawings in* **Attachment G**).

The TUFLOW model was updated to simulate the impact of this channel restoration on the 20 and 100 year ARI events. The predicted impacts during the 20 year ARI event are shown in **Figure 3.11** while the impacts during the 100 year ARI flood are shown in **Figure 3.12**. Restoring the creek channel will reduce the flood level increases to approximately 35 mm during the 20 year ARI, as compared to approximately 43 mm without restoring the creek channel. Likewise, for the 100 year ARI event, restoring the channel is expected to reduce the flood level impacts in the channel to approximately 41 mm, as compared to approximately 125 mm prior to restoring the channel. This reduction in flood level impacts was confirmed in equivalent HEC-RAS modelling for this area.

Compliance with SSI-5100 Licence Conditions of Approval

C7:

With respect to flooding, the Minister's Licence Conditions of Approval (SSI-5100) require that the NWRL a viaducts, as well as any associated works be designed, to the extent that is feasible and reasonable, to not worsen the existing flood characteristics in the vicinity of the works. To not worsen is defined as:

- A maximum increase in flood level of not more than 20 mm in the 100 year ARI flood event;
- A maximum increase of not more than 50 mm during the Probable Maximum Flood event;
- A maximum increase in the time of inundation of not more than 1 hour in the 100 year ARI event; and

- Any increase in flow velocity during the 100 year ARI flood event should not increase the potential for soil erosion and scouring.

C8:

The Minister's Licence Conditions of Approval (SSI-5100) required the preparation of a *Stormwater and Flooding Management Plan or Plans*. The plan or plans must cover the impacts associated with the construction and operation of the NWRL viaduct, and must include the following:

- The design of temporary works and compensatory measures that would be implemented during the construction to not worsen, to the extent that is feasible and reasonable, existing and known future flooding characteristics;
- Identification of flood risks to the NWRL viaduct and adjoining areas, including the consideration of local drainage catchment assessments, and climate change implications on rainfall and drainage characteristics;
- Identification of design and mitigation measures that would be implemented to protect proposed construction activities and to not worsen existing flooding characteristics during construction, including soil erosion and scouring;
- Identify flood risk, potential for inflows, potential consequences and required mitigation measures for each tunnel entrance; and
- A flood / emergency response / management plan.

The 20 and 100 year ARI floods have been modelled as part of the assessment of impacts on the temporary works, which is appropriate given the temporary pier construction platforms will only be required during the period of construction. The temporary haul road will need to be in operation for 8 years following construction (*as required by TfNSW*); however the areas that present the greatest likelihood of having flood impacts will be rehabilitated after 2 years.

With respect to acceptable flood level increases, the Minister's Licence Conditions of Approval are being explicitly met upstream of the Tributary 4 crossing at all areas except for immediately at the entrance to the Tributary 4 culvert under Windsor Road. The impacts on flood level and velocity at this location are the result of the designed redistribution of the flow at this site, and for the most part there is no overall increase in the resultant flood levels or velocities during the 100 year ARI event, nor is there a significant increase in the potential for scour. The duration of flooding is less than 2 hours in either the existing or proposed works cases, so any increase in the duration of inundation will be significantly less than 1 hour.

At the confluence of Caddies Creek and Elizabeth Macarthur Creek the maximum acceptable increases in flood levels are not being explicitly met. The increase in peak flood levels during the 100 year ARI event is greater than specified by the approval conditions; however, the increases are not expected to increase the number of properties affected by the 100 year ARI flood. More than 500mm height of freeboard is maintained between the peak 100 year ARI flood level and the properties at Fitzroy Place, Swann Place, Austen Place and Lycett Avenue (*typically 1 to 1.5m of freeboard is maintained*).

Similarly, adequate freeboard is maintained at properties that front to Folkestone Terrace upstream of Old Windsor Road, so there are no additional impacts on residents as a result of the temporary works.

Predicted velocity increases at the confluence of Caddies Creek and Elizabeth Macarthur Creek do have the potential to increase erosion during the 100 year ARI flood. However, the extent of the area subject to velocity increases is limited, and is mostly within the haul road area. With careful

monitoring following major flooding, any erosion can be managed with appropriate stabilisation and rehabilitation works. As with the Tributary 4 crossing, the duration of flooding is sufficiently short so as to ensure that any increases in the time of inundation will be significantly less than 1 hour.

The Minister's Licence Conditions of Approval refer to the need to not worsen existing flood characteristics to the "extent that is feasible and reasonable". It is considered that the proposed temporary works are meeting the requirements of the conditions to a reasonable extent given the following context:

- The predicted flood level increases are not expected to result in any measurable impact to nearby residential properties or impact on the trafficability of roads.
- The temporary nature of the works, in which case a majority of the impact-producing works such as shoring and site fencing will be removed shortly after viaduct construction, and the haul road will also be removed after 8 years. There is only a limited chance of a 100 year ARI flood event occurring within these timeframes.
- The potential for scour is limited and manageable.
- Due to the alignment of the viaduct and the location of the associated piers, it is not feasible to redesign the temporary works to achieve lesser flood impacts.

The existing small drainage line upstream from Windsor Road can be extended with a stormwater pipe of a similar diameter and similar grade to achieve a similar flow capacity to existing. As such the extension of this line under the temporary works is not expected to have an impact on flooding, and can be considered to meet the Minister's conditions.

The Probable Maximum Flood (PMF) for the temporary works has not been simulated. It is expected that the marginal impacts as compared to the base case PMF would be very minor. There is only a very remote chance that such a rare flood would occur during the construction timeframe. The majority of the temporary works, such as the pier construction platforms, and the components with the greatest impacts, will only be in place for the duration of construction. The haul road, which is expected to be in service for up to 8 years (*as required by TfNSW*), is at a similar grade to the existing terrain and hence it can be expected to have only minor impacts in isolation.

From the simulations of the PMF that have been undertaken as part of previous studies for both the existing conditions and the proposed permanent works conditions, it is concluded that that the temporary works will not alter the way the floodplain is managed during extreme flooding such as the PMF. For example, evacuation must take place in the same manner, and would involve a similar number of residences being evacuated along similar evacuation routes. Recovery following an extreme flood would also take place in a similar manner, and would also involve a similar number of properties.

While the impacts of an extreme flood such as the PMF are significant, the majority of these impacts would be expected in the existing flood conditions. The marginal impact that results from the temporary works is relatively minor. In the context of the extreme flooding, these impacts are considered reasonable. Furthermore, as the NWRL viaduct will need to cross the Caddies Creek floodplain, the only feasible measures to mitigate the impacts of flooding have already been incorporated in to the temporary works design recommendations.

4 REFERENCES

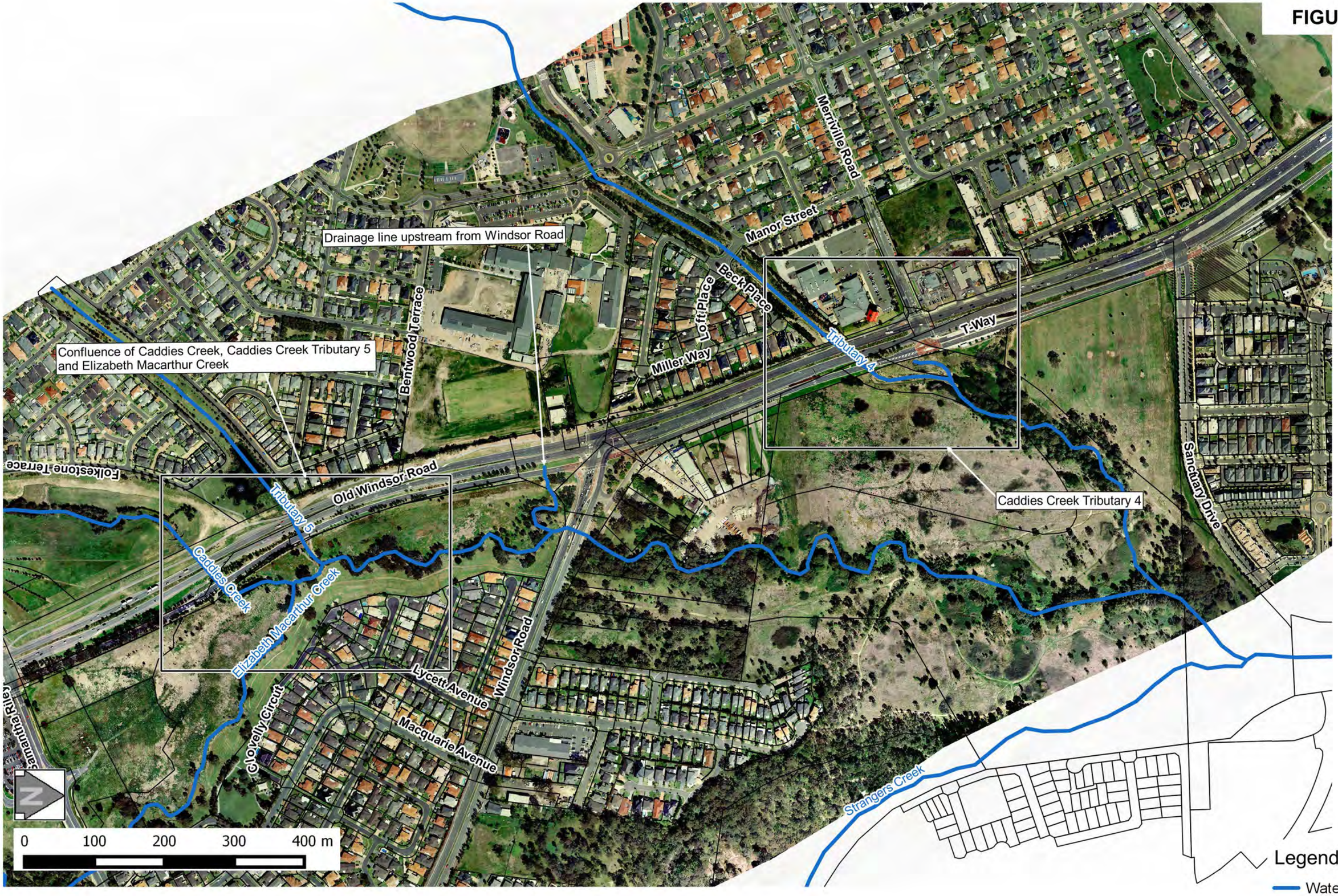
ISJV (2015a), *Stormwater and Flooding Management Plan,* Document No. NWRLSVC-ISJV-SVC-PM-PLN-040515 Revision 4.0

ISJV (2015b), *Works Plan for Work in Sydney Water Drainage Lands – Stage 1,* Document No. NWRLSVC-ISJ-SVC-PM-PLN-120217 Revision 3.0

SMEC (2014), *North West Rail Link Design and Construction of Surface and Viaduct Civil Works: Flood Modelling Report Design Lot 57*, Document No. NWRLSVC-ISM-SVC-DR-DRT-570100 Revision B

FIGURES

FIGURE 1.1



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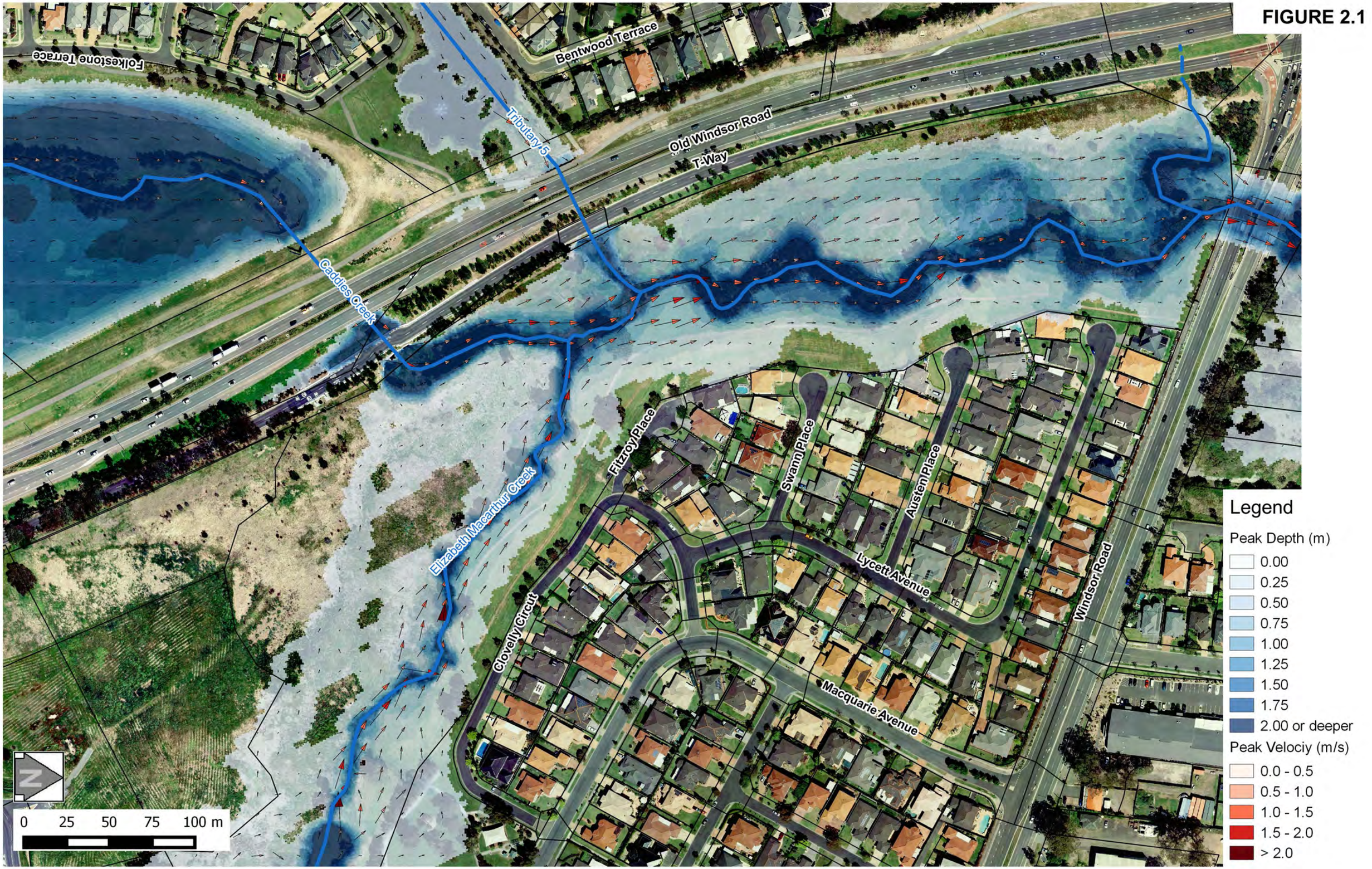
NWRL SVC WORKS SITE OVERVIEW
SAMANTHA RILEY DRIVE TO SANCTUARY DRIVE

FIGURE 2.1



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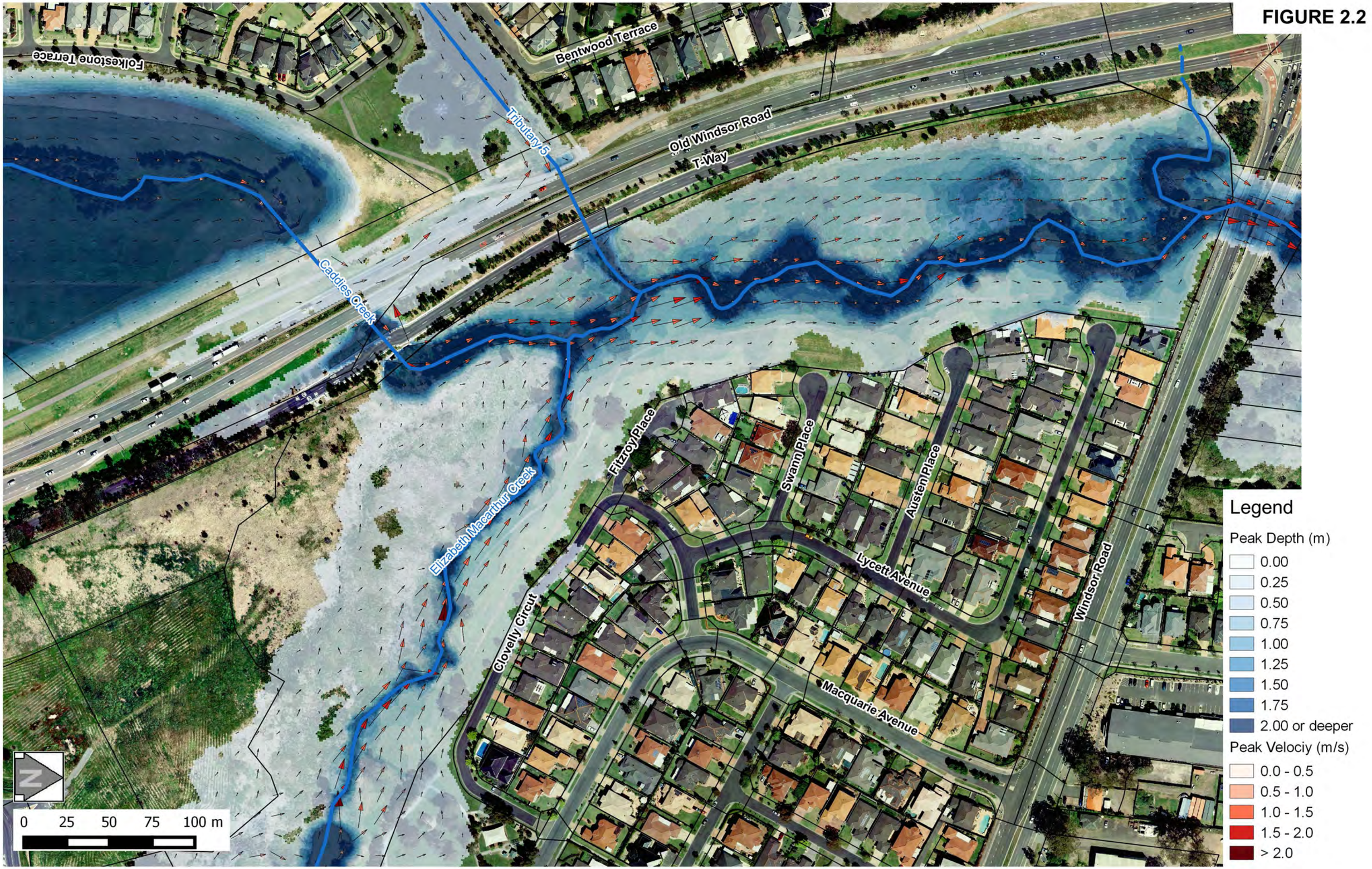
20 YEAR ARI DEPTH AND VELOCITY FOR THE EXISTING CAONDITIONS AT THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK AND WINDSOR ROAD

FIGURE 2.2



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resources & energy

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100 YEAR ARI DEPTH AND VELOCITY FOR THE EXISTING CAONDITIONS AT THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK AND WINDSOR ROAD

FIGURE 2.3

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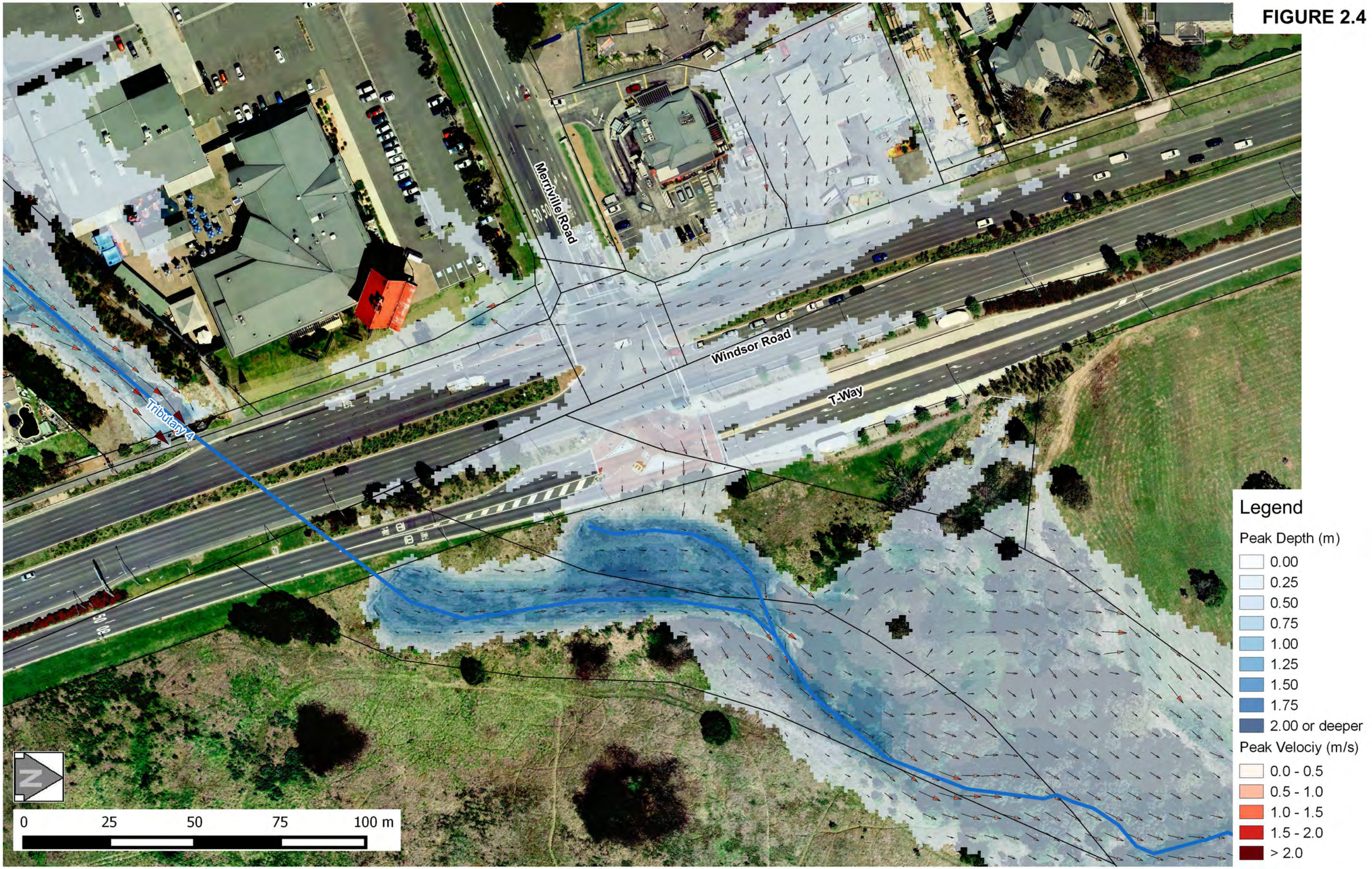
20 YEAR ARI DEPTH AND VELOCITY FOR THE EXISTING CONDITIONS AT TRIBUTARY 4

FIGURE 2.4



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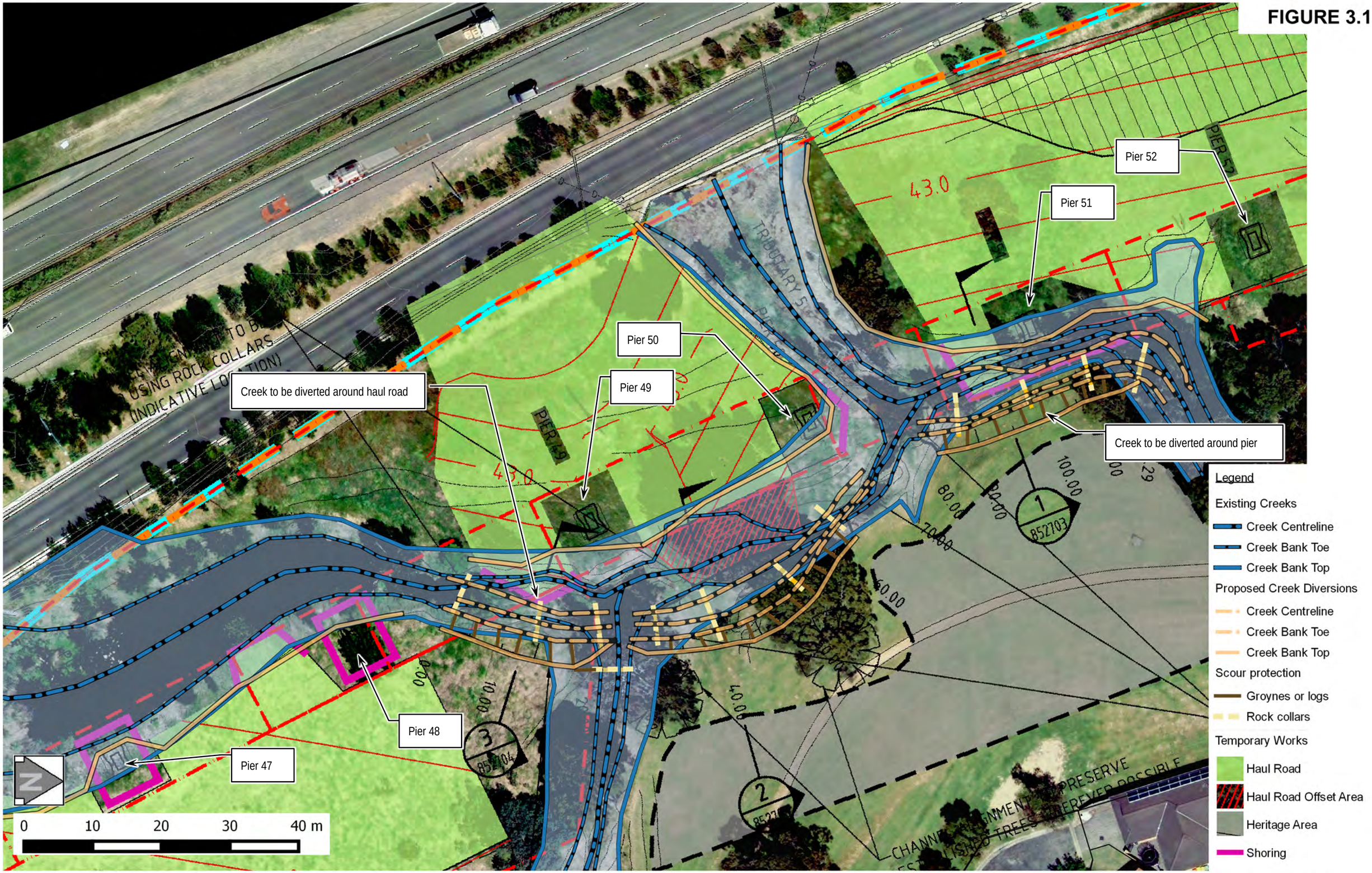
W:_Infrastructure\Projects\301015\03552 - NWRL Haul Road\11.0 Engineering\Flood Modelling\WaterRide

100 YEAR ARI DEPTH AND VELOCITY FOR THE EXISTING CONDITIONS AT TRIBUTARY 4

FIGURE 3.1



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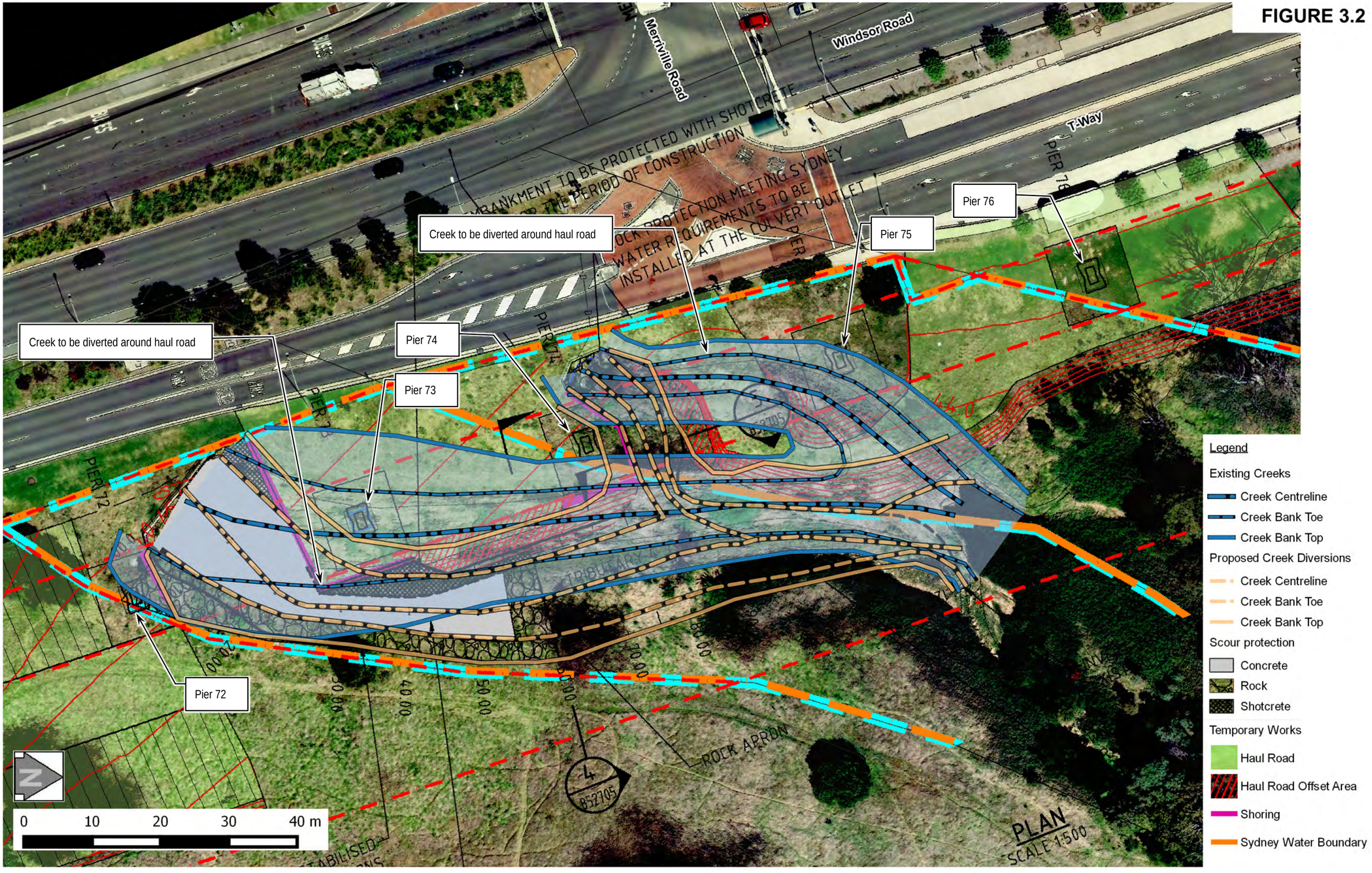
W:_Infrastructure\Projects\301015\03552 - NWRL Haul Road\11.0 Engineering\Flood Modelling\WaterRide

PROPOSED TEMPORARY CREEK DIVERSION AT THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK

FIGURE 3.2



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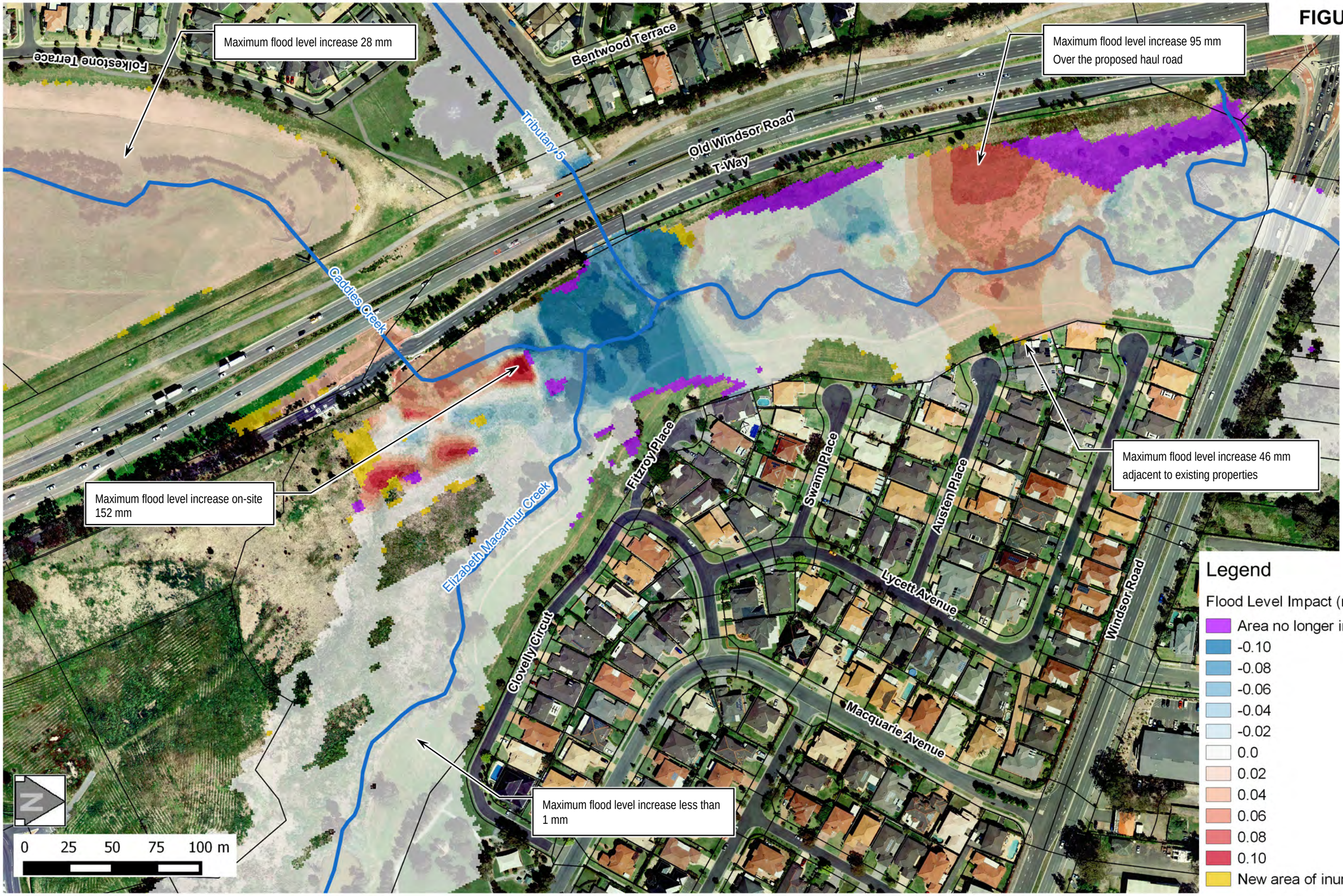
W:_Infrastructure\Projects\301015\03552 - NWRL Haul Road\11.0 Engineering\Flood Modelling\WaterRide

PROPOSED TEMPORARY CREEK DIVERSION AT TRIBUTARY 4

FIGURE 3.3



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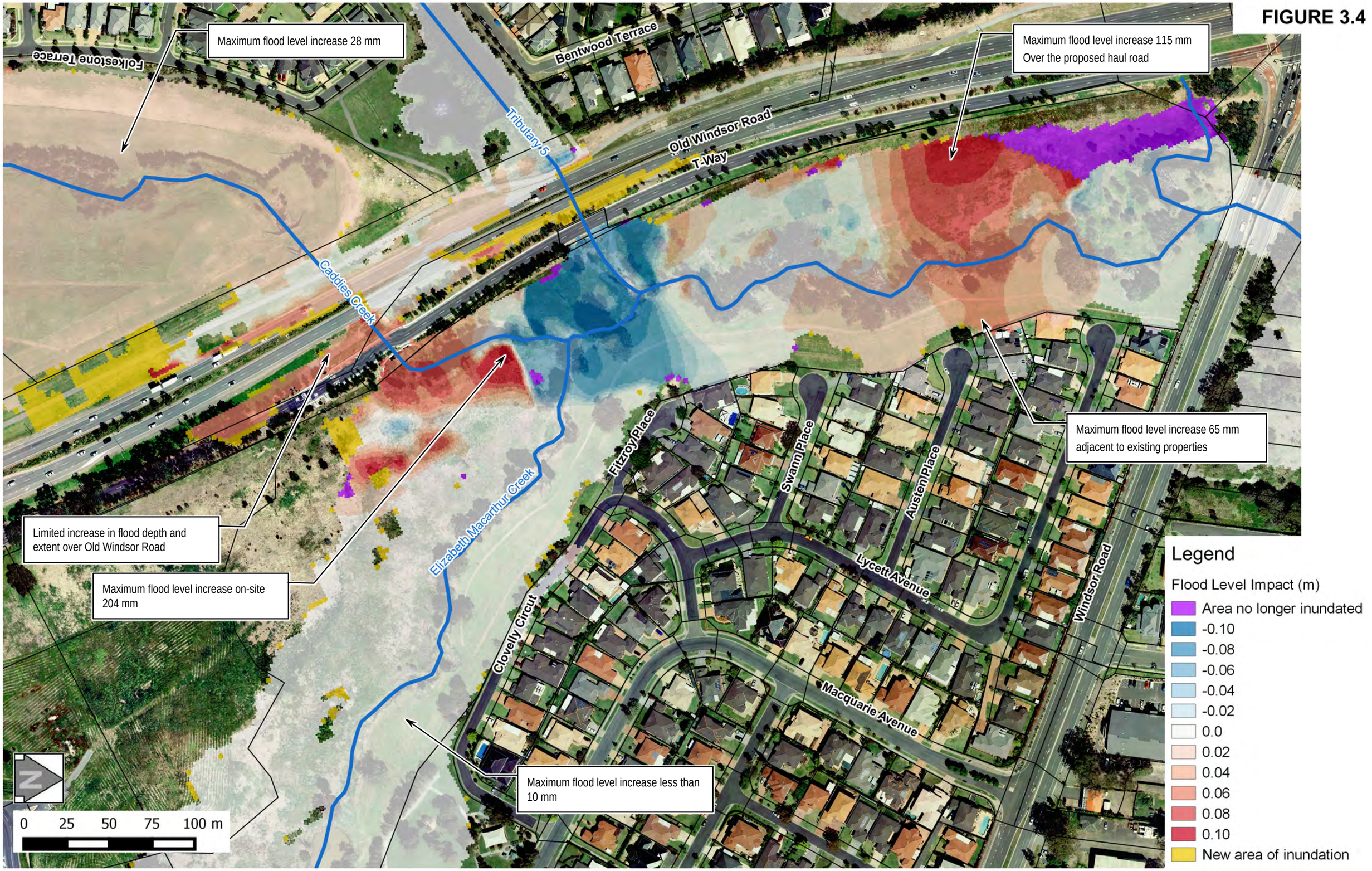
IMPACT ON PEAK FLOOD LEVELS DURING THE 20 YEAR ARI FLOOD FOR THE PROPOSED WORKS ARRANGEMENT BETWEEN THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK AND WINDSOR ROAD

FIGURE 3.4



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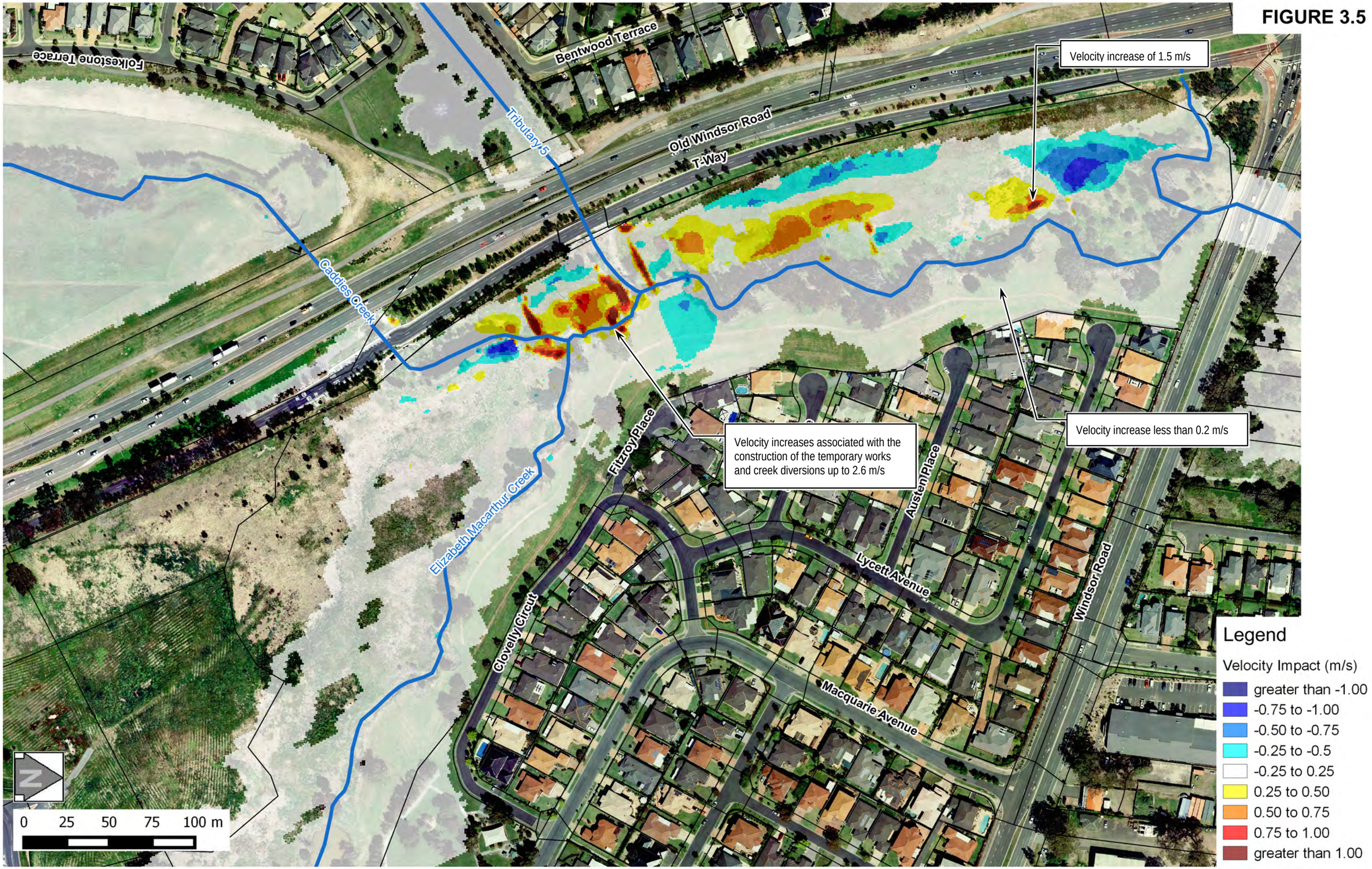
IMPACT ON PEAK FLOOD LEVELS DURING THE 100 YEAR ARI FLOOD FOR THE PROPOSED WORKS ARRANGEMENT BETWEEN THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK AND WINDSOR ROAD

FIGURE 3.5



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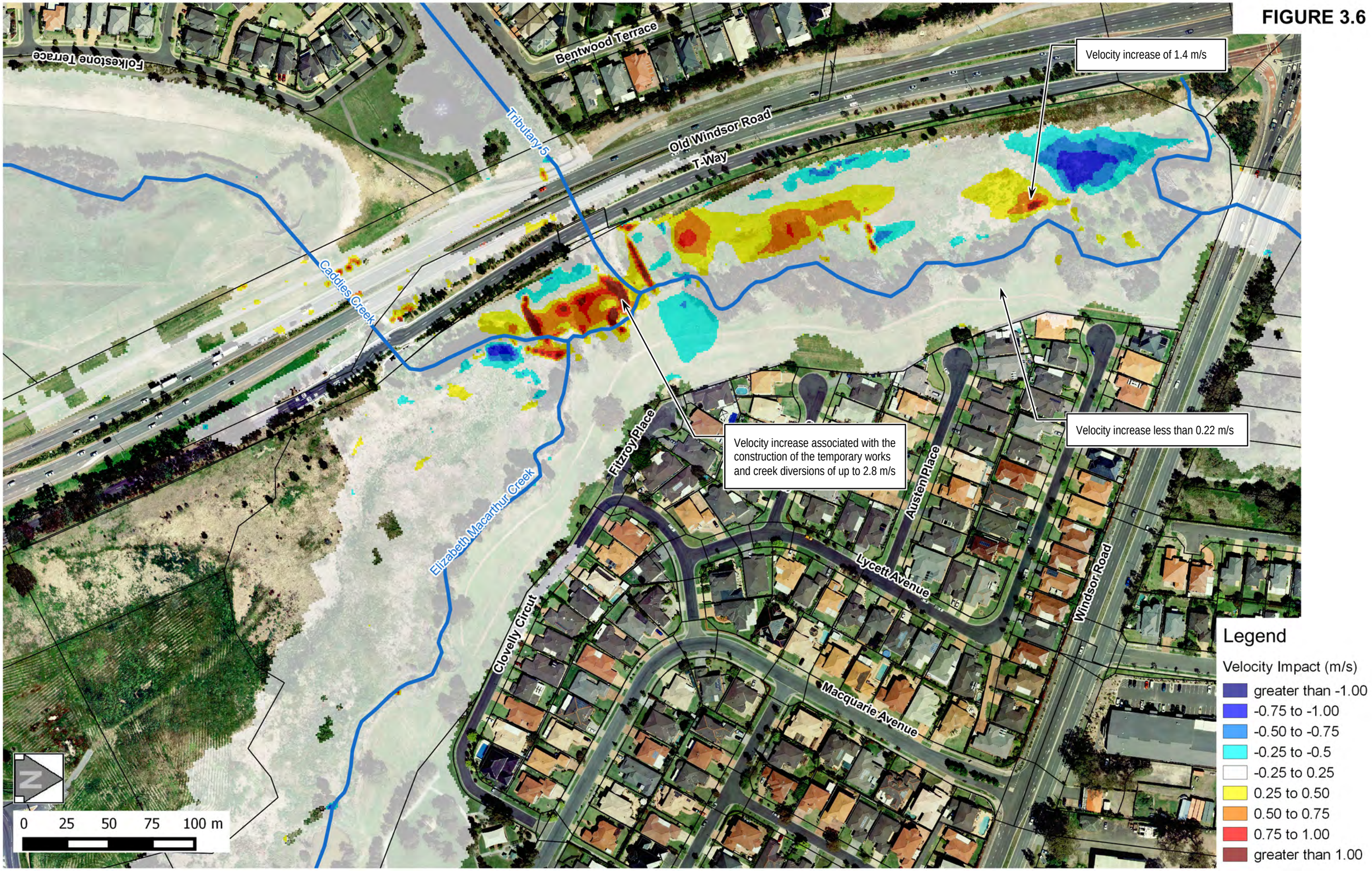
IMPACT ON PEAK FLOW VELOCITIES (20 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT BETWEEN THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK AND WINDSOR ROAD

FIGURE 3.6



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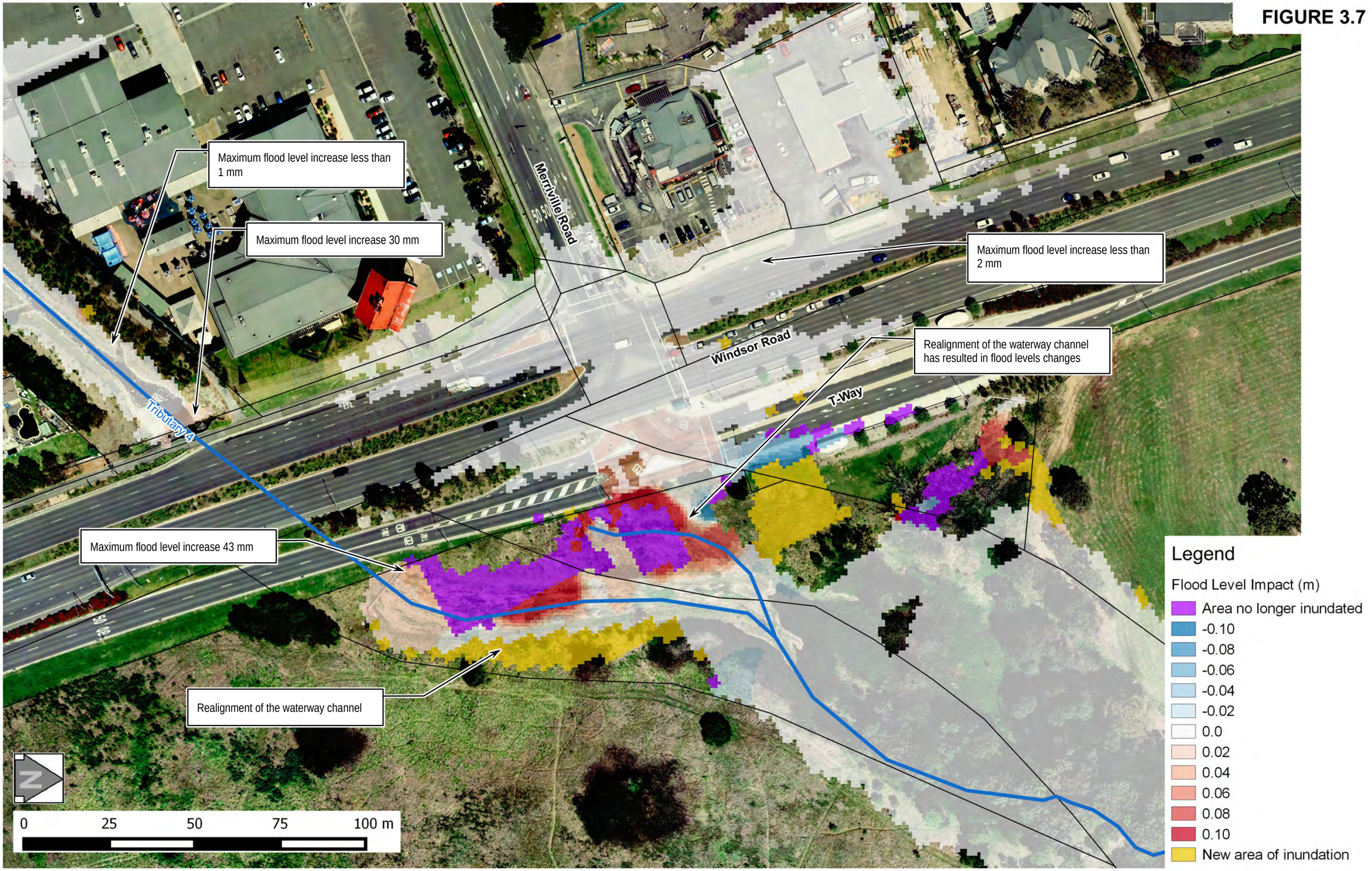
IMPACT ON PEAK FLOW VELOCITIES (100 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT BETWEEN THE CONFLUENCE OF CADDIES CREEK AND ELIZABETH MACARTHUR CREEK AND WINDSOR ROAD

FIGURE 3.7



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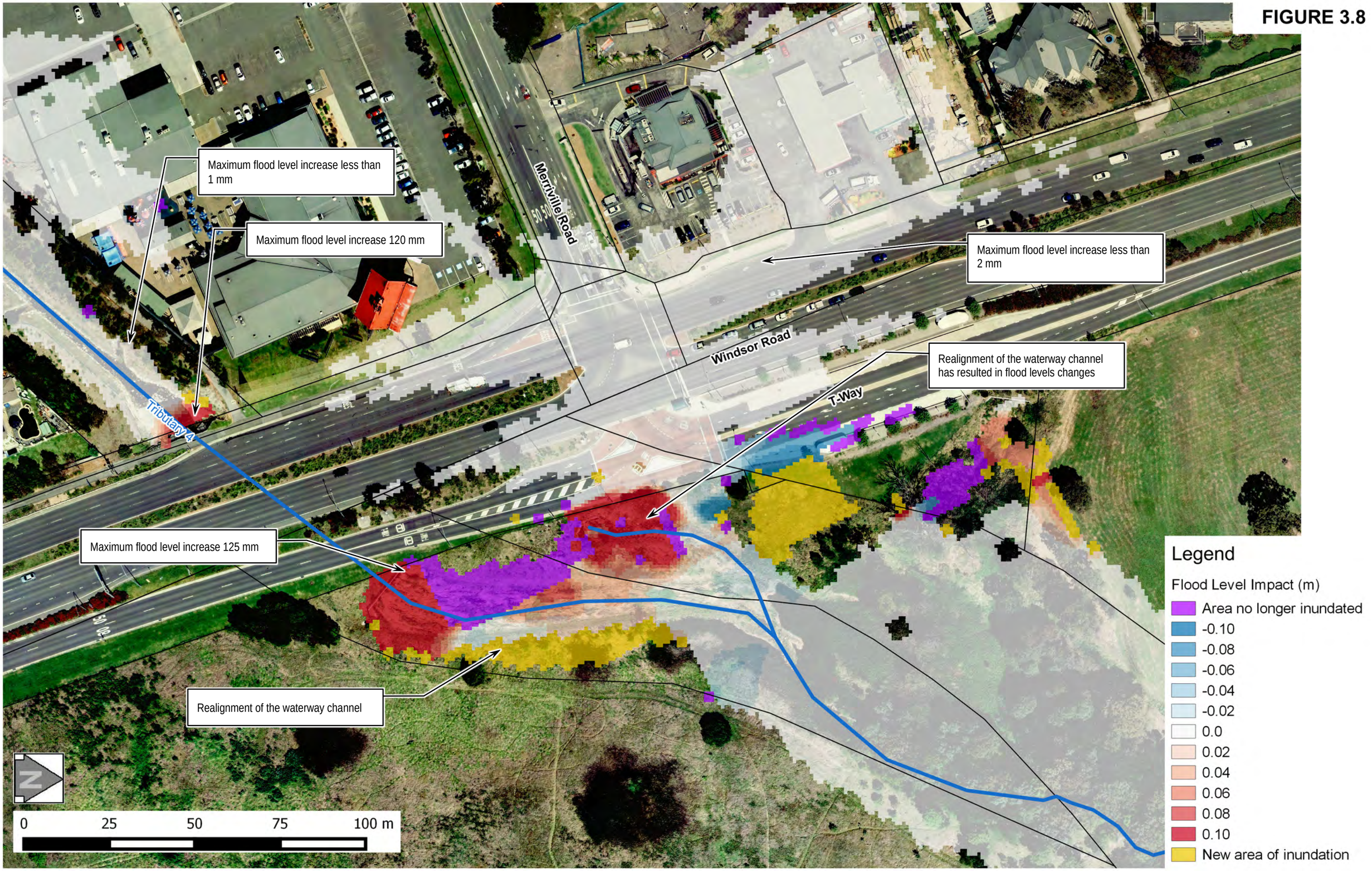
IMPACT ON PEAK FLOOD LEVELS (20 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT AT TRIBUTARY 4

FIGURE 3.8



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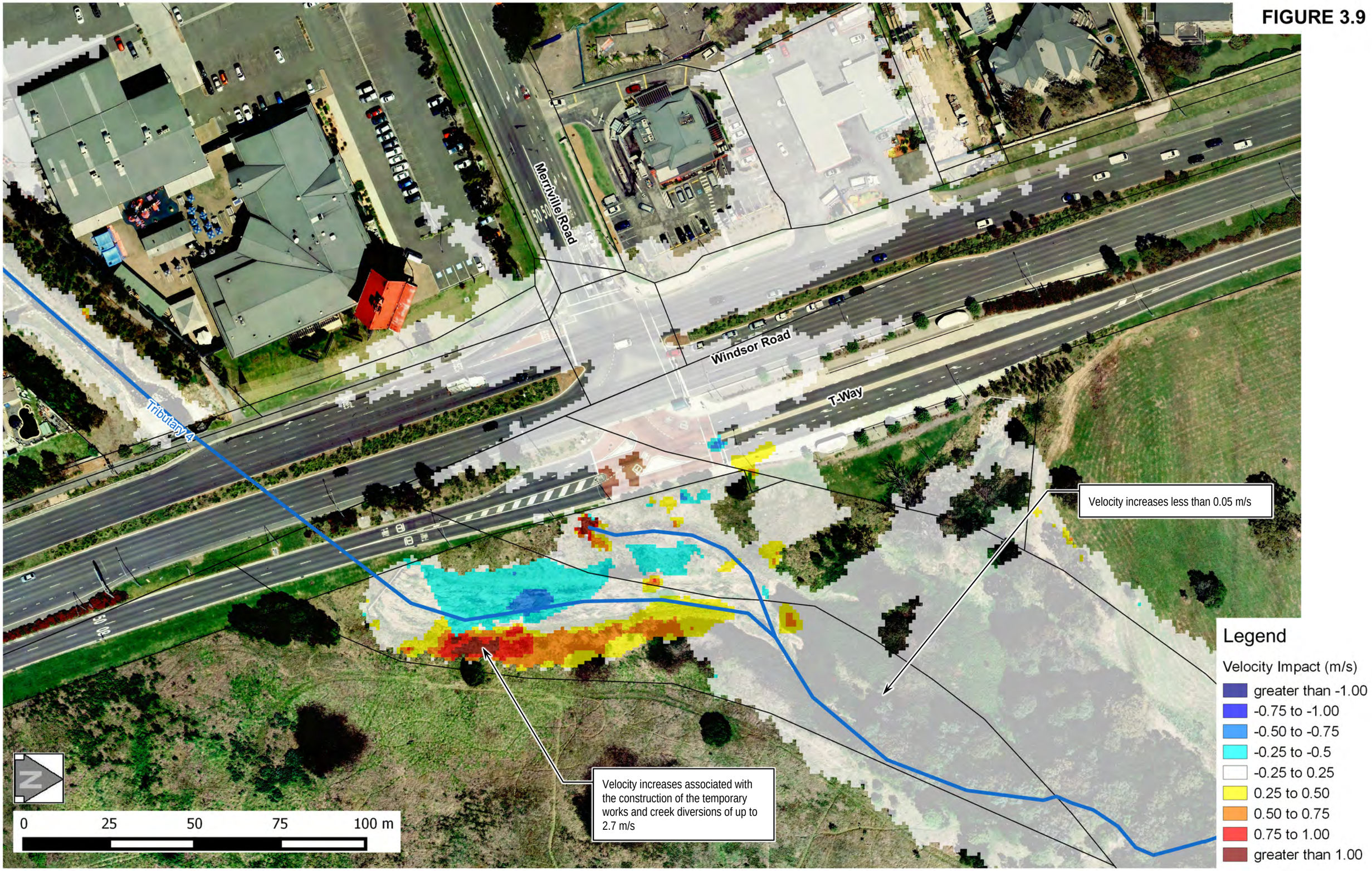
IMPACT ON PEAK FLOOD LEVELS (100 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT AT TRIBUTARY 4

FIGURE 3.9



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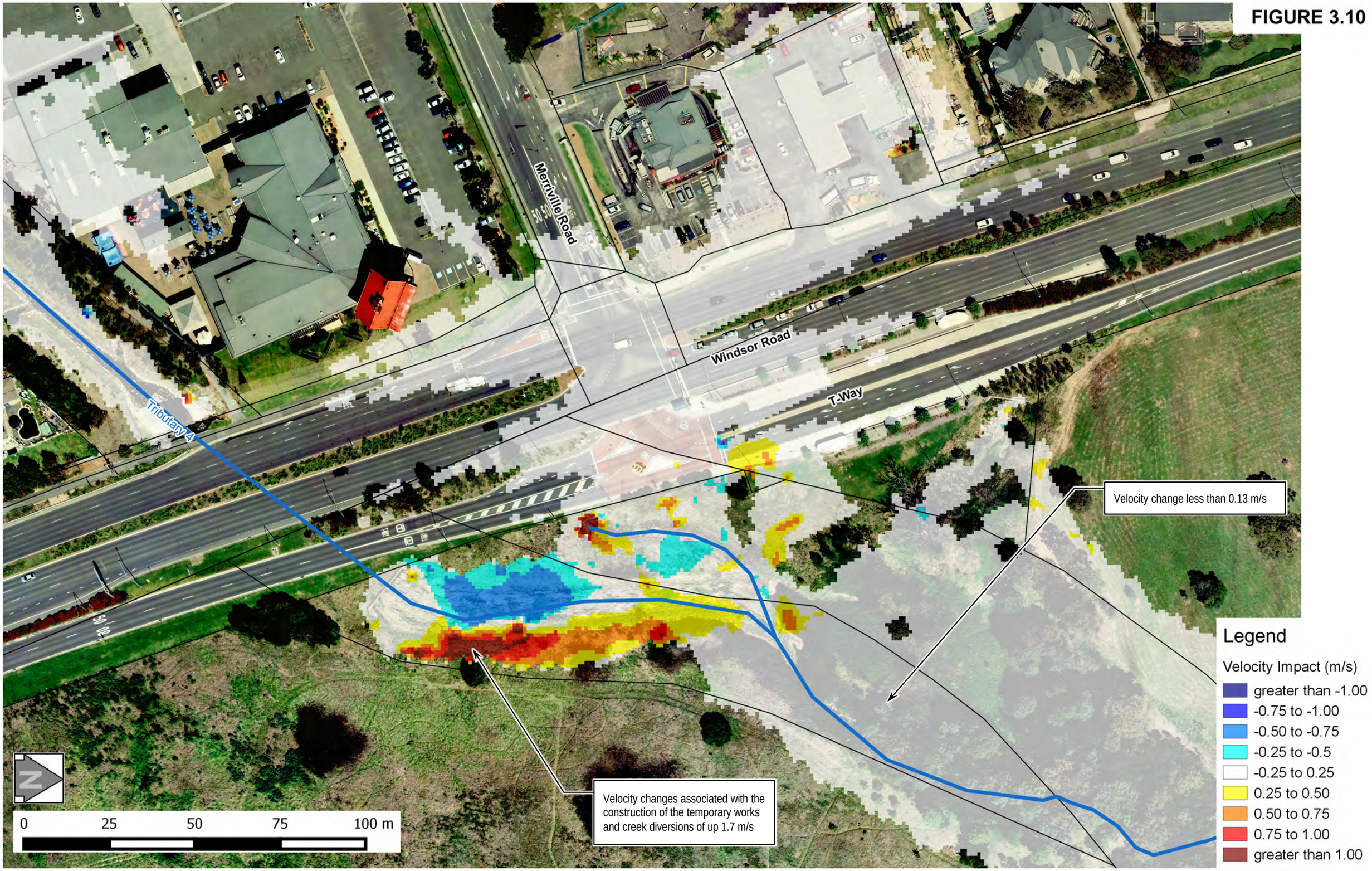
IMPACT ON PEAK FLOW VELOCITIES (20 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT AT TRIBUTARY 4

FIGURE 3.10



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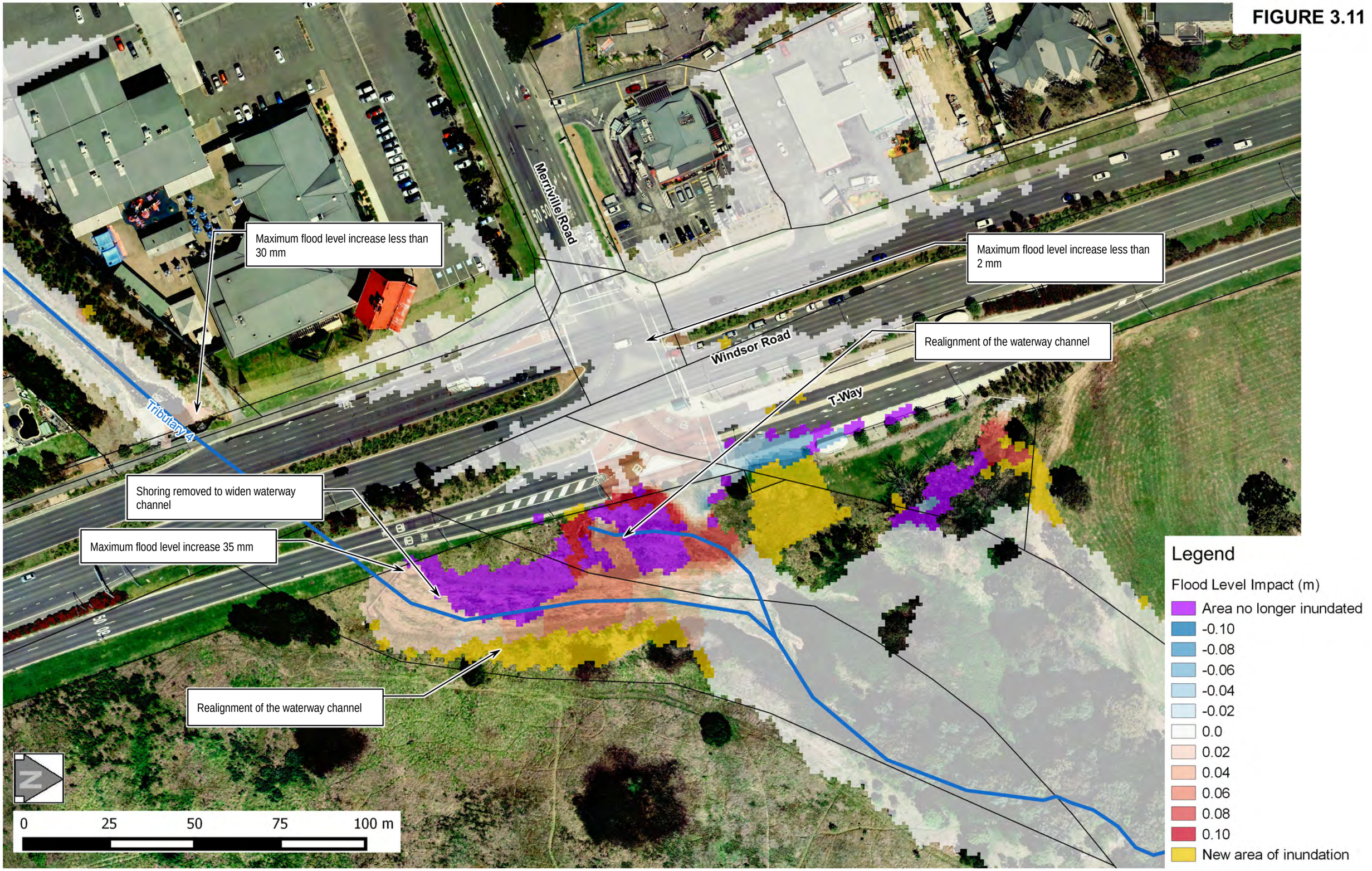
IMPACT ON PEAK FLOW VELOCITIES (100 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT AT TRIBUTARY 4

FIGURE 3.11



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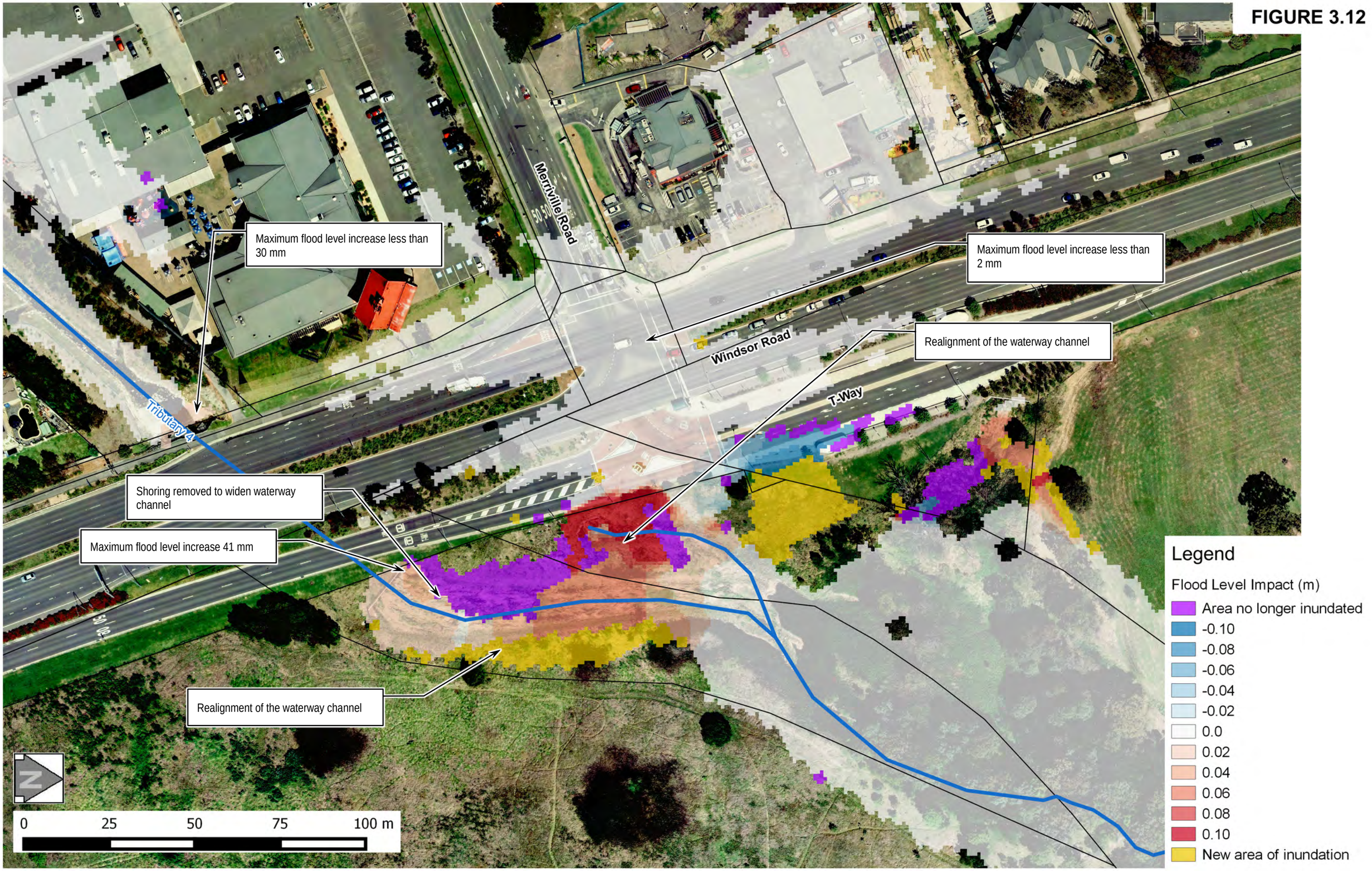
IMPACT ON PEAK FLOOD LEVELS (20 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT AT TRIBUTARY 4 WITH THE TRIBUTARY 4 CHANNEL RESTORED

FIGURE 3.12



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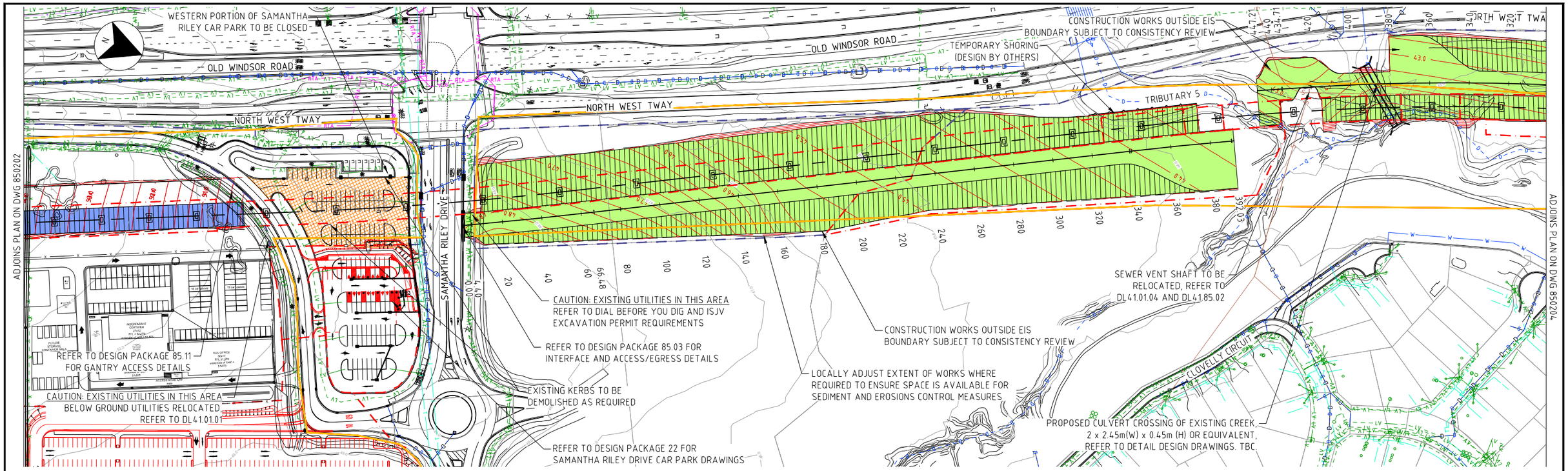
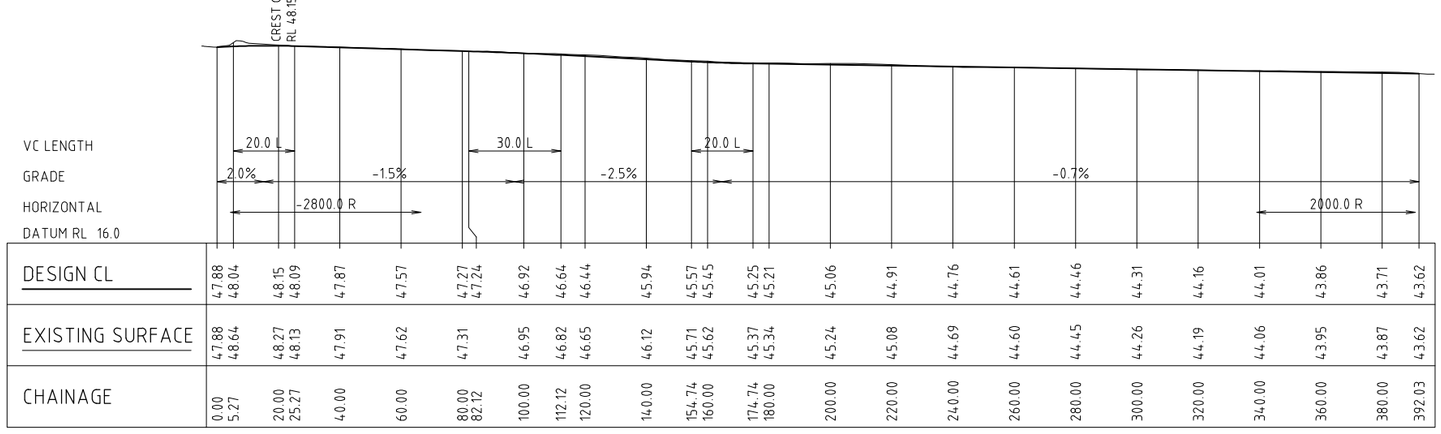
IMPACT ON PEAK FLOOD LEVELS (100 YEAR ARI) FOR THE PROPOSED WORKS ARRANGEMENT AT TRIBUTARY 4 WITH THE TRIBUTARY 4 CHANNEL RESTORED

ATTACHMENT A – PROPOSED HAUL ROAD DESIGN DRAWINGS (NWRLSVC-IWP-SVC-DN-DWG-850203 [D] & NWRLSVC-IWP-SVC-DN-DWG-850204 [D])



HAUL ROAD ALIGNMENT PLAN
1:1000



CHAINAGE	DESIGN CL	EXISTING SURFACE
0.00	47.88	47.88
5.27	48.04	48.64
20.00	48.15	48.27
25.27	48.09	48.13
40.00	47.87	47.91
60.00	47.57	47.62
80.00	47.27	47.31
82.12	47.24	
100.00	46.92	46.95
112.12	46.64	46.82
120.00	46.44	46.65
140.00	45.94	46.12
154.74	45.57	45.71
160.00	45.45	45.62
174.74	45.25	45.37
180.00	45.21	45.34
200.00	45.06	45.24
220.00	44.91	45.08
240.00	44.76	44.69
260.00	44.61	44.60
280.00	44.46	44.45
300.00	44.31	44.26
320.00	44.16	44.19
340.00	44.01	44.06
360.00	43.86	43.95
380.00	43.71	43.87
392.03	43.62	43.62

HAUL ROAD LONGITUDINAL SECTION
SCALE HORIZONTAL 1:1000
SCALE VERTICAL 1:500

KEY PLAN
NTS

PAVEMENT LEGEND
- PAVEMENT TYPE 1 - 300mm THK
- PAVEMENT TYPE 2 - 380mm THK
- PAVEMENT TYPE 3 - 410mm THK
- PAVEMENT TYPE 4 - 430mm THK
- PAVEMENT TYPE 5 - 450mm THK
- STORAGE AREA FOR PRECAST UNITS
- EXISTING PAVEMENT

NOTES
1. WORKS SHOWN ON THIS PLAN ARE WITHIN THE HILLS SHIRE COUNCIL LOCAL GOVERNMENT AREA
2. ENVIRONMENTAL CONTROLS MAPPING ZONES:
   ECM3A AND ECM3B (SOUTH OF SAMANTHA RILEY DRIVE)
   ECM4 (NORTH OF SAMANTHA RILEY DRIVE)
3. EROSION AND SEDIMENT CONTROL PLANS:
   ESCP 3A-1, ESCP 3B-1, ESCP 3B-2 AND ESCP 3B-3 (SOUTH OF SAMANTHA RILEY DRIVE)
   ESCP 4A-1 (NORTH OF SAMANTHA RILEY DRIVE)

APPROXIMATE MATERIAL VOLUMES (SAMANTHA RILEY DRIVE TO TRIBUTARY 5)
1. STRIPPING
   STRIPPING AREA = 17,998m^2
   STRIPPING DEPTH = 500mm
   STRIPING VOLUME = 8,999m^3
2. BULK EARTHWORKS
   CUT = -665m^3
   FILL = 3,033m^3
   EXCESS FILL = 2,368m^3
3. PAVEMENTS BASED ON DESA OF 1.3E+05 WITH EXISTING CBR OF 8%
   DM20 SFS ROADBASE = 5,248m^3
   PAVEMENT THICKNESS = 300mm

NOTES:
1. FOR QUANTITY CALCULATIONS TOPSOIL STRIPPING DEPTH HAS BEEN ALLOWED FOR BASED ON ADVICE FROM ISJV
2. BULK EARTHWORKS VOLUMES EXCLUDE STRIPPING AND PAVEMENTS

STAGE 2 SUBMISSION

REV.	BY	DATE	DESCRIPTION	APPD.
D	PBC	19.12.14	STAGE 2 SUBMISSION (FINAL DESIGN DOCUMENTATION)	DG
C	PBC	13.11.14	ISSUED FOR FINAL DESIGN DOCUMENTATION	
B	PBC	17.10.14	RE-ISSUED FOR ISJV REVIEW AND COMMENT	
A	PBC	15.08.14	ISSUED FOR ISJV REVIEW AND COMMENT	

SCALES
10 0 10 20 30 40m
1 : 1000 FULL SIZE A1

INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink; salini impregilo ISJV – SVC Works; WorleyParsons resources & energy

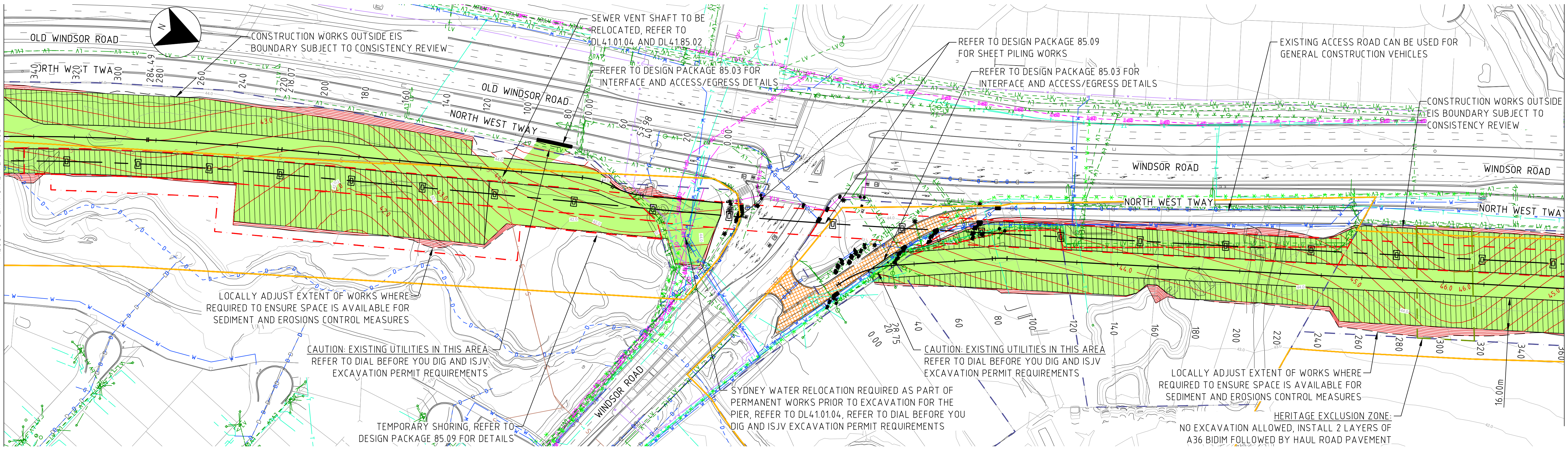
DRAWN PHILLIP CORNISH
DESIGNED PHILLIP CORNISH
DRG CHECK VAUGHAN PATRICK
DESIGN CHECK ANDREW GILHAM
APPROVED DAVID GRIFFITHS

NORTH WEST RAIL LINK
KELLYVILLE CONSTRUCTION AREA 2
HAUL ROAD
PLAN AND LONG SECTION

STATUS: FINAL DESIGN DOCUMENTATION | SHEET 3 OF 9 | ©

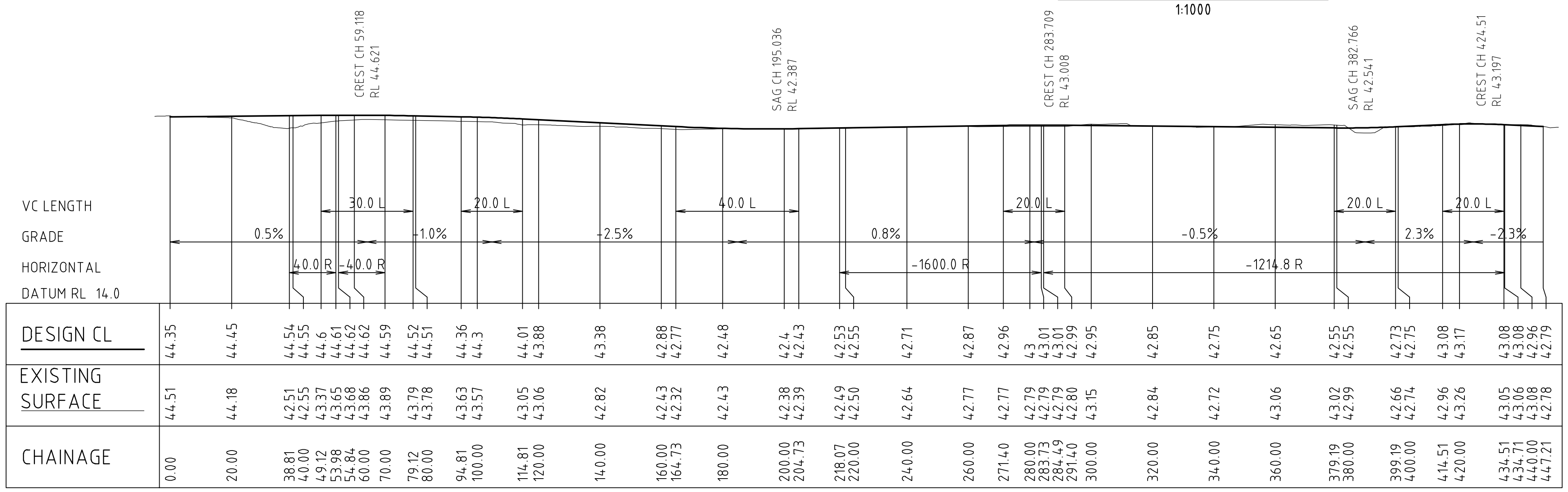
NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-850203 | NWRL REV. D

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.



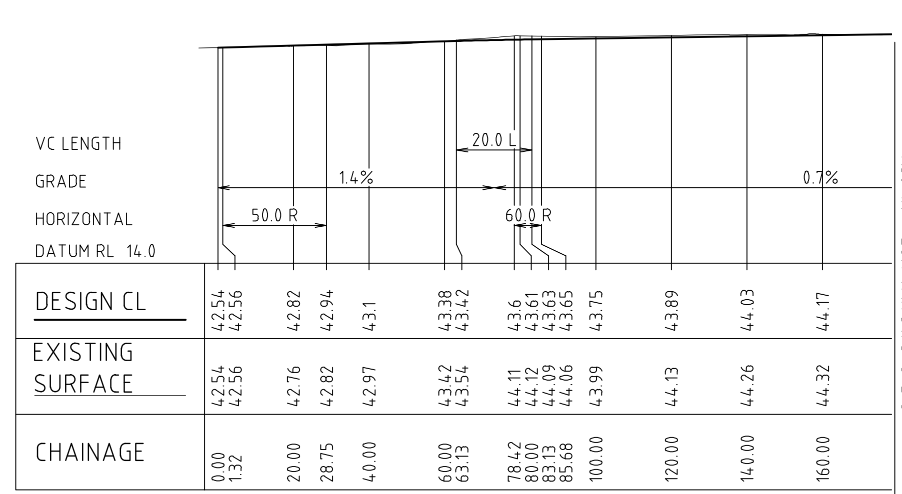
HAUL ROAD ALIGNMENT PLAN

1:1000



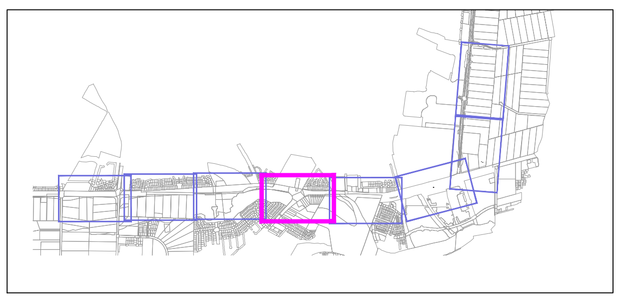
HAUL ROAD LONGITUDINAL SECTION

SCALE HORIZONTAL 1:1000
SCALE VERTICAL 1:500



HAUL ROAD LONGITUDINAL SECTION

SCALE HORIZONTAL 1:1000
SCALE VERTICAL 1:500



KEY PLAN

NTS

PAVEMENT LEGEND

- PAVEMENT TYPE 1 - 300mm THK
- PAVEMENT TYPE 2 - 380mm THK
- PAVEMENT TYPE 3 - 410mm THK
- PAVEMENT TYPE 4 - 430mm THK
- PAVEMENT TYPE 5 - 450mm THK
- STORAGE AREA FOR PRECAST UNITS
- EXISTING PAVEMENT

NOTES

1. WORKS SHOWN ON THIS PLAN ARE WITHIN THE HILLS SHIRE COUNCIL LOCAL GOVERNMENT AREA
2. ENVIRONMENTAL CONTROLS MAPPING ZONES:
   ECM4 (SOUTH OF WINDSOR ROAD)
   ECM5 (NORTH OF WINDSOR ROAD)
3. EROSION AND SEDIMENT CONTROL PLANS:
   ESCP 4A-1 (SOUTH OF WINDSOR ROAD)
   ESCP 5A-1 (NORTH OF WINDSOR ROAD)

APPROXIMATE MATERIAL VOLUMES (TRIBUTARY 5 TO WINDSOR ROAD)

1. STRIPPING
   STRIPPING AREA = 16,976m^2
   STRIPPING DEPTH = 500mm
   STRIPING VOLUME = 8,488m^3
2. BULK EARTHWORKS
   CUT = -839m^3
   FILL = 7,520m^3
   EXCESS FILL = 6,681m^3
3. PAVEMENTS BASED ON DESA OF 1.3E+05 WITH EXISTING CBR OF 8%
4. DM20 SFS ROADBASE = 4,619m^3
   PAVEMENT THICKNESS = 300mm

NOTES:
1. FOR QUANTITY CALCULATIONS TOPSOIL STRIPPING DEPTH HAS BEEN ALLOWED FOR BASED ON ADVICE FROM ISJV
2. BULK EARTHWORKS VOLUMES EXCLUDE STRIPPING AND PAVEMENTS

STAGE 2 SUBMISSION

REV.	BY	DATE	DESCRIPTION	APPD.
D	PBC	19.12.14	STAGE 2 SUBMISSION (FINAL DESIGN DOCUMENTATION)	DG
C	PBC	13.11.14	ISSUED FOR FINAL DESIGN DOCUMENTATION	
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A	PBC	15.08.14	ISSUED FOR ISJV REVIEW AND COMMENT	

SCALES: 1:1000 FULL SIZE A1

INFORMATION ONLY NOT TO BE USED FOR CONSTRUCTION

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink, salini impregilo, ISJV - SVC Works, WorleyParsons resources & energy

DRAWN: PHILLIP CORNISH
DESIGNED: PHILLIP CORNISH
DRG CHECK: VAUGHAN PATRICK
DESIGN CHECK: ANDREW GILHAM
APPROVED: DAVID GRIFFITHS

NORTH WEST RAIL LINK

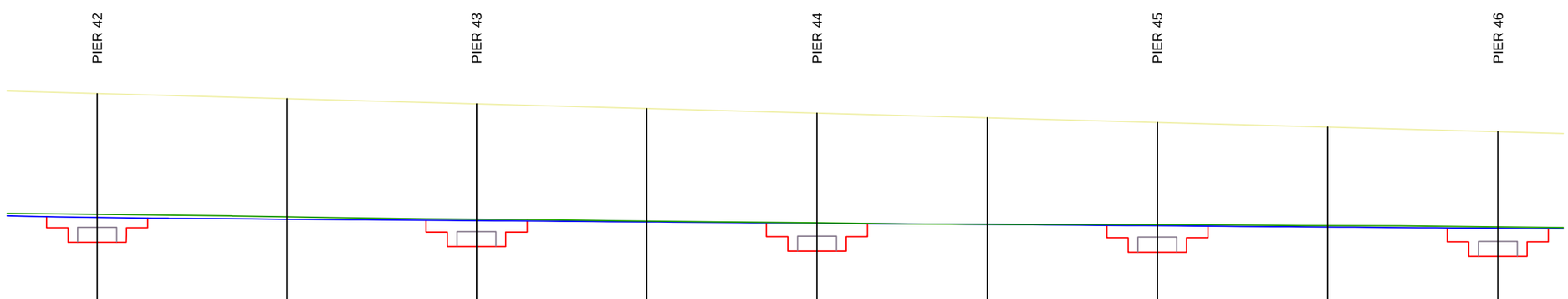
BEAUMONT HILLS CONSTRUCTION AREA
HAUL ROAD
PLAN AND LONG SECTION

STATUS: FINAL DESIGN DOCUMENTATION | SHEET 4 OF 9 | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-850204 | NWRL REV. D

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

ATTACHMENT B – PILE CAP EXCAVATION CROSS-SECTIONS



Datum 36

Track Formation Level	57.934	57.403	56.871	56.395	55.918	55.441	54.964	54.487	54.010
EXISTING SURFACE	45.532	45.276	45.036	44.851	44.665	44.501	44.483	44.365	44.242
DESIGN FL	45.209	45.037	44.891	44.759	44.628	44.497	44.366	44.234	44.103
TOP OF PILE CAP	44.212		43.757		43.293		43.189		42.753
DESIGN EXCAVATION	42.662		42.207		41.743		41.639		41.203
Chainages	42826.271	42845.771	42865.271	42882.771	42900.271	42917.771	42935.270	42952.771	42970.271

REV	ZONE	AMENDMENTS	APP'D	DATE

GENERAL NOTES / REFERENCES

SURVEYED / DRAWN BY

CHECKED

VERIFIED

SCALE 1 :

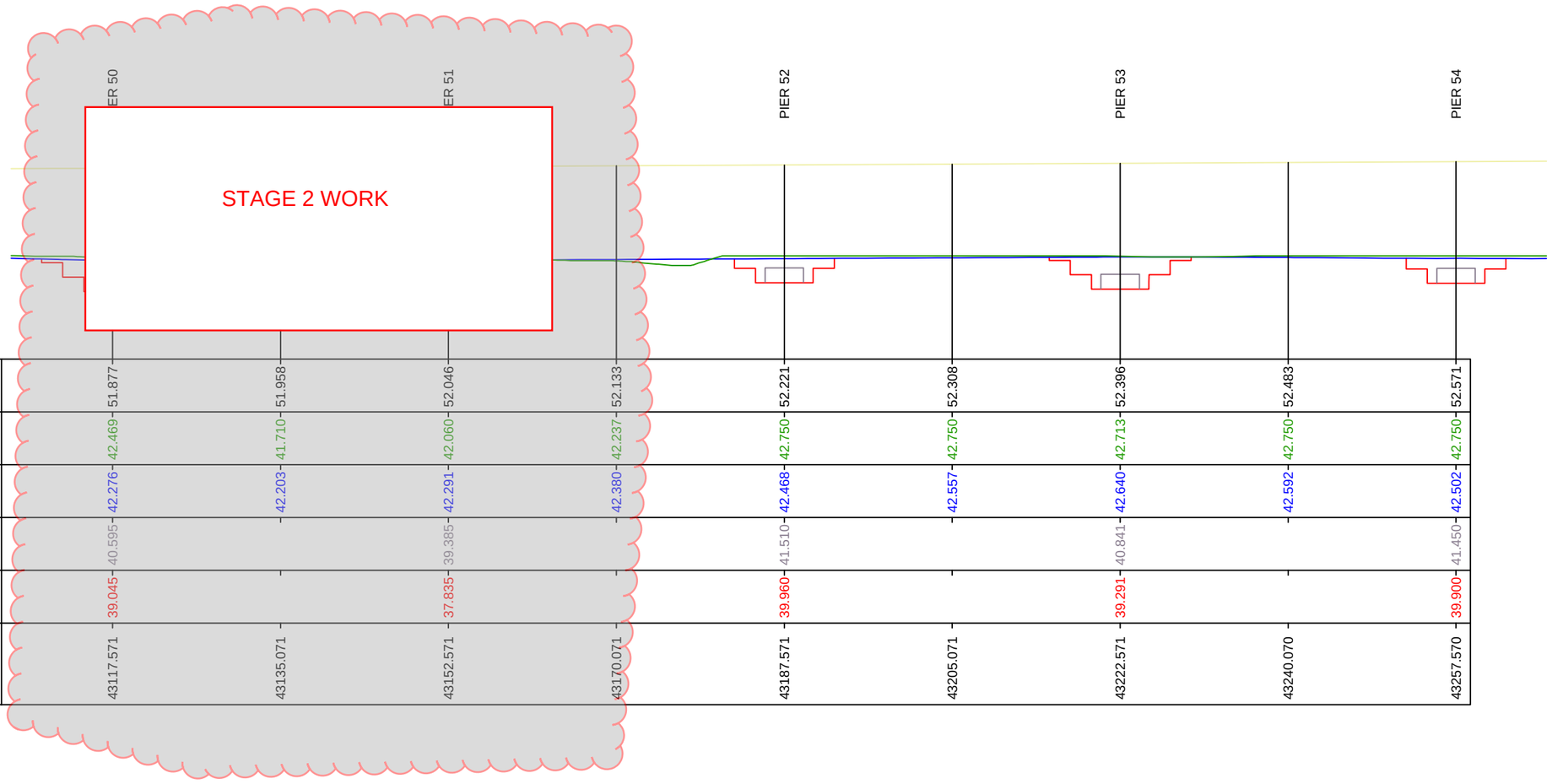
PLOT DATE: Tue May 12 12:33:55 2015 LOCATION :

ISSUED FOR INFORMATION ONLY TO SYDNEY WATER
ZONE 4 - LONGITUDINAL SECTION
PAGE 1

DRAWING STATUS | DRAWING No. | REV.

PRECISION SURVEY GROUP - NWRL SYC A3 19/05/2014

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150



Datum 32

Track Formation Level	51.877	51.958	52.046	52.133	52.221	52.308	52.396	52.483	52.571
EXISTING SURFACE	42.469	41.710	42.060	42.237	42.750	42.750	42.713	42.750	42.750
DESIGN FL	42.276	42.203	42.291	42.380	42.468	42.557	42.640	42.592	42.502
TOP OF PILE CAP	40.595		39.385		41.510		40.841		41.450
DESIGN EXCAVATION	39.045		37.835		39.960		39.291		39.900
Chainages	43117.571	43135.071	43152.571	43170.071	43187.571	43205.071	43222.571	43240.070	43257.570

REV	ZONE	AMENDMENTS	APP'D	DATE

GENERAL NOTES / REFERENCES

SURVEYED / DRAWN BY

CHECKED

VERIFIED

SCALE 1 :

PLOT DATE: Tue May 12 12:33:56 2015 LOCATION :

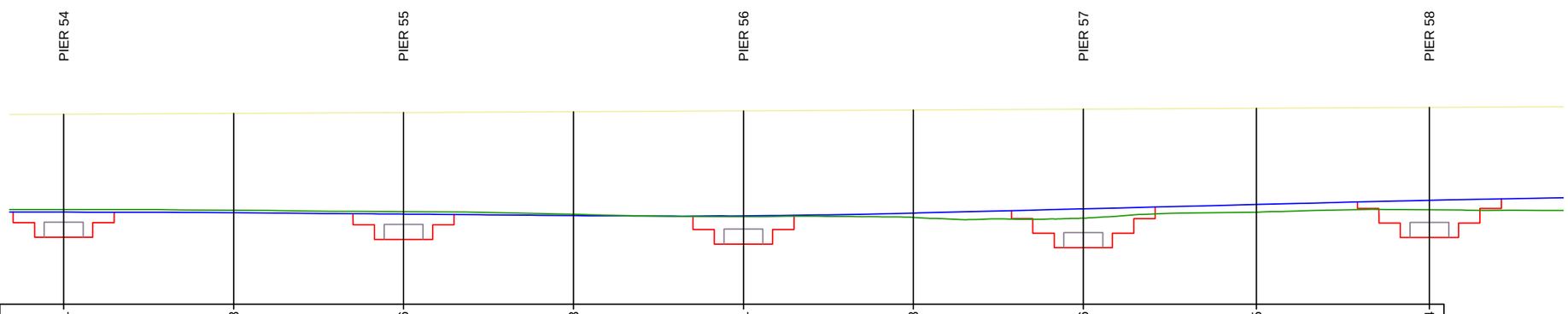
ISSUED FOR INFORMATION ONLY TO SYDNEY WATER
ZONE 4 - LONGITUDINAL SECTION
PAGE 2

DRAWING STATUS

DRAWING No.

REV.

PRECISION SURVEY GROUP - NWRL SVC A3 19/05/2014



Datum 33

Track Formation Level	52.571	52.658	52.746	52.833	52.921	53.008	53.096	53.185	53.274
EXISTING SURFACE	42.750	42.682	42.525	42.272	42.030	41.946	41.871	42.490	42.728
DESIGN FL	42.502	42.429	42.289	42.139	42.110	42.393	42.830	43.275	43.715
TOP OF PILE CAP	41.450		41.230		40.748		40.372		41.421
DESIGN EXCAVATION	39.900		39.680		39.198		38.822		39.871
Chainages	43257.570	43275.071	43292.571	43310.071	43327.572	43345.071	43362.571	43380.390	43398.210

REV	ZONE	AMENDMENTS	APP'D	DATE

GENERAL NOTES / REFERENCES

SURVEYED / DRAWN BY

CHECKED

VERIFIED

SCALE 1 :

PLOT DATE: Tue May 12 12:33:57 2015 LOCATION :

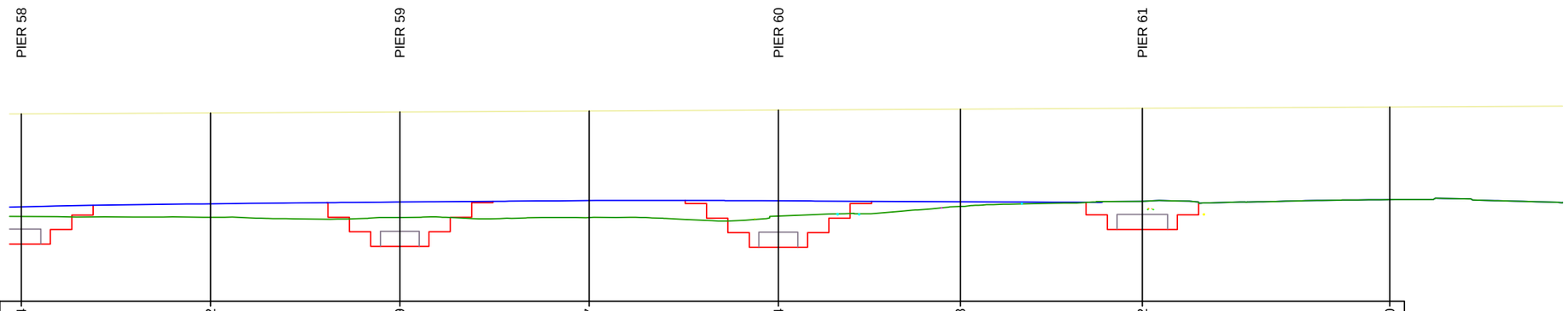
ISSUED FOR INFORMATION ONLY TO SYDNEY WATER
ZONE 4 - LONGITUDINAL SECTION
PAGE 3

DRAWING STATUS

DRAWING No.

REV.

PRECISION SURVEY GROUP - NWRL SYC A3 19/05/2014



Datum 34

Track Formation Level	53.274	53.372	53.469	53.567	53.664	53.758	53.852	53.980
EXISTING SURFACE	42.728	42.632	42.619	42.616	42.772	43.745	44.289	44.454
DESIGN FL	43.715	44.024	44.208	44.356	44.333	44.240	44.289	44.454
TOP OF PILE CAP	41.421		41.193		41.107		42.942	
DESIGN EXCAVATION	39.871		39.643		39.557		41.392	
Chainages	43398.210	43417.710	43437.210	43456.710	43476.210	43494.961	43513.711	43539.211

REV	ZONE	AMENDMENTS	APP'D	DATE

GENERAL NOTES / REFERENCES

SURVEYED / DRAWN BY

CHECKED

VERIFIED

SCALE 1 :

PLOT DATE: Tue May 12 12:33:57 2015 LOCATION :

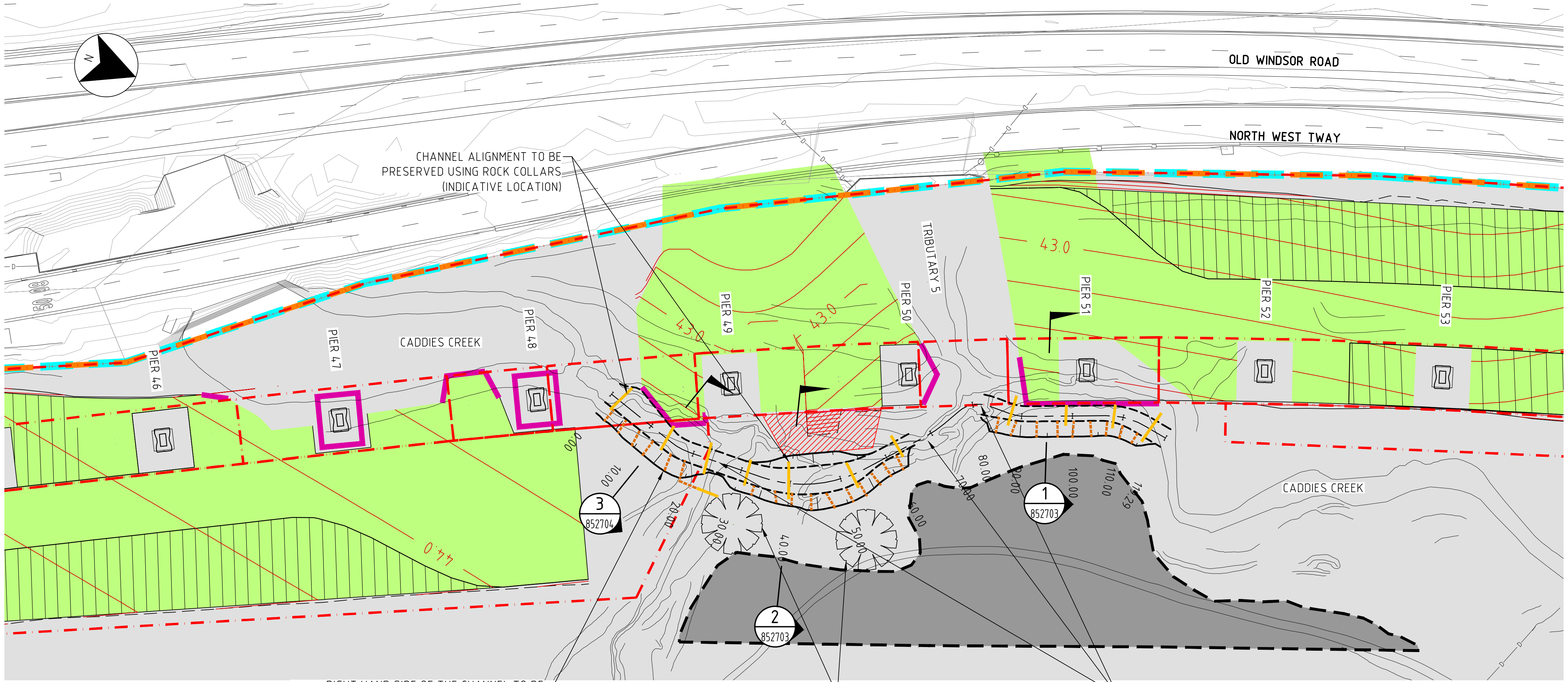
ISSUED FOR INFORMATION ONLY TO SYDNEY WATER
ZONE 4 - LONGITUDINAL SECTION
PAGE 4

DRAWING STATUS | DRAWING No. | REV.

PRECISION SURVEY GROUP - NWRL SVC A3 19/05/2014

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

ATTACHMENT C – TEMPORARY CREEK DIVERSION DESIGN PLANS (NWRLSVC-IWP-SCV-DN-DWG-852701 [01] TO NWRLSVC-IWP-SCV-DN-DWG-852707 [01])



LEGEND

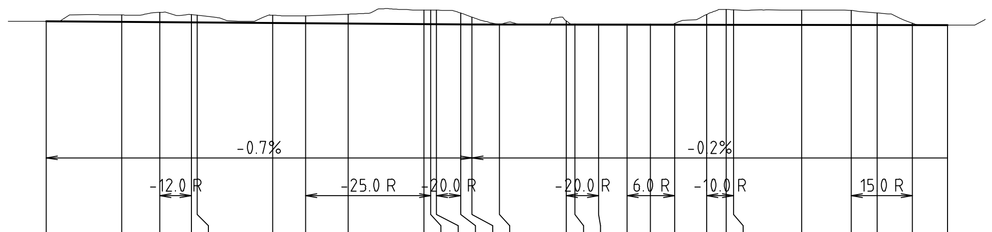
- CREEK CENTRELINE AND CHAINAGES
- BOTTOM OF BANK (BASE)
- TOP OF BANK
- SYDNEY WATER PROPERTY BOUNDARIES
- HERITAGE AREA
- HAUL ROAD & LAYDOWN AREA AS PER ISJV FIGURES "MOD04-LAYOUT 5 & MOD02-LAYOUT 5"
- PROJECT BOUNDARIES
- VERTICAL SHORING (BY OTHERS)
- HAUL ROAD OFFSET
- EXISTING SURFACE CONTOURS (0.25m INTERVAL)
- HAUL ROAD SURFACE CONTOURS (0.25m INTERVAL)
- ROCK COLLARS
- LOGS/GROYNES
- EXISTING TREES

PLAN

SCALE 1:500

SYDNEY WATER ROCK SPECIFICATION

- 70% BETWEEN 200kg & 500kg WITH A REGULAR SHAPE 0.75m TO 1.2m (L) x 0.5m (W) x 0.25 TO 0.45m (H)
- 15% BETWEEN 4kg & 33kg
- 15% LESS THAN 4kg

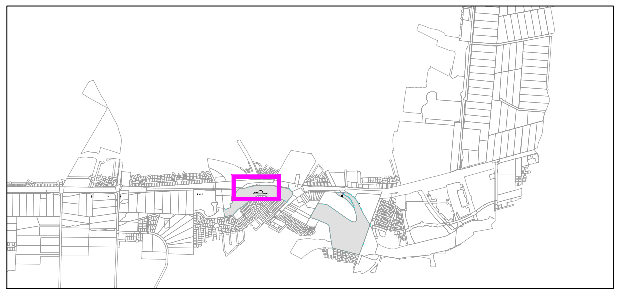


VC LENGTH
GRADE: -0.7% ; -0.2%
HORIZONTAL: -12.0 R ; -25.0 R ; -20.0 R ; -20.0 R ; 6.0 R ; -10.0 R ; 15.0 R
DATUM RL 13.0

CHAINAGE	DESIGN CL	EXISTING SURFACE
0.00	41.09	41.09
10.00	41.02	41.92
15.05	40.99	42.29
19.22	40.96	41.98
20.00	40.95	41.90
30.00	40.88	41.90
34.35	40.85	41.81
40.00	40.8	42.01
50.00	40.73	42.56
50.90	40.73	42.56
51.66	40.72	42.55
54.86	40.7	42.19
56.34	40.69	41.65
60.00	40.68	40.69
68.85	40.66	41.15
70.00	40.66	40.69
73.14	40.66	40.69
76.88	40.65	40.69
80.00	40.64	40.71
83.21	40.64	40.79
87.42	40.63	42.00
90.00	40.63	42.65
90.99	40.63	42.62
100.00	40.61	42.59
106.56	40.6	42.53
110.00	40.59	42.19
114.67	40.58	40.84
119.29	40.58	40.58

CADDIES CREEK LONGITUDINAL SECTION

SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:500



KEY PLAN

NTS

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
C	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
B	PBC	13.08.15	DRAFT ISSUE TO SYDNEY WATER	
A	PBC	11.08.15	DRAFT ISSUE FOR REVIEW AND COMMENT	

SCALES: 5 0 5 10 15m — 1:500 FULL SIZE A1

CLIENT: NSW GOVERNMENT Transport for NSW

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SERVICE PROVIDERS: northwestrraillink, salini impregilo, WorleyParsons resources & energy

DRAWN: ENOSH NEWAR
DESIGNED: JOSH ATKINSON
DRG CHECK: ANDREW GILHAM
DESIGN CHECK: WARICK HONOUR
APPROVED: ANDREW GILHAM

NORTH WEST RAIL LINK

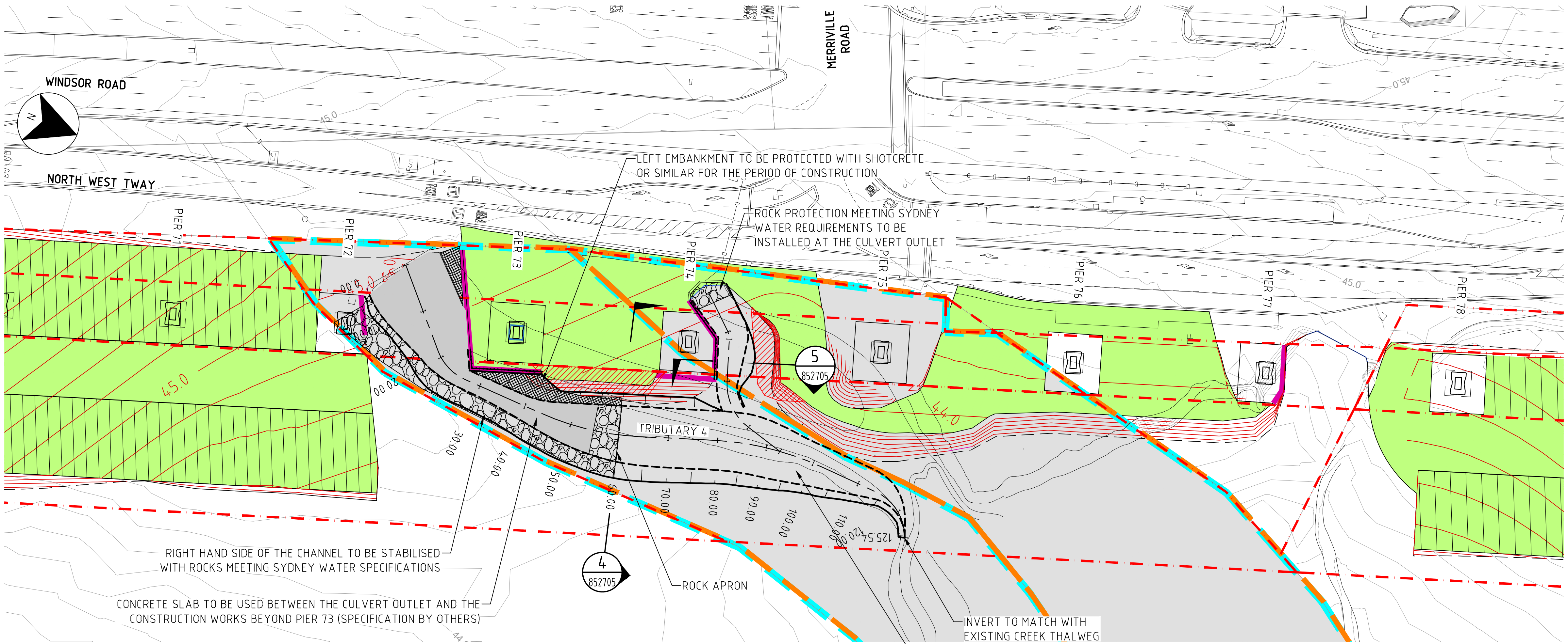
KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
CADDIES CREEK PLAN AND LONG SECTION
(CONFLUENCES WITH TRIBUTARY 5 & ELIZABETH MACARTHUR CREEK)

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852701 | NWRL REV. 01

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

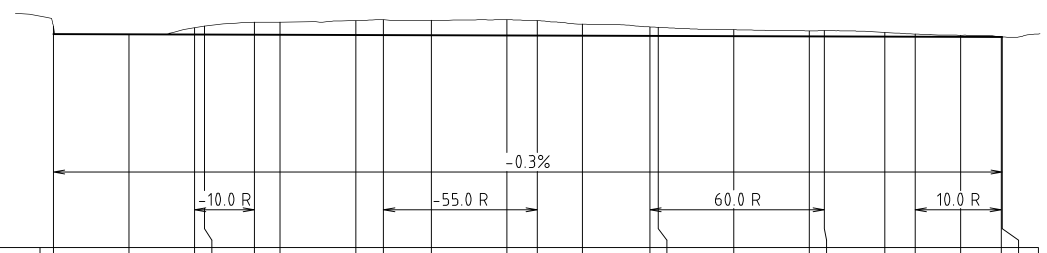
Cad File: W:_Infrastructure\Projects\301015\03552 - NWRL Haul Road\12.0 Drawings\Drgs\CIVIL\NWRLSVC-IWP-SCV-DN-DWG-852701_01.dwg Plot Date: 02/10/15 - 11:45 100mm AT FULL SIZE



LEGEND

- CREEK CENTRELINE AND CHAINAGES (90.00, 100.00)
- BOTTOM OF BANK (BASE)
- TOP OF BANK
- SYDNEY WATER PROPERTY BOUNDARIES
- HERITAGE AREA
- HAUL ROAD & LAYDOWN AREA AS PER ISJV FIGURES "MOD04-LAYOUT 5 & MOD02-LAYOUT 5"
- PROJECT BOUNDARIES
- VERTICAL SHORING (BY OTHERS)
- HAUL ROAD OFFSET
- EXISTING SURFACE CONTOURS (0.25m INTERVAL) (54.0)
- HAUL ROAD SURFACE CONTOURS (0.25m INTERVAL) (49.0)
- SHOTCRETE
- ROCK
- CONCRETE

PLAN
SCALE 1:500



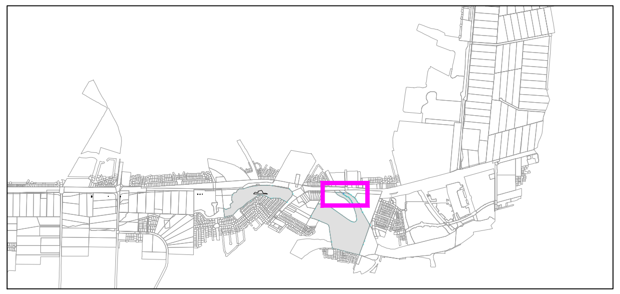
GRADE: -0.3%

HORIZONTAL: -10.0 R, -55.0 R, 60.0 R, 10.0 R

DATUM RL 14.0

DESIGN CL	43.27	42.21	42.18	42.18	42.16	42.15	42.12	42.11	42.09	42.06	42.04	42.03	42	42	41.97	41.94	41.93	41.9	41.89	41.87	41.86	41.86
EXISTING SURFACE	43.27	42.24	43.09	43.30	43.79	43.81	44.03	44.15	44.05	44.15	44.05	43.56	43.19	43.15	42.82	42.69	42.70	42.46	42.25	42.10	41.87	41.86
CHAINAGE	0.00	10.00	18.69	20.00	26.61	30.00	40.00	43.66	50.00	60.00	64.02	70.00	78.91	80.00	90.00	100.00	102.00	110.00	113.99	120.00	125.41	125.54

TRIBUTARY 4 LONGITUDINAL SECTION
SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:500



KEY PLAN
NTS

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
C	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
B	PBC	13.08.15	DRAFT ISSUE TO SYDNEY WATER	
A	PBC	11.08.15	DRAFT ISSUE FOR REVIEW AND COMMENT	

SCALES: 5 0 5 10 15m — 1 : 500 FULL SIZE A1

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink, salini impregilo, WorleyParsons resources & energy

DRAWN ENOSH NEWAR
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK
KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
TRIBUTARY 4 PLAN AND LONG SECTION

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852702 | NWRL REV. 01

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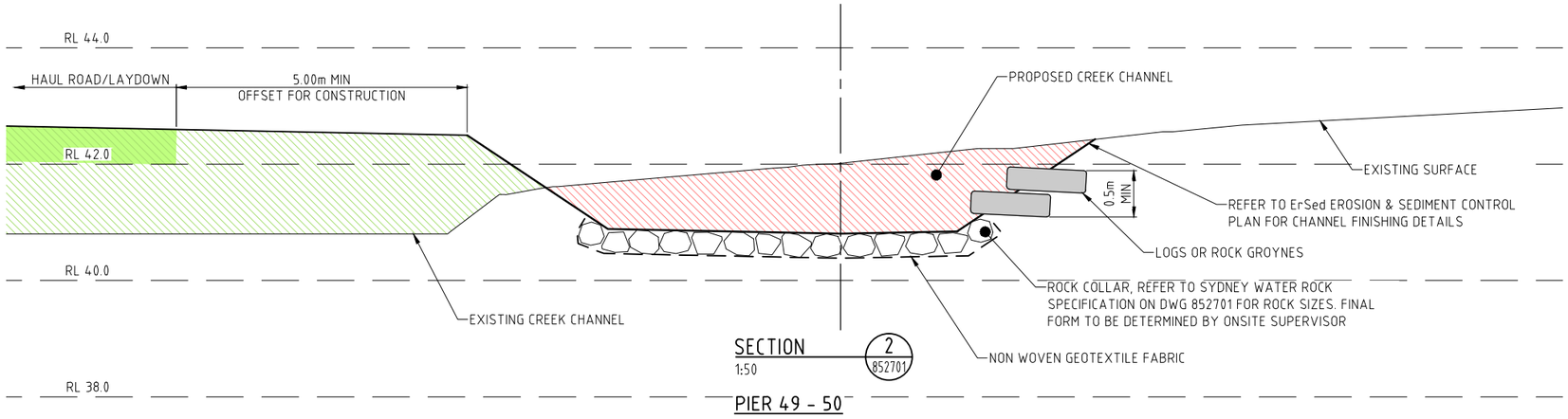

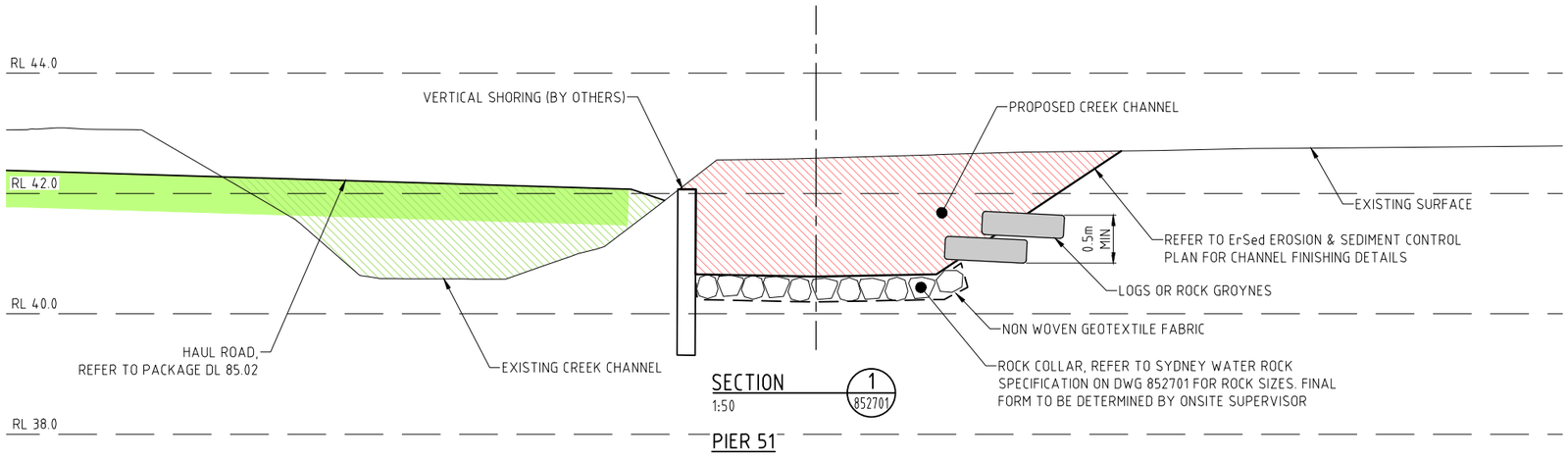

LEGEND

- FILL
- CUT

NOTE

1. OVERBANK AND CHANNEL AREAS NOT PROTECTED BY ROCK ARMOUR ARE TO BE REVEGETATED IN ACCORDANCE WITH THE REHABILITATION PLAN

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
C	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
B	PBC	13.08.15	DRAFT ISSUE FOR SYDNEY WATER REVIEW	
A	PBC	11.08.15	ISSUED FOR ISJV REVIEW AND COMMENT	

SCALES: 0.5 0 0.5 1 1.5m — 1 : 50 FULL SIZE A1

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink; salini impregilo; WorleyParsons resources & energy

DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
TYPICAL SECTIONS
SHEET 1 OF 3

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852703 | NWRL REV. 01

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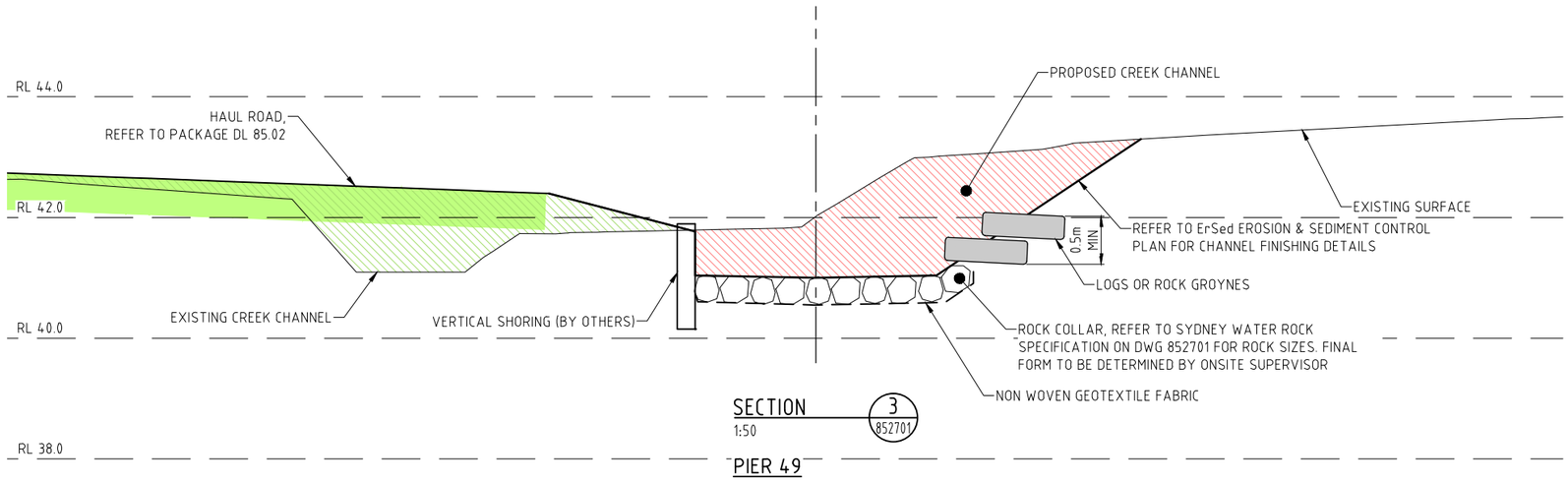


SECTION 3 / 852701
1:50

PIER 49

LEGEND

FILL

CUT

NOTE

1. OVERBANK AND CHANNEL AREAS NOT PROTECTED BY ROCK ARMOUR ARE TO BE REVEGETATED IN ACCORDANCE WITH THE REHABILITATION PLAN

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
C	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
B	PBC	13.08.15	DRAFT ISSUE FOR SYDNEY WATER REVIEW	
A	PBC	11.08.15	ISSUED FOR ISJV REVIEW AND COMMENT	

SCALES
0.5 0 0.5 1 1.5m
1 : 50 FULL SIZE A1

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink; salini impregilo; WorleyParsons resources & energy

DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

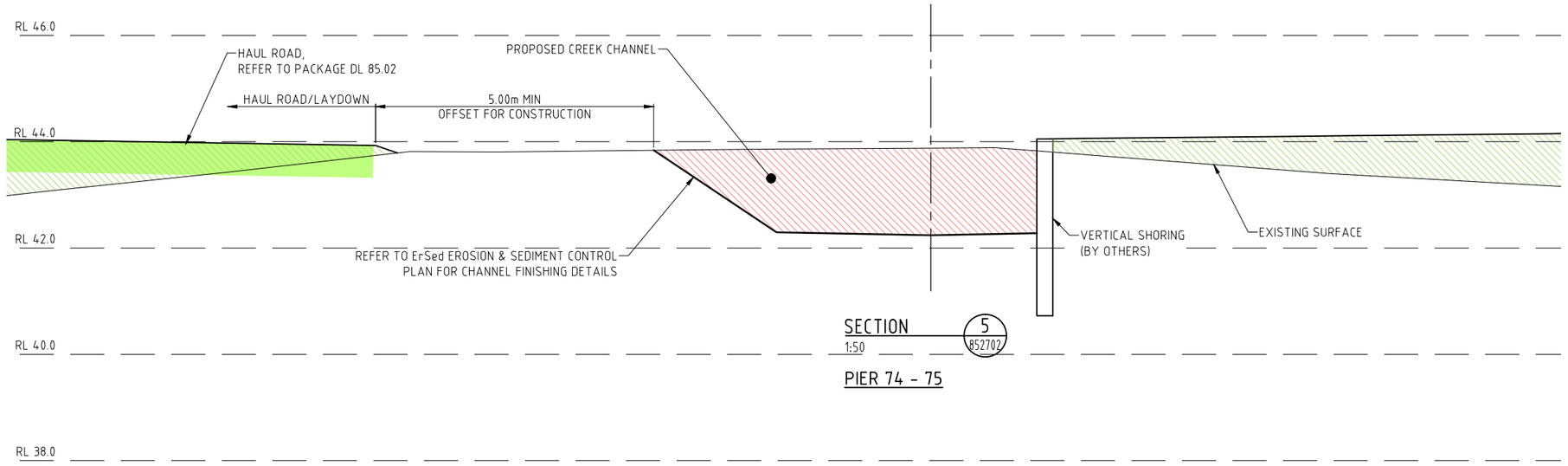
NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
TYPICAL SECTIONS
SHEET 2 OF 3

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

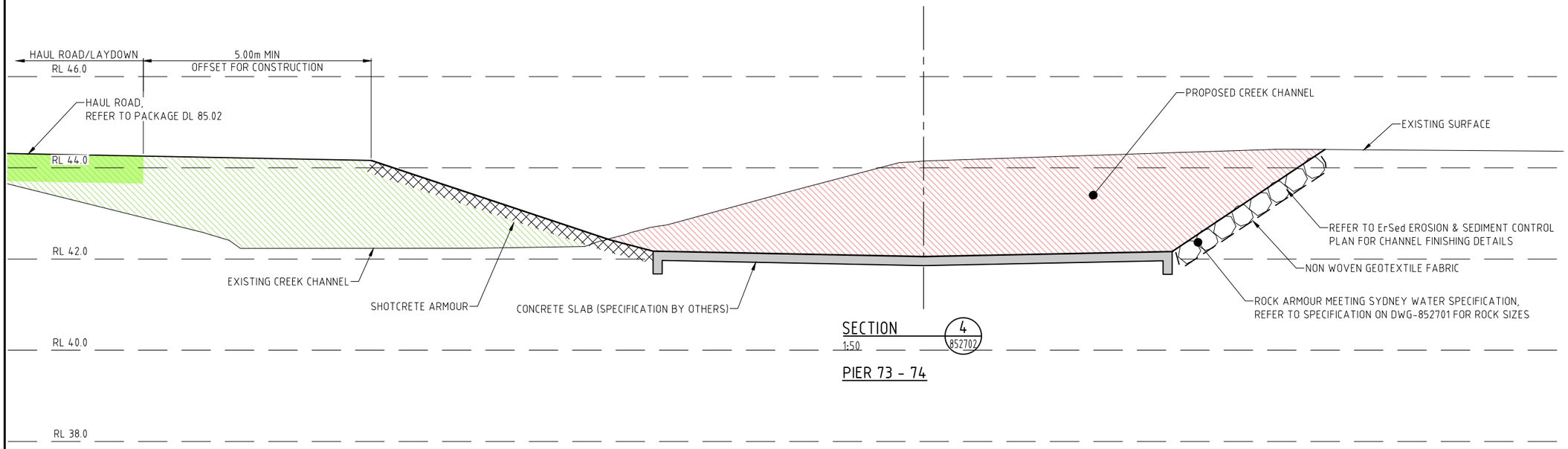
NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852704 | NWRL REV. 01

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.



SECTION 5 / 852702
1:50

PIER 74 - 75



SECTION 4 / 852702
1:50

PIER 73 - 74

LEGEND

FILL

CUT

NOTE

1. OVERBANK AND CHANNEL AREAS NOT PROTECTED BY ROCK ARMOUR ARE TO BE REVEGETATED IN ACCORDANCE WITH THE REHABILITATION PLAN

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
C	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
B	PBC	13.08.15	DRAFT ISSUE FOR SYDNEY WATER REVIEW	
A	PBC	11.08.15	ISSUED FOR ISJV REVIEW AND COMMENT	

SCALES: 0.5 0 0.5 1 1.5m — 1 : 50 FULL SIZE A1

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink; salini impregilo; WorleyParsons resources & energy

DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
TYPICAL SECTIONS
SHEET 3 OF 3

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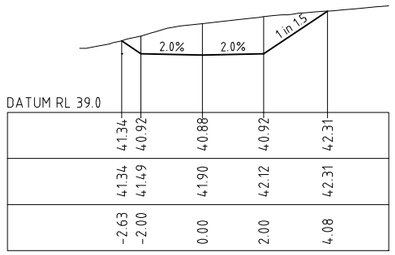
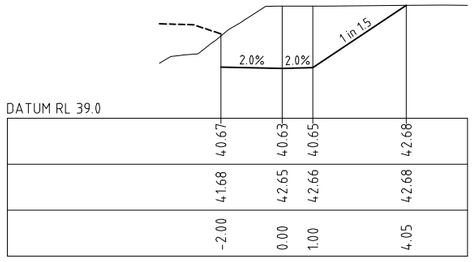
NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852705 | NWRL REV. 01



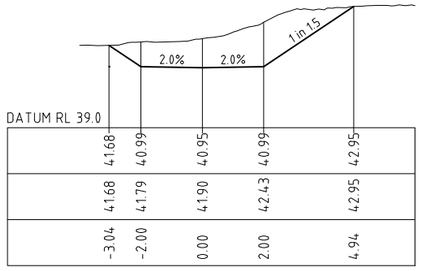
	4.134	4.092	4.088	4.092	4.231
	4.134	4.149	4.190	4.212	4.231
	-2.63	-2.00	0.00	2.00	4.08

CH 30



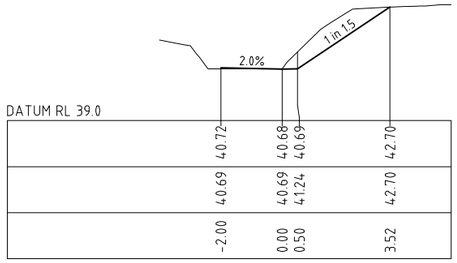
	40.67	40.63	40.65	42.68
	41.68	42.65	42.66	42.68
	-2.00	0.00	1.00	4.05

CH 90



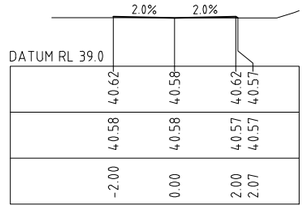
	4.168	4.099	4.095	4.099	4.295
	4.168	4.179	4.190	4.243	4.295
	-3.04	-2.00	0.00	2.00	4.94

CH 20



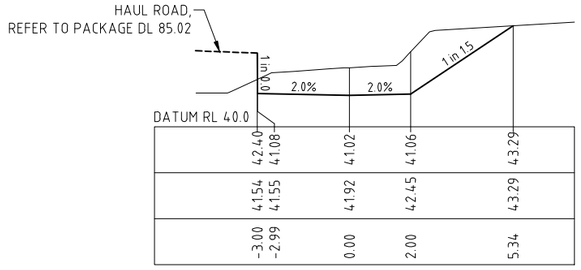
	40.72	40.68	40.69	42.70
	40.69	40.69	41.24	42.70
	-2.00	0.00	0.50	3.52

CH 60



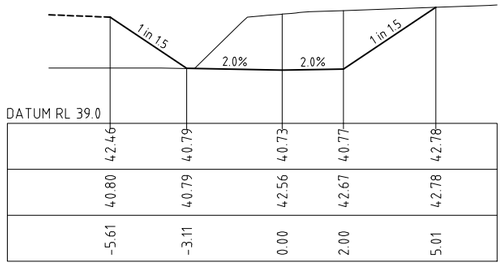
	40.62	40.58	40.62	40.57
	40.58	40.58	40.57	40.57
	-2.00	0.00	2.00	2.07

CH 119.29



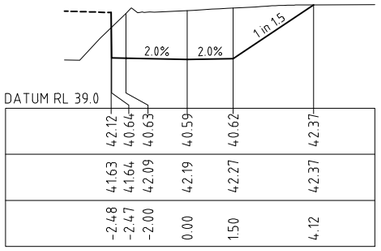
	4.240	4.108	4.102	4.106	4.329
	4.154	4.155	4.192	4.245	4.329
	-3.00	-2.99	0.00	2.00	5.34

CH 10



	42.46	40.79	40.73	40.77	42.78
	40.80	40.79	42.56	42.67	42.78
	-5.61	-3.11	0.00	2.00	5.01

CH 50

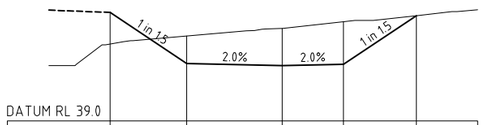


	42.12	40.63	40.59	40.62	42.37
	41.63	41.64	42.19	42.27	42.37
	-2.48	-2.47	0.00	1.50	4.12

CH 110

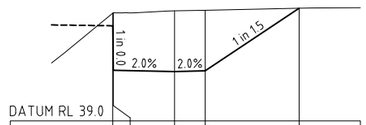
DESIGN	4.115	4.109	4.113	4.299
EXISTING SURFACE	4.124	4.109	4.115	4.299
CL OFFSET	-2.60	0.00	2.00	4.78

CH 0



	42.53	40.87	40.80	40.84	42.43
	41.50	41.77	42.01	42.23	42.43
	-5.61	-3.11	0.00	2.00	4.38

CH 40



	42.10	40.65	40.61	40.63	42.67
	42.51	42.52	42.59	42.61	42.67
	-2.01	-2.00	0.00	1.00	4.07

CH 100

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
B	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
A	PBC	13.08.15	DRAFT ISSUE FOR SYDNEY WATER REVIEW	

SCALES

1 0 1 2 3 4m

1 : 100 FULL SIZE A1

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WorleyParsons resources & energy

DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
CADDIES CREEK AT TRIBUTARY 5 & ELIZABETH MACARTHUR CREEK
DESIGN CROSS SECTIONS

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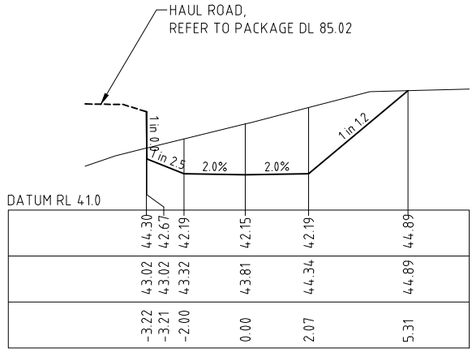
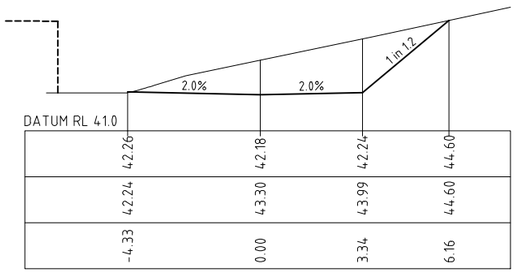
A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.



CH 30



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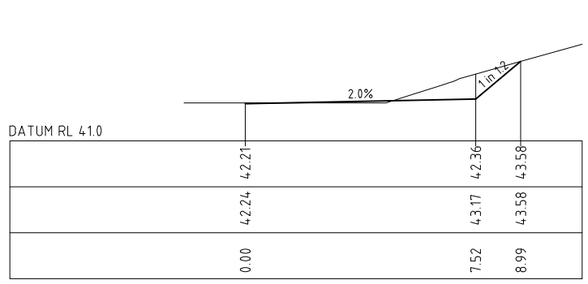

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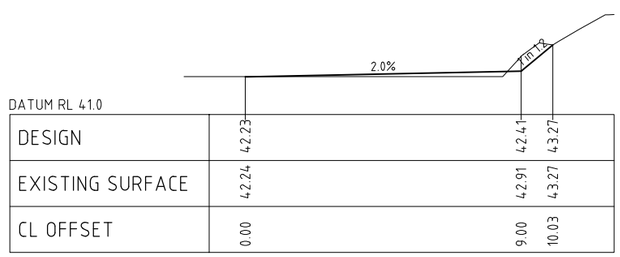
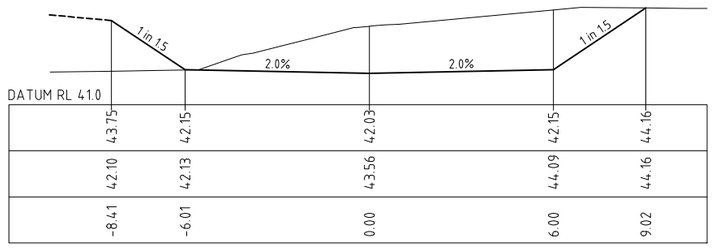


CH 3



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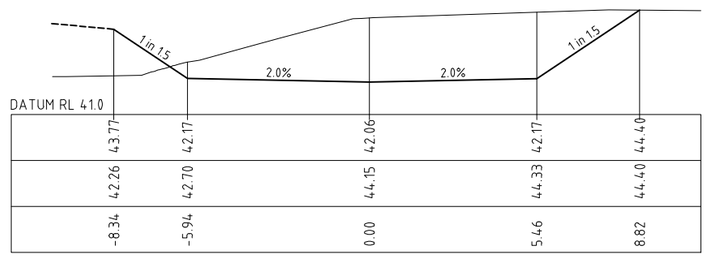

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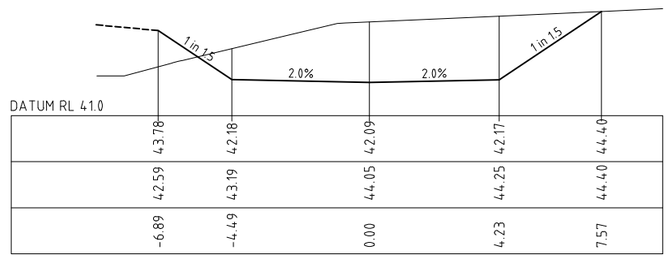

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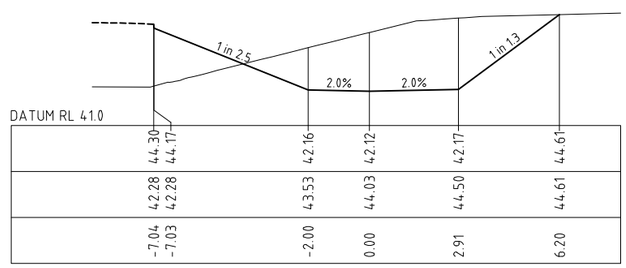

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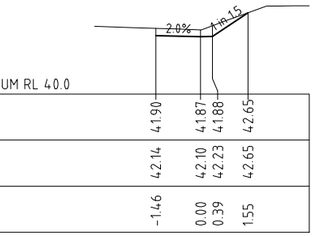

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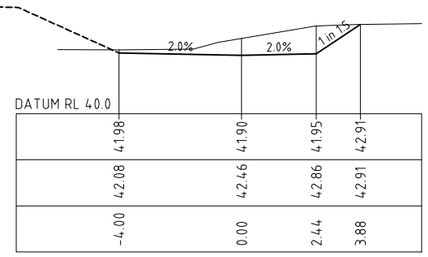

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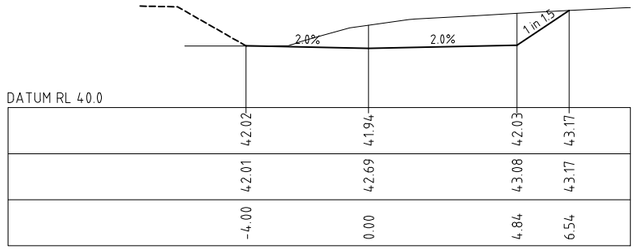

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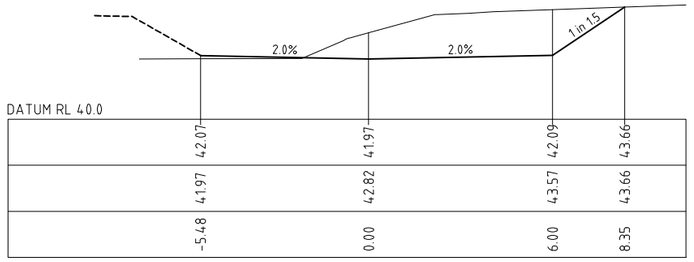

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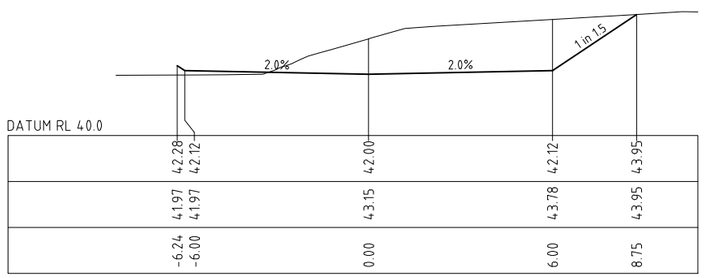

CH 80

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
B	PBC	15.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG
A	PBC	13.08.15	DRAFT ISSUE FOR SYDNEY WATER REVIEW	

SCALES
1 0 1 2 3 4m
1 : 100 FULL SIZE A1

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WorleyParsons resources & energy

DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - TEMPORARY WORKS
TRIBUTARY 4
DESIGN CROSS SECTIONS

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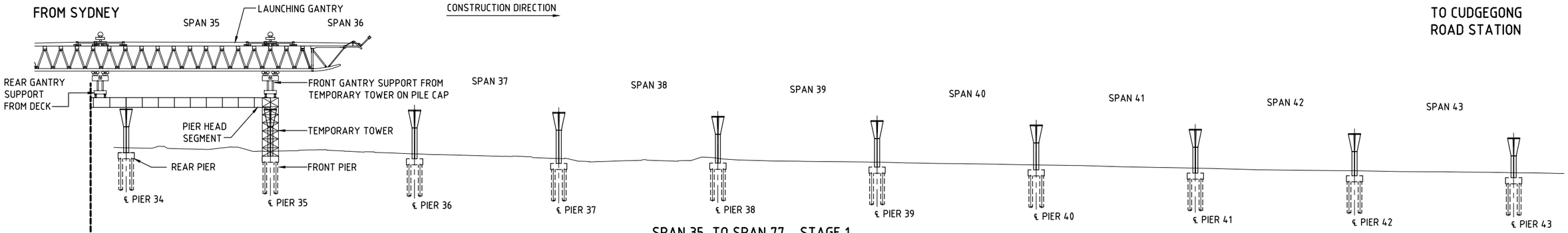
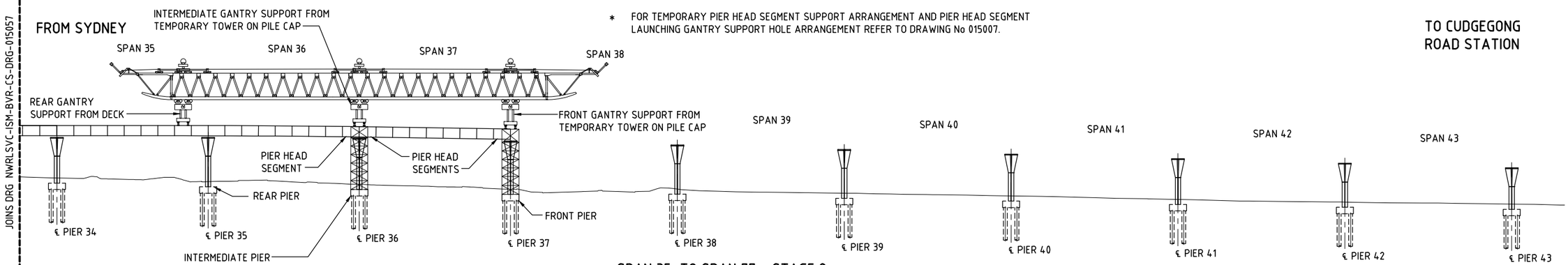
ATTACHMENT D – BELLA VISTA TO ROUSE HILL VIADUCT CONSTRUCTION SEQUENCE (NWRLSVC-ISM-BVR-CS-DRG-015047[01] TO NWRLSVC-ISM-BVR-CS-DRG-015051[01])



SPAN 35 TO SPAN 77 - STAGE 1

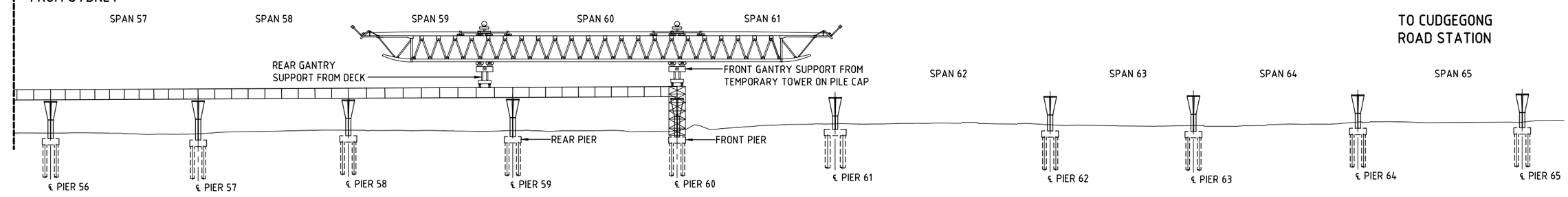
1. CONSTRUCT PILES, PILECAPS, PIERS.
2. ERECT PIER 35 PIER HEAD SEGMENT ON TEMPORARY SUPPORT BRACKETS. *
3. MOVE GANTRY FORWARD TO SPAN 35.
4. ERECT REMAINING SPAN 35 SEGMENTS SIMULTANEOUSLY USING LAUNCHING GANTRY.
5. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING
6. INSTALL PERMANENT BEARINGS
7. STRESS STAGES 1 AND 2 TENDONS FOR SPAN 35. REFER TO DRG No 015199 TO 015120 FOR DETAILS
8. HANGARS OF LAUNCHING GANTRY MUST BE RELEASED AFTER STRESSING STAGE 1 TENDONS
9. REMOVE TEMPORARY PRETRESS

* FOR TEMPORARY PIER HEAD SEGMENT SUPPORT ARRANGEMENT AND PIER HEAD SEGMENT LAUNCHING GANTRY SUPPORT HOLE ARRANGEMENT REFER TO DRAWING No 015007.



SPAN 35 TO SPAN 77 - STAGE 2

1. ERECT PIERS 36 AND 37 PIER HEAD SEGMENTS ON TEMPORARY SUPPORT BRACKETS *
2. MOVE GANTRY FORWARD TO SPANS 36 AND 37.
3. ERECT REMAINING SPANS 36 AND 37 SEGMENTS SIMULTANEOUSLY USING LAUNCHING GANTRY,
4. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING
5. INSTALL PERMANENT BEARINGS
6. STRESS STAGES 1 AND 2 TENDONS FOR SPANS 36 AND 37 REFER TO DRAWING No 015199 TO 015200 FOR DETAILS.
7. HANGERS OF LAUNCHING GANTRY MUST BE RELEASED AFTER STRESSING STAGE 1 TENDONS
8. REMOVE TEMPORARY PRESTRESS.



SPAN 35 TO SPAN 77 - STAGE 3

1. ERECT PIER HEAD SEGMENT AT SUBSEQUENT PIERS ON TEMPORARY SUPPORT BRACKETS. *
2. MOVE GANTRY FORWARD BY 2 SPANS.
3. COMPLETE CONSTRUCTION OF SPANS 37 AND 38 FOLLOWING STEPS 3 TO 8 FROM STAGE 2.
4. REPEAT STEPS 1 TO 3 UNTIL SPANS 39 TO 59 SEGMENTS ARE ERECTED.
5. MOVE GANTRY FORWARD TO SPAN 60.
6. COMPLETE CONSTRUCTION OF SPAN 60 FOLLOWING STEPS 4 TO 9 FROM STAGE 1.

REV.	BY	DATE	DESCRIPTION	APPD.
01	TF	08.05.2015	ASSURED FOR CONSTRUCTION	DJ

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

SCALES

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING

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NWRLSVC-HYD-SVC-DN-CER-012504

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SMEC
SMEC AUSTRALIA PTY LTD

DRAWN Mahdi Toghranegar
DESIGNED Chun Ng
DRG CHECK Tom Fisher
DESIGN CHECK Chris Kalyvis
APPROVED David Jefferson

NORTH WEST RAIL LINK

41km355 TO 45km140
BELLA VISTA TO ROUSE HILL VIADUCT
CONSTRUCTION SEQUENCE
SHEET 6

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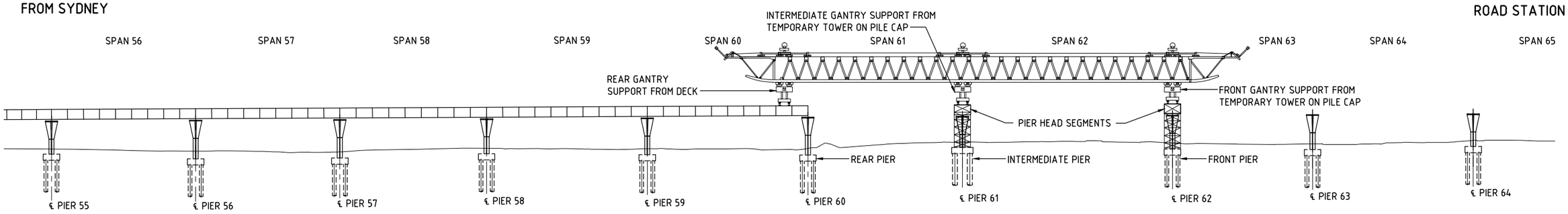
FROM SYDNEY

TO CUDGEGONG ROAD STATION



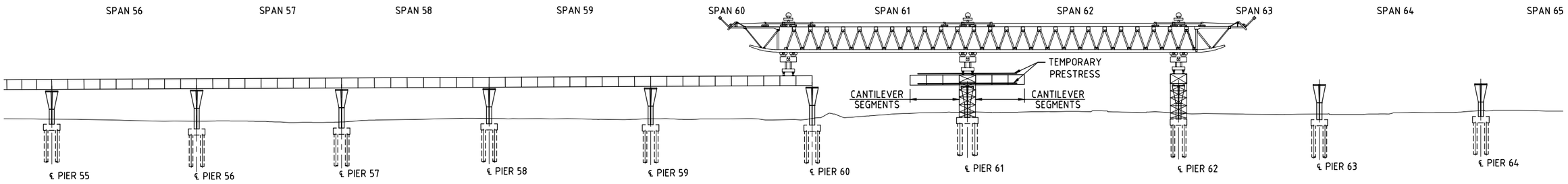
SPAN 35 TO SPAN 77 - STAGE 4

1. ERECT PIERS 61 AND 62 PIER HEAD SEGMENTS ON TEMPORARY SUPPORT BRACKETS.*
2. INSTALL PERMANENT BEARINGS ON PIERS 61 AND 62.
3. MOVE GANTRY FORWARD TO SPANS 61 AND 62

* FOR PIER HEAD SEGMENT LAUNCHING GANTRY SUPPORT HOLE ARRANGEMENT REFER TO DRAWING No 015007.

FROM SYDNEY

TO CUDGEGONG ROAD STATION

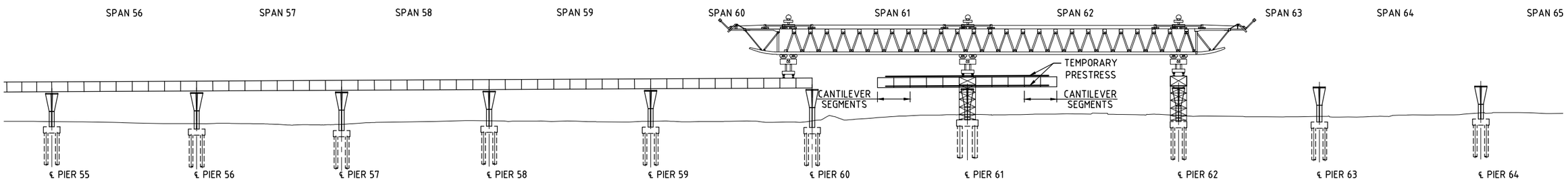


SPAN 35 TO SPAN 77 - STAGE 5

1. ERECT FIRST 3 PAIRS OF PIER 61 CANTILEVER SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF CANTILEVER SEGMENTS.
3. STRESS STAGE 1 CANTILEVER TENDONS OVER PIER 61 REFER TO DRAWING No 015217 FOR DETAILS.
4. RELEASE HANGERS OF LAUNCHING GANTRY.

FROM SYDNEY

TO CUDGEGONG ROAD STATION



SPAN 35 TO SPAN 77 - STAGE 6

1. ERECT 4TH TO 5TH PAIRS OF PIER 61 CANTILEVER SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF CANTILEVER SEGMENTS.
3. STRESS STAGE 2 CANTILEVER TENDONS OVER PIER 61 REFER TO DRAWING No 015217 FOR DETAILS.
4. RELEASE HANGERS OF LAUNCHING GANTRY.

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A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied

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SERVICE PROVIDERS: salini impregilo; SMEC; SMEC AUSTRALIA PTY LTD

DRAWN Mahdi Toghranegar
DESIGNED Chun Ng
DRG CHECK Tom Fisher
DESIGN CHECK Chris Kalyvis
APPROVED David Jefferson

NORTH WEST RAIL LINK

41km355 TO 45km140
BELLA VISTA TO ROUSE HILL VIADUCT
CONSTRUCTION SEQUENCE
SHEET 7

STATUS: ASSURED FOR CONSTRUCTION | SHEET 36 OF 303 | ©

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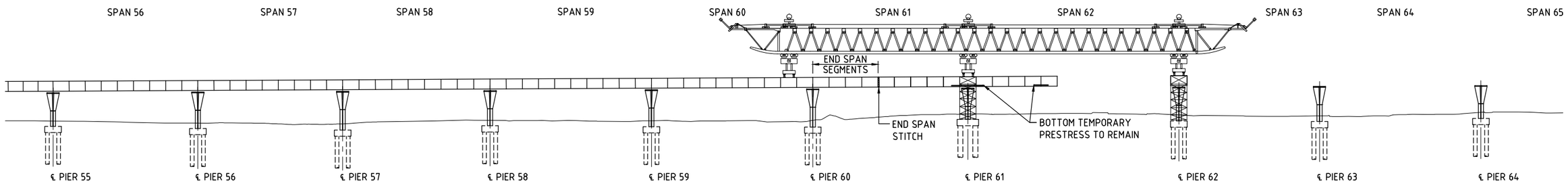
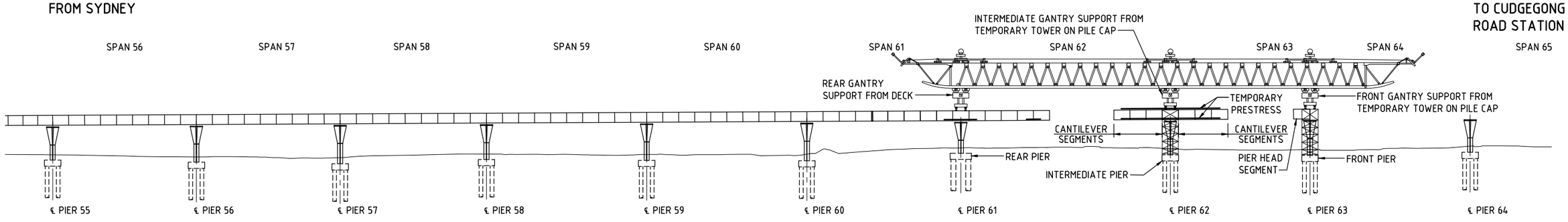


SPAN 35 TO SPAN 77 - STAGE 7

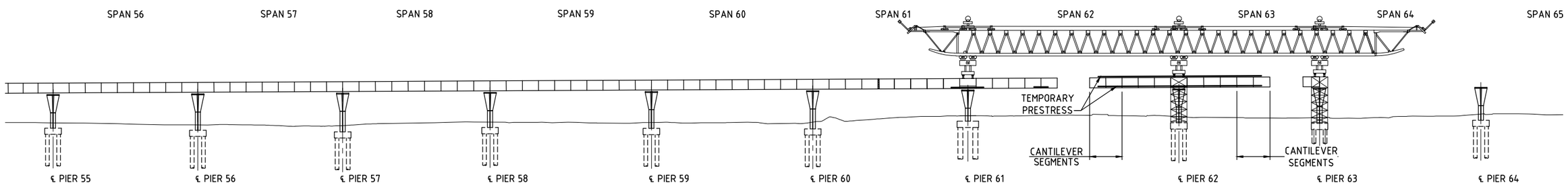
1. ERECT SPAN 61 END SPAN SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF END SPAN SEGMENTS.
3. INSTALL PERMANENT BEARINGS ON PIER 60.
4. CONSTRUCT SPAN 61 END SPAN STITCH.
5. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 40MPa,STRESS STAGE 1 CONTINUITY TENDONS REFER TO DRAWING No 015217 FOR DETAILS.
6. RELEASE ROTATIONAL RESTRAINT AT PIER 61 TEMPORARY SUPPORT BRACKETS.
7. RELEASE HANGERS OF LAUNCHING GANTRY.
8. REMOVE TEMPORARY PRESTRESS EXCEPT THE BOTTOM TEMPORARY PRESTRESS ACROSS SEGMENT JOINTS AS SHOWN ABOVE.



SPAN 35 TO SPAN 77 - STAGE 8

1. ERECT PIER 63 PIER HEAD SEGMENTS ON TEMPORARY SUPPORT BRACKETS.*
2. MOVE GANTRY FORWARD TO SPANS 62 AND 63.
3. ERECT FIRST 3 PAIRS OF PIER 62 CANTILEVER SEGMENTS.
4. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF CANTILEVER SEGMENTS.
5. STRESS STAGE 1 CANTILEVER TENDONS OVER PIER 62, REFER TO DRAWING No 015217 FOR DETAILS.
6. RELEASE HANGERS OF LAUNCHING GANTRY.

* FOR TEMPORARY PIER HEAD SEGMENT SUPPORT ARRANGEMENT AND PIER HEAD SEGMENT LAUNCHING GANTRY SUPPORT HOLE ARRANGEMENT REFER TO DRAWING No 015007.



SPAN 35 TO SPAN 77 - STAGE 9

1. ERECT 4TH AND 5TH PAIRS OF PIER 62 CANTILEVER SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF CANTILEVER SEGMENTS.
3. STRESS STAGE 2 CANTILEVER TENDONS OVER PIER 62, REFER TO DRAWING No 015217 FOR DETAILS.
4. RELEASE HANGERS OF LAUNCHING GANTRY.

REV.	BY	DATE	DESCRIPTION	APPD.
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SCALES

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING

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DRAWN Mahdi Toghranegar

DESIGNED Chun Ng

DRG CHECK Tom Fisher

DESIGN CHECK Chris Kalyvis

APPROVED David Jefferson

NORTH WEST RAIL LINK

41km355 TO 45km140
BELLA VISTA TO ROUSE HILL VIADUCT
CONSTRUCTION SEQUENCE
SHEET 8

STATUS: ASSURED FOR CONSTRUCTION | SHEET 37 OF 303 | ©

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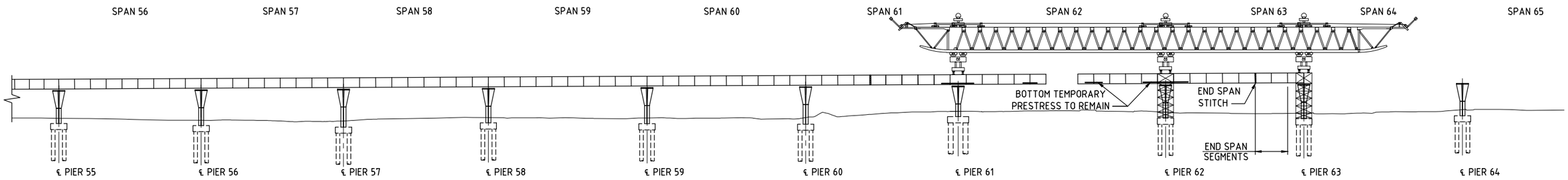
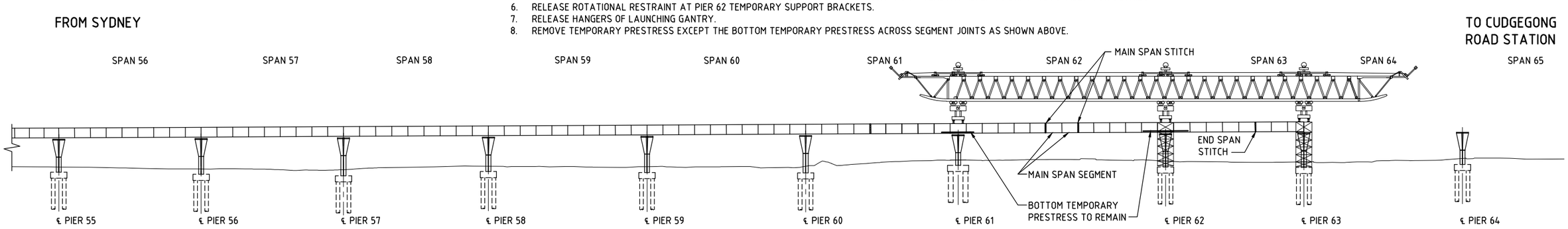
A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

100mm AT FULL SIZE Plot Date: 08/05/15 - 10:20 Cad File: V:_Vault\Projects\300\1407\CAD\DWG\01_Viaduct_BVR\NWRLSVC\ISM-BVR-CS-DRG-015048.dwg



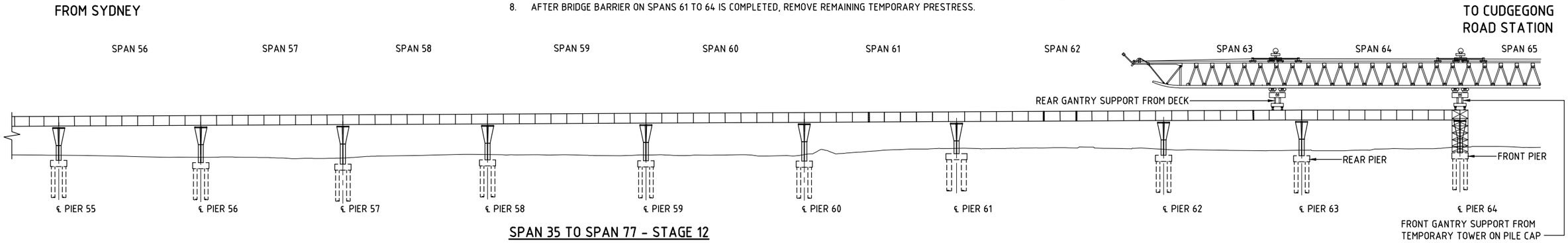
SPAN 35 TO SPAN 77 - STAGE 10

1. ERECT SPAN 63 END SPAN SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF END SPAN SEGMENTS.
3. INSTALL PERMANENT BEARINGS ON PIER 63.
4. CONSTRUCT SPAN 63 END SPAN STITCH.
5. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 35MPa, STRESS STAGE 2 CONTINUITY TENDONS REFER TO DRAWING No 015217 FOR DETAILS.
6. RELEASE ROTATIONAL RESTRAINT AT PIER 62 TEMPORARY SUPPORT BRACKETS.
7. RELEASE HANGERS OF LAUNCHING GANTRY.
8. REMOVE TEMPORARY PRESTRESS EXCEPT THE BOTTOM TEMPORARY PRESTRESS ACROSS SEGMENT JOINTS AS SHOWN ABOVE.



SPAN 35 TO SPAN 77 - STAGE 11

1. ERECT MAIN SPAN SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF MAIN SPAN SEGMENTS.
3. CONSTRUCT MAIN SPAN STITCHES.
4. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 30MPa, STRESS STAGE 3 CONTINUITY TENDONS, REFER TO DRAWING No 015217 FOR DETAILS.
5. RELEASE HANGERS OF LAUNCHING GANTRY.
6. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 50MPa, STRESS STAGE 4 CONTINUITY TENDONS, REFER TO DRAWING No 015217 FOR DETAILS.
7. REMOVE TEMPORARY PRESTRESS EXCEPT THE BOTTOM TEMPORARY PRESTRESS ACROSS SEGMENT JOINTS AS SHOWN ABOVE.
8. AFTER BRIDGE BARRIER ON SPANS 61 TO 64 IS COMPLETED, REMOVE REMAINING TEMPORARY PRESTRESS.



SPAN 35 TO SPAN 77 - STAGE 12

1. ERECT PIER HEAD SEGMENT AT SUBSEQUENT PIERS ON TEMPORARY SUPPORT BRACKETS. *
2. MOVE GANTRY FORWARD TO SPAN 64.
3. COMPLETE CONSTRUCTION OF SPAN 64 FOLLOWING STEPS 4 TO 9 FROM STAGE 1.
4. MOVE GANTRY FORWARD TO SPANS 65 AND 66.
5. COMPLETE CONSTRUCTION OF SPANS 65 AND 66 FOLLOWING STEPS 3 TO 8 FROM STAGE 2.

* FOR TEMPORARY PIER HEAD SEGMENT SUPPORT ARRANGEMENT AND PIER HEAD SEGMENT LAUNCHING GANTRY SUPPORT HOLE ARRANGEMENT REFER TO DRAWING No 015007.

REV.	BY	DATE	DESCRIPTION	APPD.
01	TF	08.05.2015	ASSURED FOR CONSTRUCTION	DJ

SCALES

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING

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CLIENT

NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS

salini impregilo

SMEC AUSTRALIA PTY LTD

DRAWN Mahdi Toghranegar
DESIGNED Chun Ng
DRG CHECK Tom Fisher
DESIGN CHECK Chris Kalyvis
APPROVED David Jefferson

NORTH WEST RAIL LINK

41km355 TO 45km140
BELLA VISTA TO ROUSE HILL VIADUCT
CONSTRUCTION SEQUENCE
SHEET 9

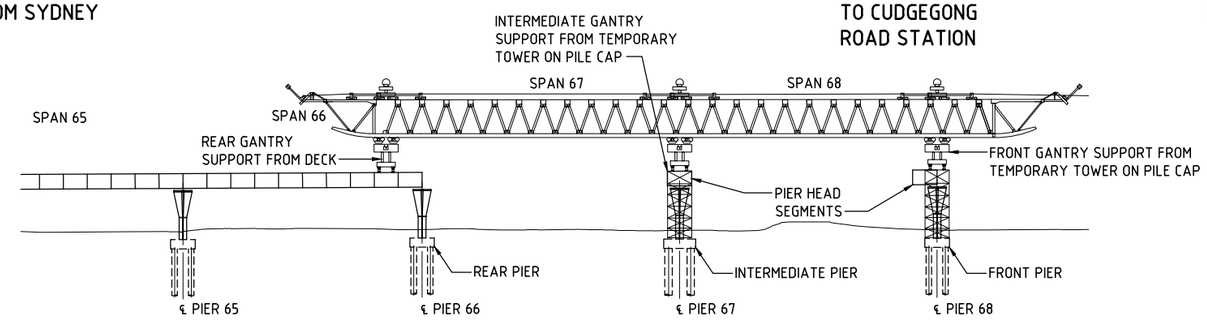
STATUS: ASSURED FOR CONSTRUCTION | SHEET 38 OF 303 | ©

NWRL Drg No. NWRLSVC-ISM-BVR-CS-DRG-015049 | NWRL REV. 01

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

FROM SYDNEY

TO CUDGEGONG ROAD STATION



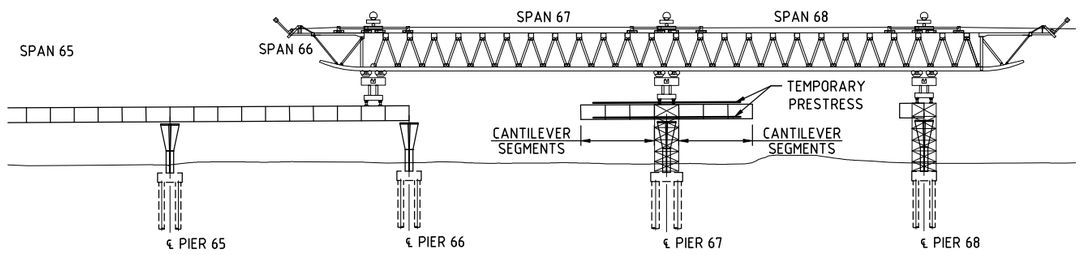
SPAN 35 TO SPAN 77 - STAGE 13

1. ERECT PIERS 67 AND 68 PIER HEAD SEGMENT ON TEMPORARY SUPPORT BRACKETS*
2. INSTALL PERMANENT BEARING ON PIER 67
3. MOVE GANTRY FORWARD BY 2 SPANS.

* FOR TEMPORARY PIER HEAD SEGMENT SUPPORT ARRANGEMENT AND PIER HEAD SEGMENT LAUNCHING GANTRY SUPPORT HOLE ARRANGEMENT REFER TO DRAWING No 015007.

FROM SYDNEY

TO CUDGEGONG ROAD STATION

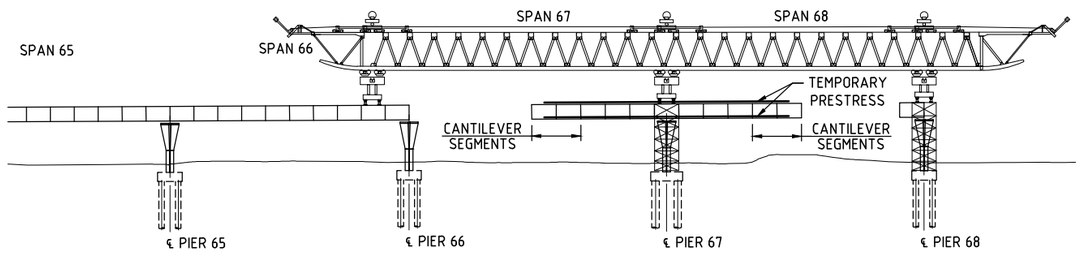


SPAN 35 TO 77 - STAGE 14

1. ERECT FIRST 3 PAIRS OF PIER 67 CANTILEVER SEGMENTS USING LAUNCHING GANTRY
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF CANTILEVER SEGMENTS
3. STRESS STAGE 1 CANTILEVER TENDONS OVER PIER 67 REFER TO DRAWING No 015210 FOR DETAILS
4. RELEASE HANGERS OF LAUNCHING GANTRY

FROM SYDNEY

TO CUDGEGONG ROAD STATION

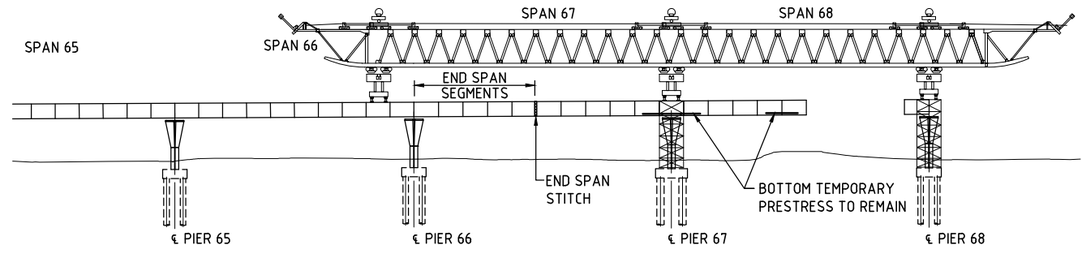


SPAN 35 TO 77 - STAGE 15

1. ERECT 4TH TO 5TH PAIRS OF PIER 66 CANTILEVER SEGMENTS USING LAUNCHING GANTRY
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF CANTILEVER SEGMENTS
3. STRESS STAGE 2 CANTILEVER TENDONS OVER PIER 67 REFER TO DRAWING No 015210 FOR DETAILS
4. RELEASE HANGERS OF LAUNCHING GANTRY

FROM SYDNEY

TO CUDGEGONG ROAD STATION

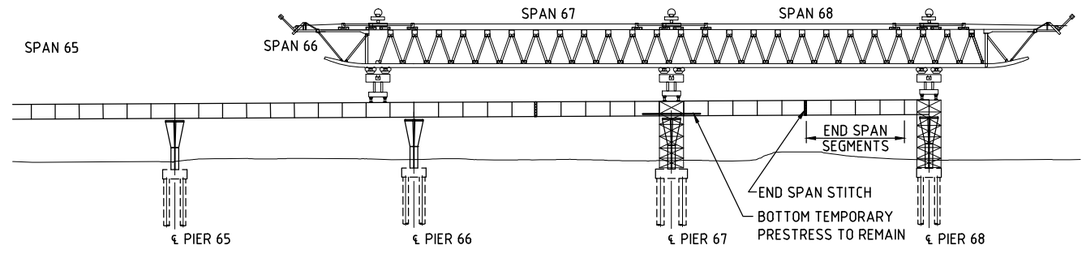


SPAN 35 TO 77 - STAGE 16

1. ERECT SPAN 67 END SPAN SEGMENTS USING LAUNCHING GANTRY.
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF END SPAN SEGMENTS
3. INSTALL PERMANENT BEARINGS ON PIER 66
4. CONSTRUCT SPAN 67 END SPAN STITCH
5. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 40MPa,STRESS STAGE 1 CONTINUITY TENDONS REFER TO DRAWING No 015210 FOR DETAILS
6. RELEASE ROTATIONAL RESTRAINT AT PIER 67 TEMPORARY SUPPORT BRACKETS
7. RELEASE HANGERS OF LAUNCHING GANTRY
8. REMOVE TEMPORARY PRESTRESS EXCEPT THE BOTTOM TEMPORARY PRESTRESS ACROSS SEGMENT JOINTS AS SHOWN ABOVE

FROM SYDNEY

TO CUDGEGONG ROAD STATION

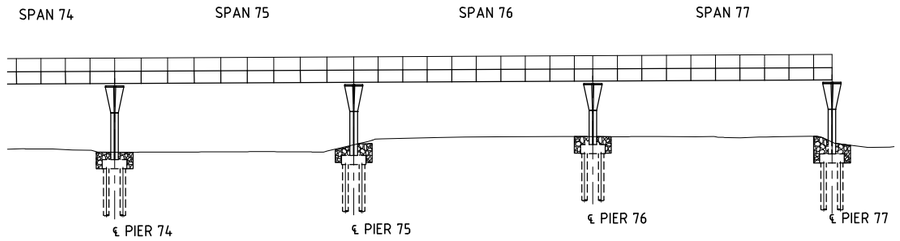


SPAN 35 TO 77 - STAGE 17

1. ERECT SPAN 68 END SPAN SEGMENTS USING LAUNCHING GANTRY
2. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING OF END SPAN SEGMENTS
3. INSTALL PERMANENT BEARINGS ON PIER 68
4. CONSTRUCT SPAN 68 END SPAN STITCH
5. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 40MPa,STRESS STAGE 2 CONTINUITY TENDONS REFER TO DRAWING No 015210 FOR DETAILS
7. RELEASE HANGERS OF LAUNCHING GANTRY
8. REMOVE TEMPORARY PRESTRESS EXCEPT THE BOTTOM TEMPORARY PRESTRESS ACROSS SEGMENT JOINTS AS SHOWN ABOVE
9. AFTER THE STRENGTH OF STITCH CONCRETE REACHES 55MPa, STRESS STAGE 3 CONTINUITY TENDONS. REFER TO DRAWING 015210 FOR DETAILS
10. AFTER BRIDGE BARRIER IS COMPLETED, REMOVE REMAINING TEMPORARY PRESTRESS

FROM SYDNEY

TO CUDGEGONG ROAD STATION



SPAN 35 TO 77 - STAGE 18

1. COMPLETE CONSTRUCTION OF SPANS 69 AND 70 FOLLOWING THE STEPS FROM STAGES 13 TO 17.
2. ERECT PIER HEAD SEGMENTS AT SUBSEQUENT PIERS ON TEMPORARY SUPPORT BRACKETS*
3. MOVE GANTRY FORWARD TO SPAN 71.
4. COMPLETE CONSTRUCTION OF SPAN 71 FOLLOWING STEPS 4 TO 9 FROM STAGE 1.
5. MOVE GANTRY FORWARD BY 2 SPANS.
6. COMPLETE CONSTRUCTION OF SPANS 72 AND 73 FOLLOWING STEPS 3 TO 8 FROM STAGE 2.
7. REPEAT STEPS 2, 5 AND 6 UNTIL SPANS 74 TO 77 SEGMENTS ARE ERECTED.
8. COMPLETE REMAINING CONSTRUCTION.

REV.	BY	DATE	DESCRIPTION	APPD.
01	TF	08.05.2015	ASSURED FOR CONSTRUCTION	DJ

SCALES

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING

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NWRLSVC-HYD-SVC-DN-CER-012504

Refer to: Electronic file issue disclaimer on transmittal form

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: salini impregilo; SMEC AUSTRALIA PTY LTD

DRAWN Mahdi Toghranegar
DESIGNED Chun Ng
DRG CHECK Tom Fisher
DESIGN CHECK Chris Kalyvis
APPROVED David Jefferson

NORTH WEST RAIL LINK

41km355 TO 45km140
BELLA VISTA TO ROUSE HILL VIADUCT
CONSTRUCTION SEQUENCE
SHEET 10

STATUS: ASSURED FOR CONSTRUCTION | SHEET 39 OF 303 | ©

NWRL Drg No. NWRLSVC-ISM-BVR-CS-DRG-015050 | NWRL REV. 01

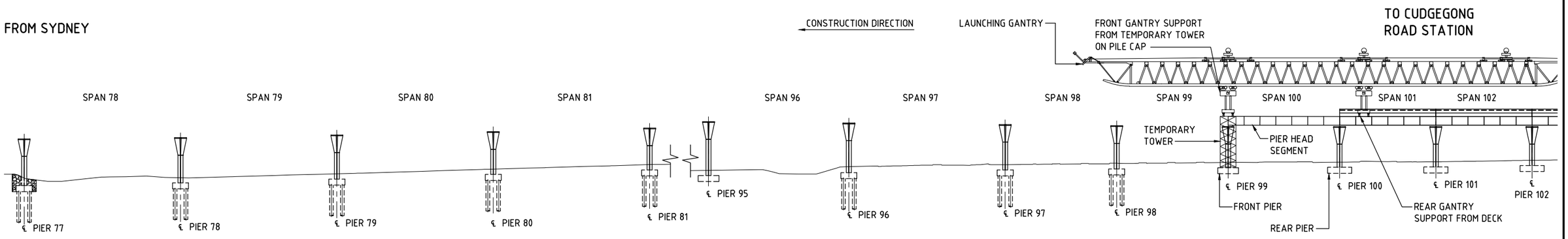
A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

Cad File: V:_Vault\Projects\3001407\CAD\DWG\01_Viaduct_BVR\NWRLSVC\ISM-BVR-CS-DRG-015050.dwg Plot Date: 08/05/15 - 10:21 100mm AT FULL SIZE

FROM SYDNEY

CONSTRUCTION DIRECTION

TO CUDGEGONG ROAD STATION



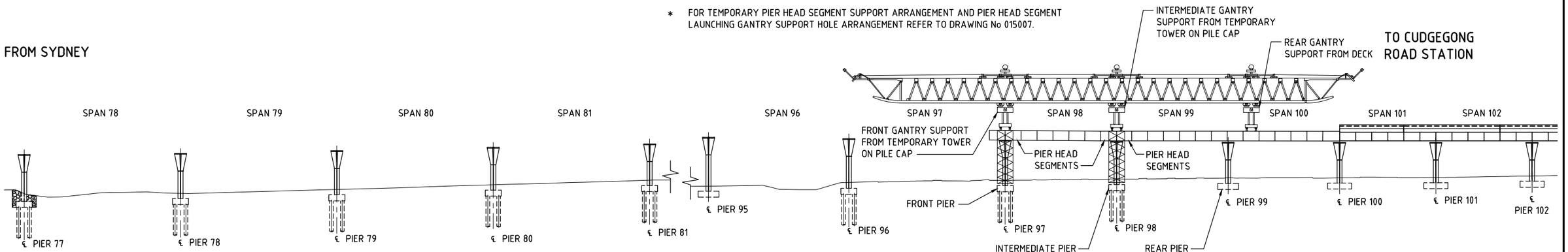
SPANS 78 TO SPAN 100 - STAGE 1

1. CONSTRUCT PILES, PILECAP AND PIERS
2. ERECT PIER 99 PIER HEAD SEGMENT ON TEMPORARY SUPPORT BRACKETS*
3. ERECT REMAINING SPAN 100 SEGMENTS SIMULTANEOUSLY USING LAUNCHING GANTRY
4. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING
5. INSTALL PERMANENT BEARINGS
6. STRESS STAGES 1 AND 2 TENDONS FOR SPAN 100. REFER TO DRG No 015222 FOR DETAILS
7. HANGARS OF LAUNCHING GANTRY MUST BE RELEASED AFTER STRESSING STAGE 1 TENDONS
8. REMOVE TEMPORARY PRESTRESS

* FOR TEMPORARY PIER HEAD SEGMENT SUPPORT ARRANGEMENT AND PIER HEAD SEGMENT LAUNCHING GANTRY SUPPORT HOLE ARRANGEMENT REFER TO DRAWING No 015007.

FROM SYDNEY

TO CUDGEGONG ROAD STATION

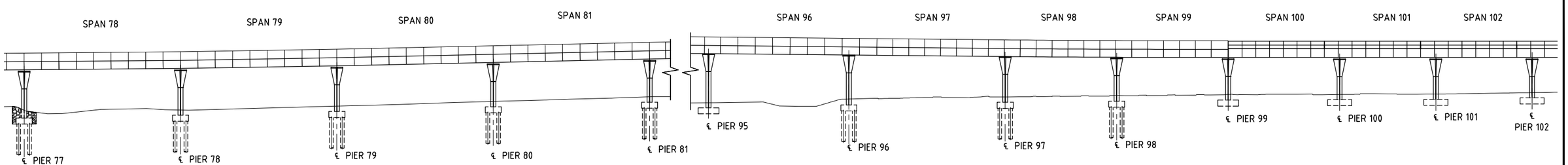


SPANS 78 TO SPAN 100 - STAGE 2

1. ERECT PIERS 97 AND 98 PIER HEAD SEGMENTS ON TEMPORARY SUPPORT BRACKETS*
2. MOVE GANTRY FORWARD TO SPANS 98 AND 99.
3. ERECT REMAINING SPANS 98 AND 99 SEGMENTS SIMULTANEOUSLY USING LAUNCHING GANTRY
4. INSTALL TEMPORARY PRESTRESS FOR EPOXY GLUING
5. INSTALL PERMANENT BEARINGS
6. STRESS STAGES 1 AND 2 TENDONS FOR SPANS 98 AND 99. REFER TO DRG No 015199, 015200, 015221 AND 015222 FOR DETAILS
7. HANGERS OF LAUNCHING GANTRY MUST BE RELEASED AFTER STRESSING STAGE 1 TENDONS
8. REMOVE TEMPORARY PRESTRESS

FROM SYDNEY

TO CUDGEGONG ROAD STATION



SPANS 78 TO SPAN 100 - STAGE 3

1. ERECT PIER HEAD SEGMENTS AT SUBSEQUENT PIERS ON TEMPORARY SUPPORT BRACKET*
2. MOVE GANTRY FORWARD BY 2 SPANS.
3. COMPLETE CONSTRUCTION OF SPANS 95 AND 96 FOLLOWING STEPS 3 TO 8 FROM STAGE 2.
4. REPEAT STEPS 1 TO 3 UNTIL SPANS 78 TO 94 SEGMENTS ARE ERECTED.
5. COMPLETE REMAINING CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	TF	08.05.2015	ASSURED FOR CONSTRUCTION	DJ

SCALES

DESIGN MODEL FILE(S) USED FOR DOCUMENTATION OF THIS DRAWING

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DRAWN Mahdi Toghranegar
DESIGNED Chun Ng
DRG CHECK Tom Fisher
DESIGN CHECK Chris Kalyvis
APPROVED David Jefferson

NORTH WEST RAIL LINK

41km355 TO 45km140
BELLA VISTA TO ROUSE HILL VIADUCT
CONSTRUCTION SEQUENCE
SHEET 11

STATUS: ASSURED FOR CONSTRUCTION | SHEET 40 OF 303 | ©

NWRL Drg No. NWRLSVC-ISM-BVR-CS-DRG-015051 | NWRL REV. 01

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

ATTACHMENT E – BOUNDARY FENCING FOR PIERS 44 TO 60

Surveyed Fence Location - Sydney Water Land Zone 4
ISJV-SWCLand-Fencing-WAE-Rev1
07 Aug 2015

1:20yr flood

WAE Fence

LEGEND

Installed (Works as Executed) wire mesh fence

Aboriginal Heritage no-go area

1 in 20 Yr Flood

ATTACHMENT F – EROSION AND SEDIMENT CONTROL PLAN FOR SAMANTHA RILEY DRIVE TO WINDSOR ROAD

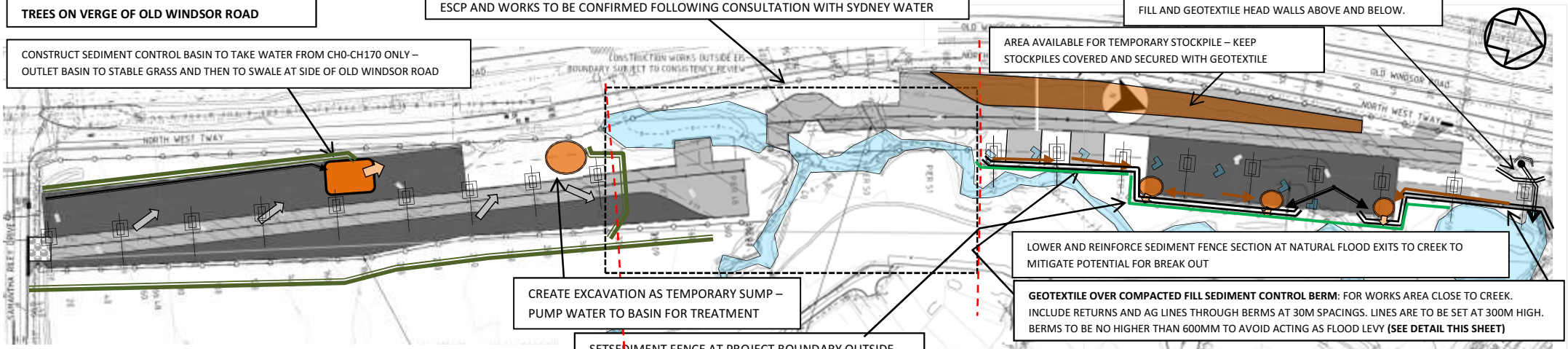
NOTE: NO STOCKPILING UNDER DRIP LINE OF TREES ON VERGE OF OLD WINDSOR ROAD

SEE SEPARATE ESCPS FOR WORKS IN CREEK AREAS (STAGE 2 WORKS): P47-P51
ESCP AND WORKS TO BE CONFIRMED FOLLOWING CONSULTATION WITH SYDNEY WATER

PIPE CULVERT UNDER HAUL ROAD: PROVIDE COMACTED FILL AND GEOTEXTILE HEAD WALLS ABOVE AND BELOW.

CONSTRUCT SEDIMENT CONTROL BASIN TO TAKE WATER FROM CH0-CH170 ONLY – OUTLET BASIN TO STABLE GRASS AND THEN TO SWALE AT SIDE OF OLD WINDSOR ROAD

AREA AVAILABLE FOR TEMPORARY STOCKPILE – KEEP STOCKPILES COVERED AND SECURED WITH GEOTEXTILE



LOWER AND REINFORCE SEDIMENT FENCE SECTION AT NATURAL FLOOD EXITS TO CREEK TO MITIGATE POTENTIAL FOR BREAK OUT

CREATE EXCAVATION AS TEMPORARY SUMP – PUMP WATER TO BASIN FOR TREATMENT

GEOTEXTILE OVER COMPACTED FILL SEDIMENT CONTROL BERM: FOR WORKS AREA CLOSE TO CREEK. INCLUDE RETURNS AND AG LINES THROUGH BERMS AT 30M SPACINGS. LINES ARE TO BE SET AT 300M HIGH. BERMS TO BE NO HIGHER THAN 600MM TO AVOID ACTING AS FLOOD LEVY **(SEE DETAIL THIS SHEET)**

SETSEDIMENT FENCE AT PROJECT BOUNDARY OUTSIDE OF BERM IN CLOSE PROXIMITY TO CREEK

BASIN CALCULATIONS – PER WORK AREA

CATCHMENT AREA (APPROX) = PER 1HA (10000M2)				
R = 2500	K=0.05	LS = 1.2	C= 1.0	P= 1.3
GIVES 2 MONTH STORAGE VOLUME = 21M3				
CV=0.53	R(85%/5 DAY) =33**			
GIVES SETTLING ZONE REQUIRED OF 180M				
TOTAL VOLUME OF BASIN REQUIRED APPROX =~200M3 PER HA OF WORK CATCHMENT				
*LS value assumes stockpiles are covered or absent in catchment **NORTH PARRAMATTA				

BASIN CALCULATIONS – APPROXIMATE VOLUMES

BASIN /SUMP (AT PIER)	APPROX AREA TO BASIN (HA)	TARGET VOLUME (AREA X 200M3)	OUTLET TO
46	0.8	160	PUMP BACK OR OUTLET TO EAST/ OLSD WINDSOR ROAD
54-55	0.9	160	SPILLWAY OVER BERM TO CREEK
56-57	0.5	100	
58	0.4	80	

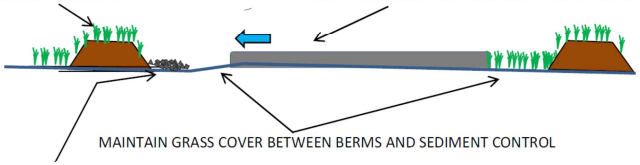
NOT : AREAS TO BE CONFIRMED ON SITE WITH SURVEY. VOLUMES INDACTED AS TARGET ONLY. ACTUAL VOLUMES MAY NOT BE ACHIEVALBE DUE TO SPACE AND ALSO DEPTH TO GROUND WATER IN FLOOD PLAIN AREAS

KEY			
	CREEK AREA		APPROX PATH OF PRIMARY FLOOD WAY. TO BE KEPT CLEAR. ESP' AT ENTRY & EXIT AT CREEK
	STABLE CONSTRUCTION ACCESS PER SD 6-14 (BLUE BOOK)		TEMP PIPE CULVERT .INCLUDE COMPACTED FILL AND GEOTEXTILE HEADWALLS
	SURFACE WATER DIVERSION /SCRATCH DRAIN	GENERAL FALL OF SURFACE	DIVERTED SITE WATER
	G GEOTEXTILE OVER COMPACTED FILL SEDIMENT CONTROL BERM. INC RETURNS AND AG LINES OUTLET AT30M SPACINGS. BERMS NOT TO ACT AS FLOOD LEVY (SEE DETAIL THIS SHEET)		
	TOP SOIL BERM – MAINTAIN OFFSET TO HAUL ROAD MAINTAIN GRASS BETWEEN ROAD AND BERM		SEDIMENT FENCE PER SD6-8 (BLUE BOOK)
	TEMPORARY STOCKPILE AREA– STOCKPILES TO BE TRIMMED AND COVERED WITH GEOTEXTILE		
	SEDIMENT CONTORL BASIN – LINE INLET & OUTLET WITH GEOTEXTILE		LINED SED CONTROL SUMP- SIZE AS SPACE ALLOWS. DO NOT INTERCEPT GROUND WATER
	LIMIT/BOUNDARY STAGE 1 & STAGE 2 WORKS AREA		

SECTION HAUL ROAD ZONE 1 SOUTH - PIER 38-46

STRIP TOPSOIL FROM HAUL ROAD ALIGNMENT TO FORM DIVERSION BERMS EITHER SIDE. ALLOW BERMS TO GRASS UP.

SHAPE HAUL ROAD TO DRAIN AWAY FROM CREEK

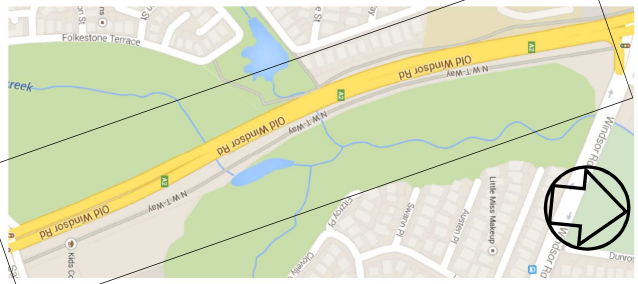


MAINTAIN GRASS COVER BETWEEN BERMS AND SEDIMENT CONTROL

USE BAGS OR SIMILAR AS SEDIMENT CONTROL AND EROSION CONTROL WHERE WATER FLOWS ALONG BERM

INSTALL SEDIMENT FENCE OUTSIDE BERM WHERE ALIGNMENT IS <5M FROM CREEK BA

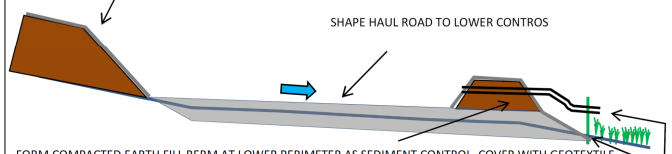
SITE LOCATION



SECTION HAUL ROAD ZONE NORTH - PIER 52-60

STRIP TOPSOIL FROM HAUL ROAD ALIGNMENT AND STOCKPILE. ALL STOCKPILES TO BE OUT OF FLOOD WAY AND COVERED WITH GEOTEXTILE.

SHAPE HAUL ROAD TO LOWER CONTROS



FORM COMPACTED EARTH FILL BERM AT LOWER PERIMETER AS SEDIMENT CONTROL. COVER WITH GEOTEXTILE INCLUDING TOE OF ANY FILL BATTER OF HAUL ROAD FORMATION

INSTALL SEDIMENT FENCE AT TOE OF FORMATION AND LIMIT OF WORK AREA – NO DISTURBANCE OUT SIDE FENCE.

INSTALL AG LINE THROUGH BERM AT 20-30M CENTRES OR AS REQUIRED. INCLUDE RETURNS TO CREATE MULTIPLE OUTLET. EXTEND FLEXIBLE LINE 1.5M PAST BERM AND LEAVE LOOSE.

ErSed Environmental Pty Ltd
PO Box 1124 Leichhardt 2040

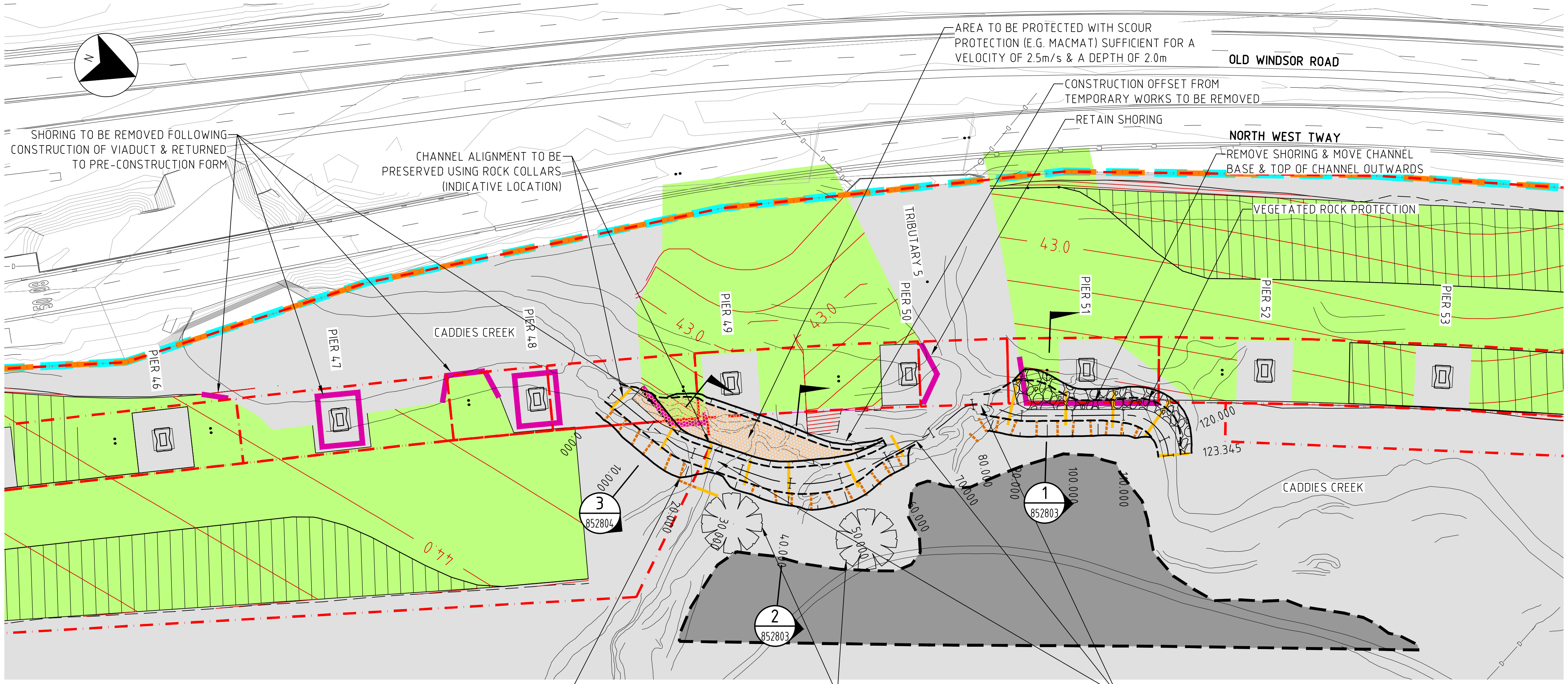
M. 0424 203 046
E.info@ersed.com.au

SHEETS IN THIS PLAN SET

1. GENERAL ARRANGEMENT – HAUL ROAD SAM RILEY TO WINDSOR ROAD

ERSED REF:	14007	**PROGRESSIVE EROSION AND SEDIMENT CONTROL PLAN**
DRAWN	CV	GENERAL ARRANGEMENT HAUL ROAD WORKS – SAM RILEY TO WINDSOR ROAD
CREATED	NOV 2014	**DRAFT FOR CONSTRUCTION REVIEW**
DATE THIS AMDT	JULY 2015	**ESCP 4A REV 4** (PREFIX NUMBER) — 1 (SHEET) — 5 (AMDT)
CLIENT	ISJV	

ATTACHMENT G – PERMANENT CREEK DIVERSION DESIGN PLANS (NWRLSVC-IWP-SCV-DN-DWG-852801 [01] TO NWRLSVC-IWP-SCV-DN-DWG-852807 [01])



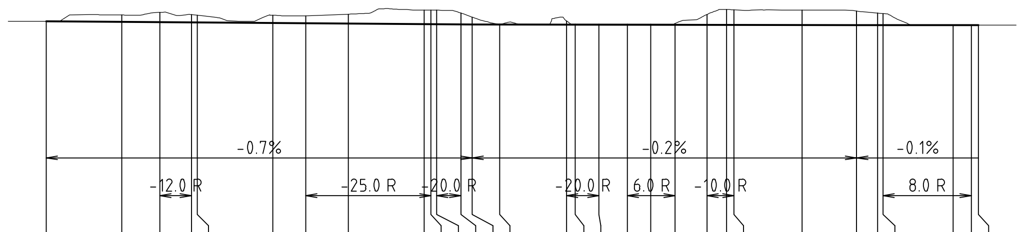
LEGEND

- CREEK CENTRELINE AND CHAINAGES
- BOTTOM OF BANK (BASE)
- TOP OF BANK
- SYDNEY WATER PROPERTY BOUNDARIES
- HERITAGE AREA
- HAUL ROAD & LAYDOWN AREA AS PER ISJV FIGURES "MOD04-LAYOUT 5 & MOD02-LAYOUT 5"
- PROJECT BOUNDARIES
- VERTICAL SHORING (BY OTHERS)
- HAUL ROAD OFFSET
- EXISTING SURFACE CONTOURS (0.25m INTERVAL)
- HAUL ROAD SURFACE CONTOURS (0.25m INTERVAL)
- ROCK COLLARS
- LOGS/GROYNES
- ROCK
- SCOUR PROTECTION
- EXISTING TREES

PLAN
SCALE 1:500

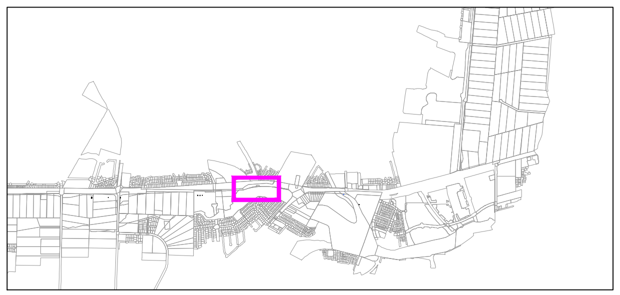
SYDNEY WATER ROCK SPECIFICATION

- 70% BETWEEN 200kg & 500kg WITH A REGULAR SHAPE 0.75m TO 1.2m (L) x 0.5m (W) x 0.25 TO 0.45m (H)
- 15% BETWEEN 4kg & 33kg
- 15% LESS THAN 4kg



CHAINAGE	DESIGN CL	EXISTING SURFACE
0.00	41.09	41.09
10.00	41.02	41.92
15.05	40.99	42.29
19.22	40.96	41.98
20.00	40.95	41.90
30.00	40.88	41.90
34.35	40.85	41.81
40.00	40.8	42.01
50.00	40.73	42.56
50.90	40.73	42.56
51.66	40.72	42.55
54.86	40.7	42.19
56.34	40.69	41.65
60.00	40.68	40.69
68.85	40.66	41.15
70.00	40.66	40.69
73.14	40.66	40.69
76.88	40.65	40.69
80.00	40.64	40.71
83.21	40.64	40.79
87.42	40.63	42.00
90.00	40.63	42.65
90.99	40.63	42.62
100.00	40.61	42.59
107.21	40.6	42.45
110.00	40.59	42.17
110.71	40.59	42.10
120.00	40.58	40.57
122.40	40.58	40.58
123.34	40.58	40.58

TRIBUTARY 5 LONGITUDINAL SECTION
SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:500



KEY PLAN
NTS

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG

SCALES: 1:500 — FULL SIZE A1

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink, salini impregilo, WorleyParsons resources & energy

DRAWN: ENOSH NEWAR
DESIGNED: JOSH ATKINSON
DRG CHECK: ANDREW GILHAM
DESIGN CHECK: WARICK HONOUR
APPROVED: ANDREW GILHAM

NORTH WEST RAIL LINK
KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
CADDIES CREEK PLAN AND LONG SECTION
(CONFLUENCES WITH TRIBUTARY 5 & ELIZABETH MACARTHUR CREEK)

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852801 | NWRL REV. 01

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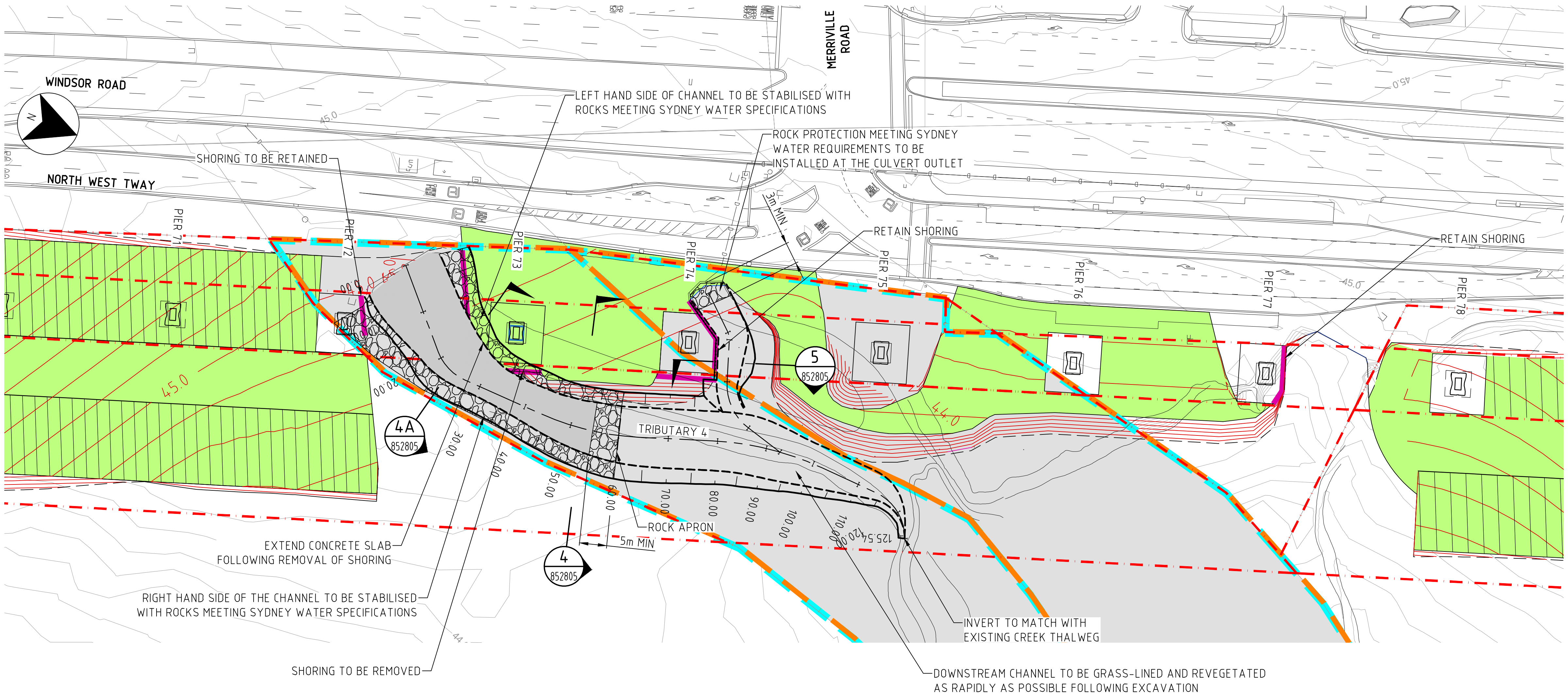
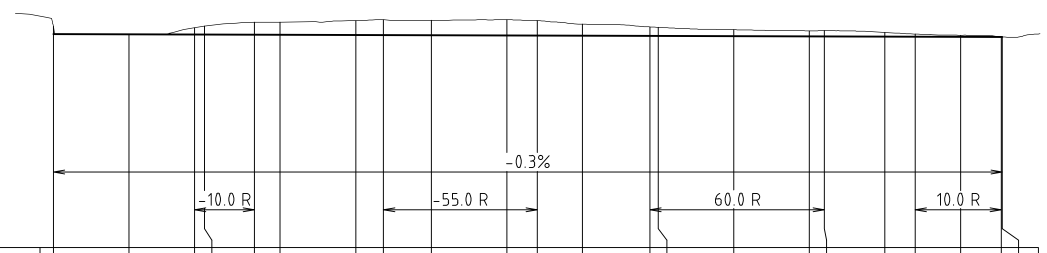


LEGEND

- CREEK CENTRELINE AND CHAINAGES (90.00, 100.00)
- BOTTOM OF BANK (BASE)
- TOP OF BANK
- SYDNEY WATER PROPERTY BOUNDARIES
- HAUL ROAD & LAYDOWN AREA AS PER ISJV FIGURES "MOD04-LAYOUT 5 & MOD02-LAYOUT 5"
- PROJECT BOUNDARIES
- VERTICAL SHORING (BY OTHERS)
- HAUL ROAD OFFSET
- EXISTING SURFACE CONTOURS (0.25m INTERVAL) (54.0)
- HAUL ROAD SURFACE CONTOURS (0.25m INTERVAL) (49.0)
- ROCK
- CONCRETE

PLAN

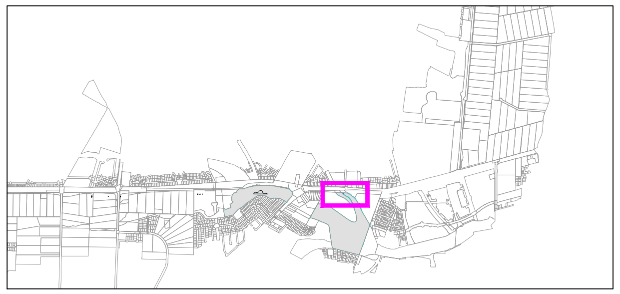
SCALE 1:500



CHAINAGE	DESIGN CL	EXISTING SURFACE
0.00	43.27	43.27
10.00	42.21	42.24
18.69	42.18	43.09
20.00	42.18	43.30
26.61	42.16	43.79
30.00	42.15	43.81
40.00	42.12	44.03
43.66	42.11	44.15
50.00	42.09	44.05
60.00	42.06	44.15
64.02	42.04	44.05
70.00	42.03	43.56
78.91	42	43.19
80.00	42	43.15
90.00	41.97	42.82
100.00	41.94	42.69
102.00	41.93	42.70
110.00	41.9	42.46
113.99	41.89	42.25
120.00	41.87	42.10
125.41	41.86	41.87
125.54	41.86	41.86

TRIBUTARY 4 LONGITUDINAL SECTION

SCALE HORIZONTAL 1:500
SCALE VERTICAL 1:500



KEY PLAN

NTS

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG

SCALES: 5 0 5 10 15m — 1:500 FULL SIZE A1

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT: NSW GOVERNMENT — Transport for NSW

SERVICE PROVIDERS: northwestraillink — salini impregilo — ISJV – SVC Works; WorleyParsons resources & energy

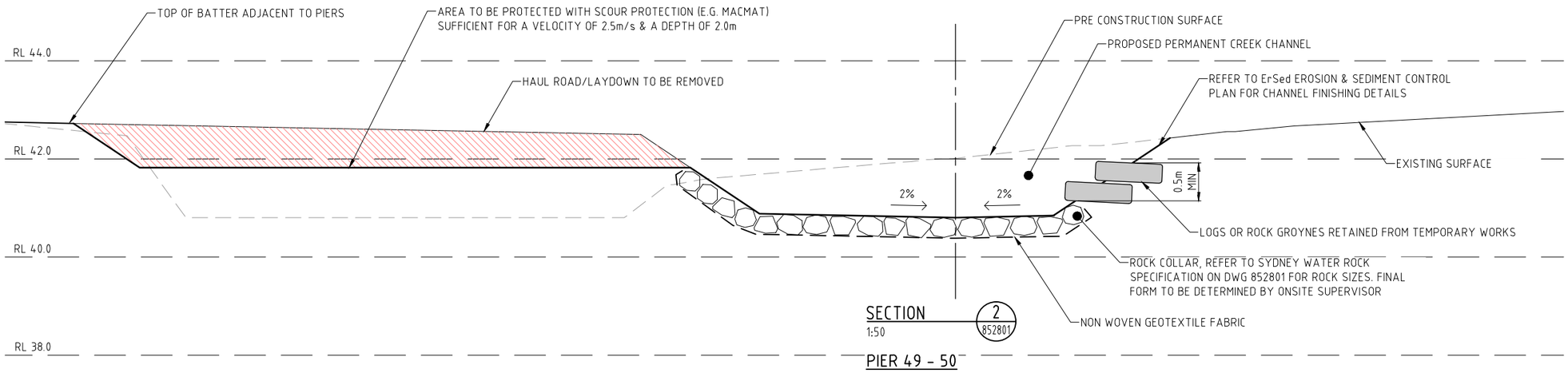
DRAWN: ENOSH NEWAR
DESIGNED: JOSH ATKINSON
DRG CHECK: ANDREW GILHAM
DESIGN CHECK: WARICK HONOUR
APPROVED: ANDREW GILHAM

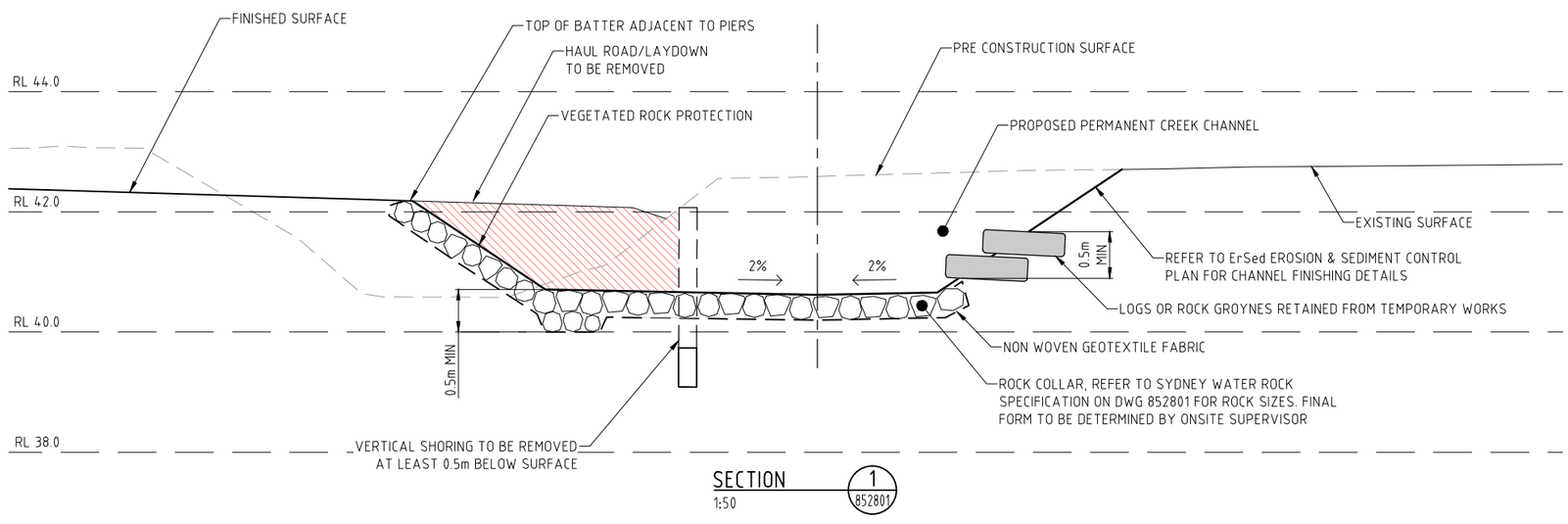
NORTH WEST RAIL LINK

ROUSE HILL CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
TRIBUTARY 4 PLAN AND LONG SECTION

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852802 | NWRL REV. 01





LEGEND

CUT

NOTE

1. OVERBANK AND CHANNEL AREAS NOT PROTECTED BY ROCK ARMOUR ARE TO BE REVEGETATED IN ACCORDANCE WITH THE REHABILITATION PLAN

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG

SCALES: 0.5 0 0.5 1 1.5m — 1 : 50 FULL SIZE A1

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink; salini impregilo; WorleyParsons resources & energy

DRAWN	PHILLIP CORNISH
DESIGNED	JOSH ATKINSON
DRG CHECK	ANDREW GILHAM
DESIGN CHECK	WARICK HONOUR
APPROVED	ANDREW GILHAM

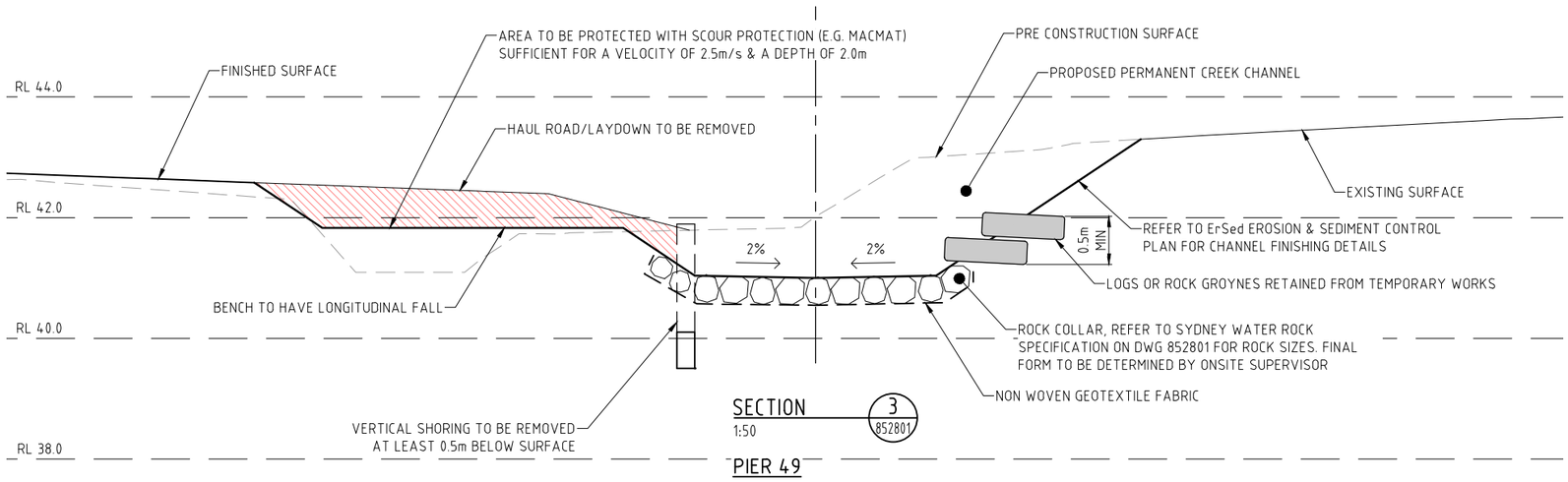
NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
TYPICAL SECTIONS
SHEET 1 OF 3

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852803 | NWRL REV. 01

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.



LEGEND

CUT

NOTE

1. OVERBANK AND CHANNEL AREAS NOT PROTECTED BY ROCK ARMOUR ARE TO BE REVEGETATED IN ACCORDANCE WITH THE REHABILITATION PLAN

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG

SCALES: 0.5 0 0.5 1 1.5m — 1 : 50 FULL SIZE A1

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT: NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS: northwestraillink; salini impregilo; WorleyParsons resources & energy

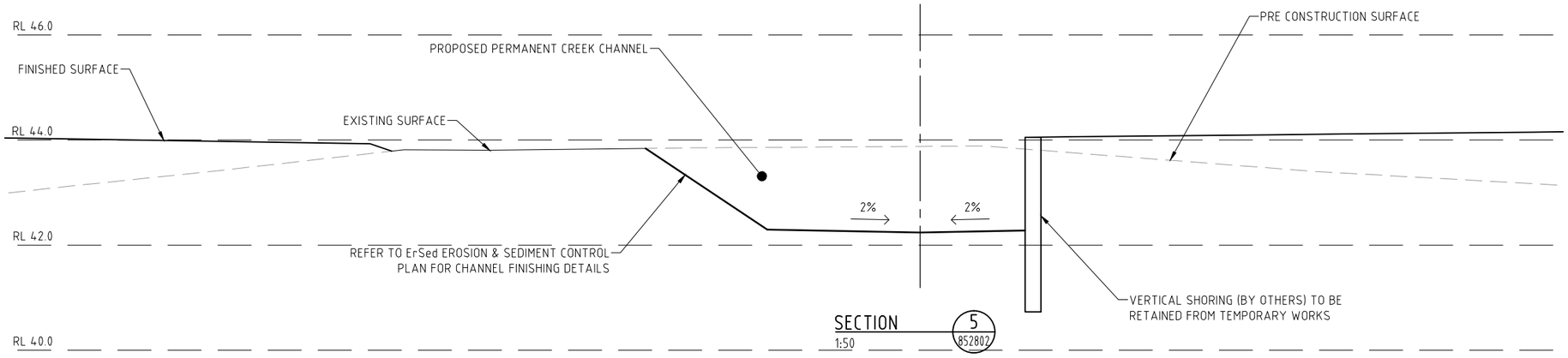
DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
TYPICAL SECTIONS
SHEET 2 OF 3

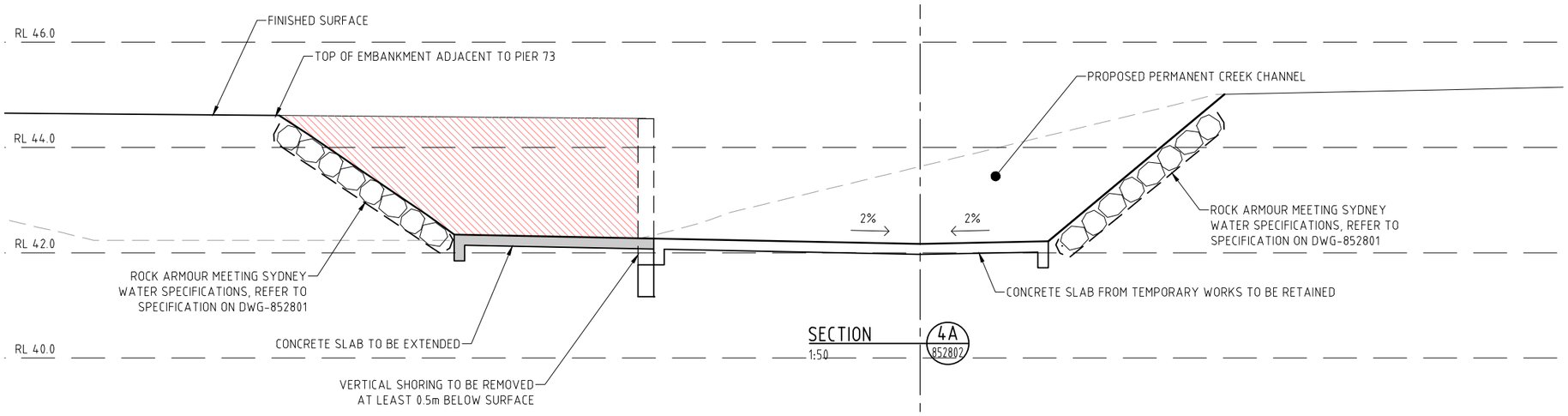
STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852804 | NWRL REV. 01

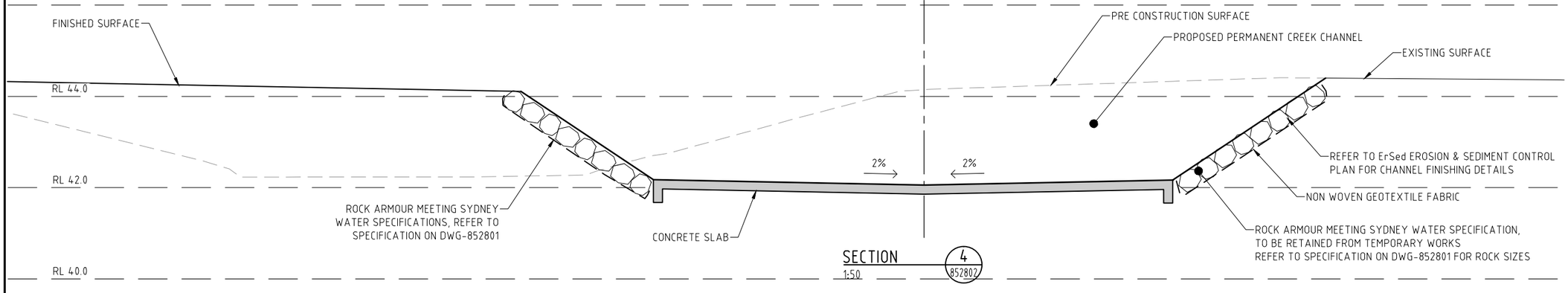


SECTION 5 (852802)
1:50

PIER 74 - 75



SECTION 4A (852802)
1:50



SECTION 4 (852802)
1:50

PIER 73 - 74

LEGEND

CUT

NOTE

1. OVERBANK AND CHANNEL AREAS NOT PROTECTED BY ROCK ARMOUR ARE TO BE REVEGETATED IN ACCORDANCE WITH THE REHABILITATION PLAN

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG

SCALES
0.5 0 0.5 1 1.5m
1 : 50 FULL SIZE A1

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT
NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS
northwestraillink
salini impregilo
WorleyParsons resources & energy

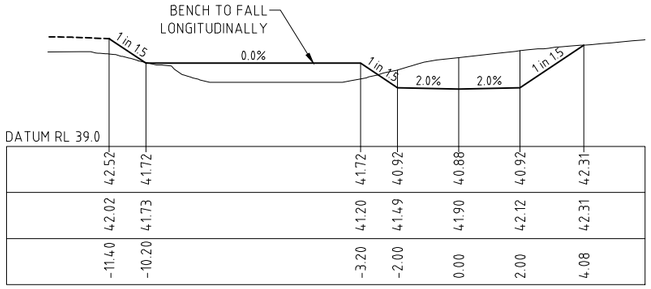
DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

ROUSE HILL CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
TYPICAL SECTIONS
SHEET 3 OF 3

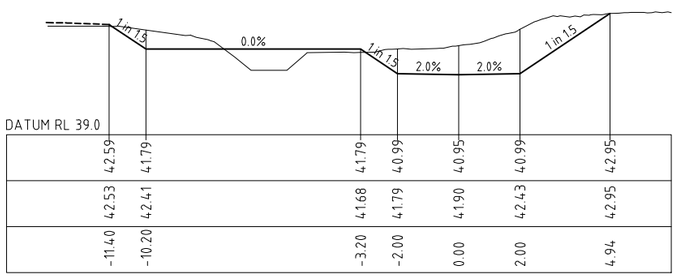
STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852805 | NWRL REV. 01



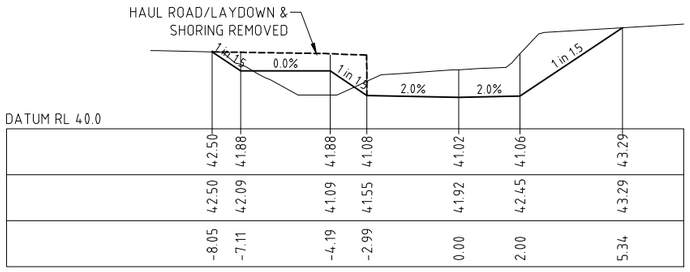
DATUM RL 39.0							
	42.52	41.72	41.72	40.92	40.88	40.92	42.31
	42.02	41.73	41.20	41.49	41.90	42.12	42.31
	-11.40	-10.20	-3.20	-2.00	0.00	2.00	4.08

CH 30



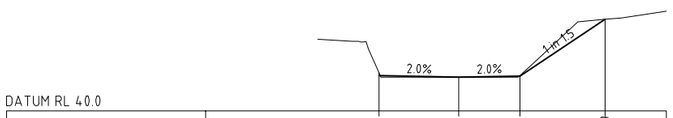
DATUM RL 39.0							
	42.59	41.79	41.79	40.99	40.95	40.99	42.95
	42.53	42.41	41.68	41.79	41.90	42.43	42.95
	-11.40	-10.20	-3.20	-2.00	0.00	2.00	4.94

CH 20



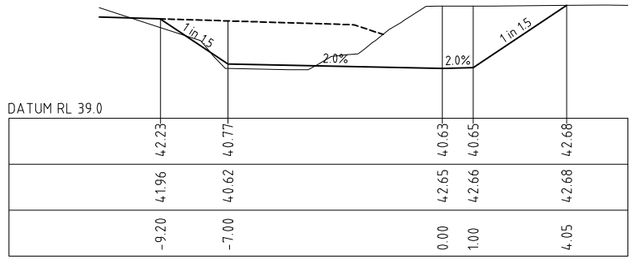
DATUM RL 40.0							
	42.50	41.88	41.88	41.08	41.02	41.06	43.29
	42.50	42.09	41.09	41.55	41.92	42.45	43.29
	-8.05	-7.11	-4.19	-2.99	0.00	2.00	5.34

CH 10



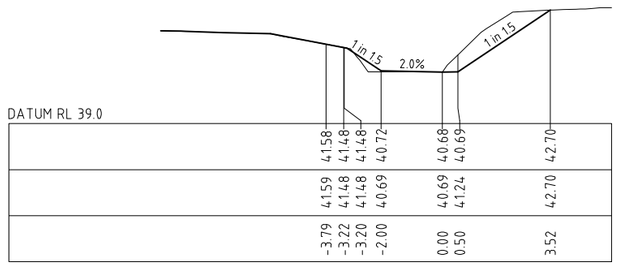
DATUM RL 40.0					
DESIGN	41.15	41.09	41.13	42.99	
EXISTING SURFACE	41.24	41.09	41.15	42.99	
CL OFFSET	-2.60	0.00	2.00	4.78	

CH 0



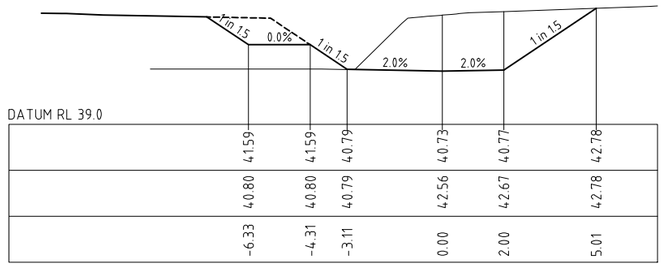
DATUM RL 39.0							
	42.23	40.77	40.63	40.65	42.68		
	41.96	40.62	42.65	42.66	42.68		
	-9.20	-7.00	0.00	1.00	4.05		

CH 90



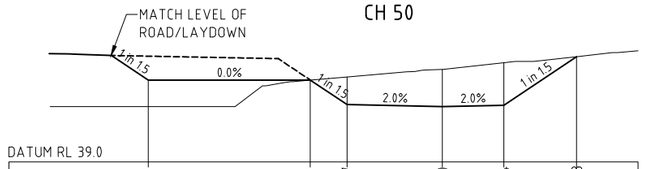
DATUM RL 39.0							
	41.58	41.48	41.48	40.72	40.68	40.69	42.70
	41.59	41.48	41.48	40.69	40.69	41.24	42.70
	-3.79	-3.22	-3.20	-2.00	0.00	0.50	3.52

CH 60



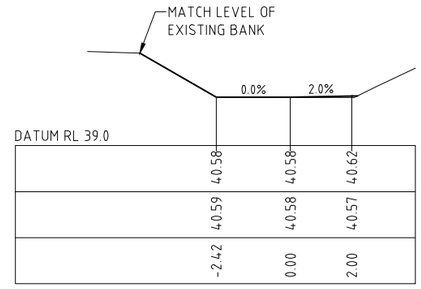
DATUM RL 39.0							
	41.59	41.59	40.79	40.73	40.77	42.78	
	40.80	40.80	40.79	42.56	42.67	42.78	
	-6.33	-4.31	-3.11	0.00	2.00	5.01	

CH 50



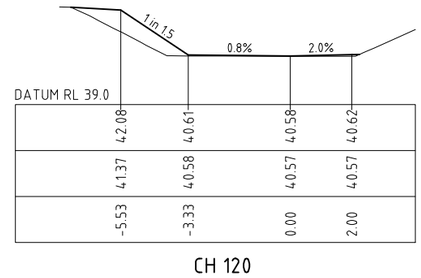
DATUM RL 39.0						
	41.67	41.67	40.87	40.80	40.84	42.43
	40.80	41.66	41.77	42.01	42.23	42.43
	-9.60	-4.31	-3.11	0.00	2.00	4.38

CH 40



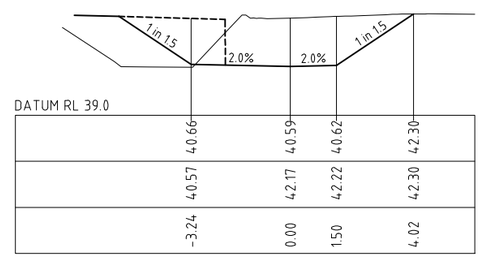
DATUM RL 39.0				
	40.58	40.58	40.62	
	40.59	40.58	40.57	
	-2.42	0.00	2.00	

CH 123.35



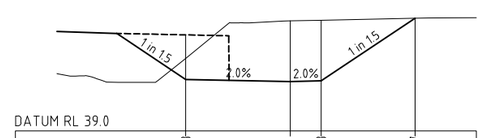
DATUM RL 39.0				
	42.08	40.61	40.58	40.62
	41.37	40.58	40.57	40.57
	-5.53	-3.33	0.00	2.00

CH 120



DATUM RL 39.0					
	40.66	40.59	40.62	42.30	
	40.57	42.17	42.22	42.30	
	-3.24	0.00	1.50	4.02	

CH 110



DATUM RL 39.0					
	40.68	40.61	40.63	42.67	
	41.36	42.59	42.61	42.67	
	-3.42	0.00	1.00	4.07	

CH 100

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	AG

SCALES
1 : 100 FULL SIZE A1

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT
NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS
northwestraillink
salini impregilo
WorleyParsons resources & energy

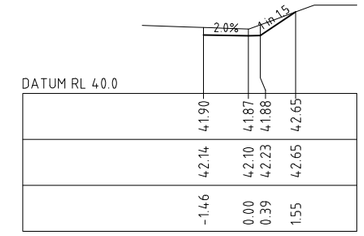
DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

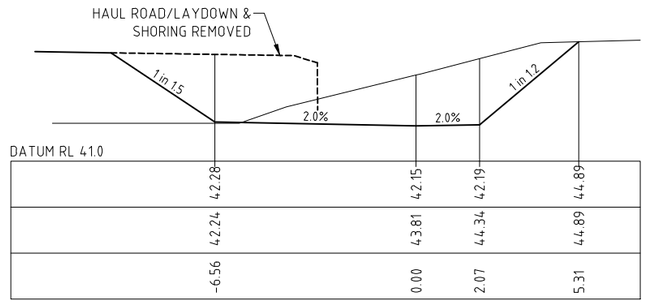
KELLYVILLE CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
CADDIES CREEK AT TRIBUTARY 5 & ELIZABETH MACARTHUR CREEK
DESIGN CROSS SECTIONS

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

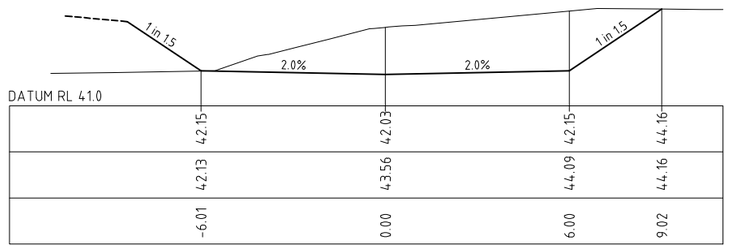
NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852806 | NWRL REV. 01



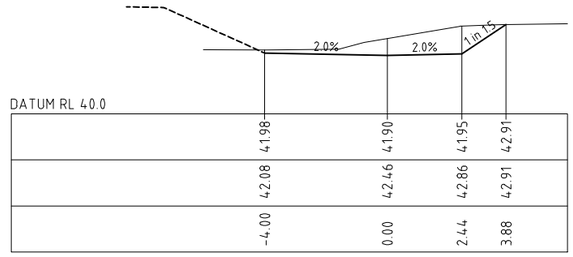
CH 120



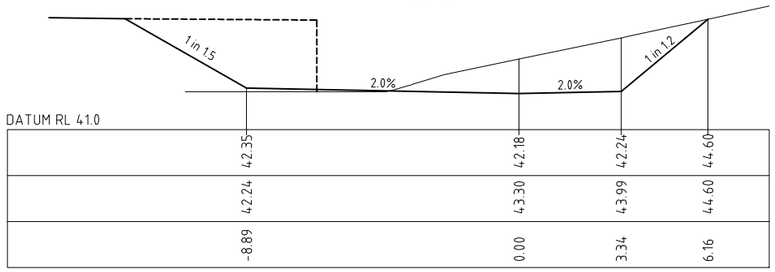
CH 30



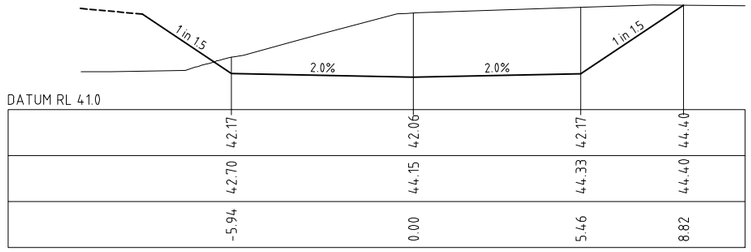
CH 70



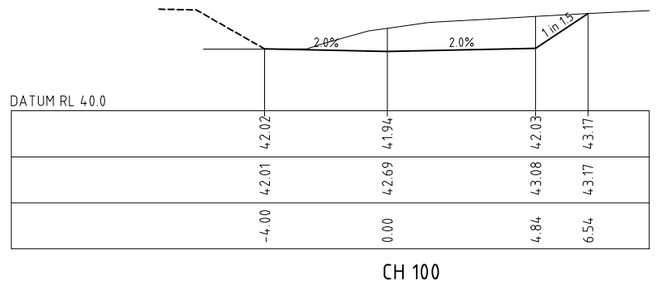
CH 110



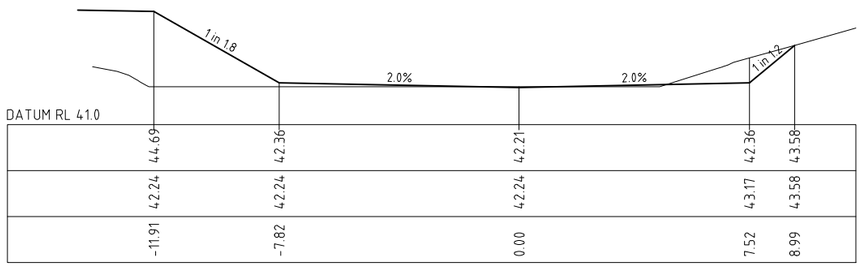
CH 20



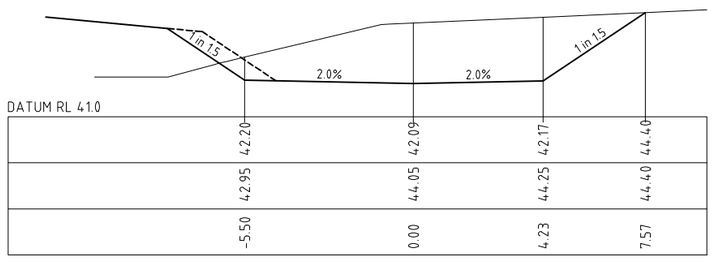
CH 60



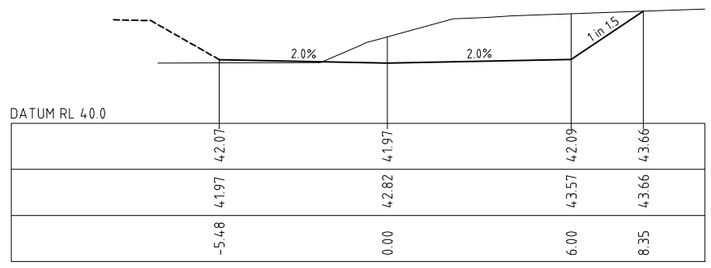
CH 100



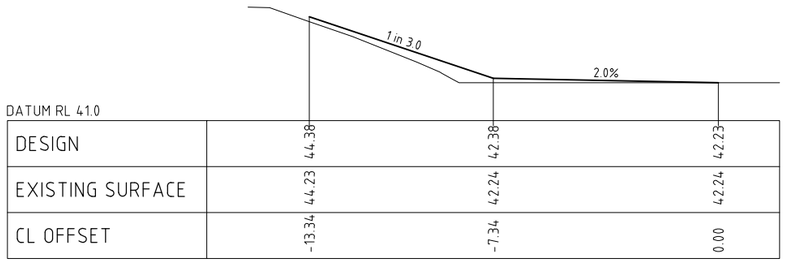
CH 10



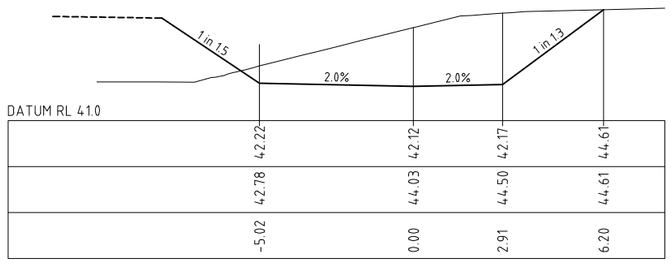
CH 50



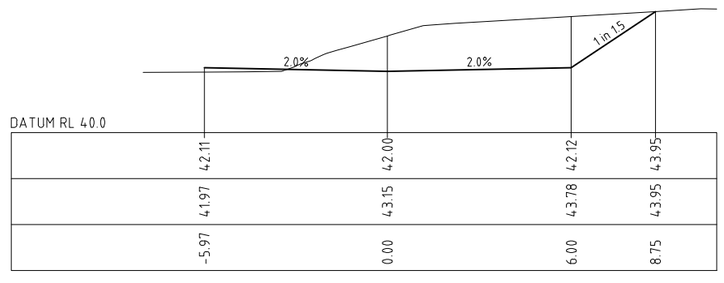
CH 90



CH 1



CH 40



CH 80

FOR CONSTRUCTION

REV.	BY	DATE	DESCRIPTION	APPD.
01	PBC	02.10.15	ASSURED FOR CONSTRUCTION	AG
A	PBC	18.09.15	ISSUED FOR FINAL DESIGN DOCUMENTATION	

SCALES 1 : 100 FULL SIZE A1

CLIENT NSW GOVERNMENT Transport for NSW

SERVICE PROVIDERS northwestraillink; salini impregilo; WorleyParsons resources & energy

DRAWN PHILLIP CORNISH
DESIGNED JOSH ATKINSON
DRG CHECK ANDREW GILHAM
DESIGN CHECK WARICK HONOUR
APPROVED ANDREW GILHAM

NORTH WEST RAIL LINK

ROUSE HILL CONSTRUCTION AREA 2
CREEK DIVERSION WORK - PERMANENT WORKS
TRIBUTARY 4
DESIGN CROSS SECTIONS

STATUS: ASSURED FOR CONSTRUCTION | SHEET OF | ©

NWRL Drg No. NWRLSVC-IWP-SVC-DN-DWG-852807 | NWRL REV. 01

A1 Original | Co-ordinate System: MGA Zone 56 | Height Datum: A.H.D. | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

100mm AT FULL SIZE Plot Date: 01/10/15 - 18:17 Cad File: W:_InfrastructureProjects\301015035\2 - NWRL Haul Road\12.0 Drawings\Drgs\CIVIL\NWRLSVC-IWP-SCV-DN-DWG-852806_01.dwg

Appendix D. **WORKS AS EXECUTED FLOOD IMPACT ASSESSMENT**

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EcoNomics

MEMORANDUM

TO	Antonio Animato
FROM	Warick Honour / Edmund Han
DATE	25th August 2017
PROJECT	NWRL Surface and Viaduct Civil Works
SUBJECT	Flood Impact Assessment for Creek Channel Diversions (Work As Executed)

1 INTRODUCTION

In February and July 2016, WorleyParsons prepared a Flood Impact Assessment on behalf of ISJV for the portion land in the North West Rail Link Project that is owned by Sydney Water. This Flood Impact Assessment was included in the ISJV Works Plan submitted to Transport for NSW (*TfNSW*) and Sydney Water. In July 2017, ISJV requested WorleyParsons to prepare a revised Flood Impact Assessment for the North West Rail Link creek channel diversions between Piers 46 and 78, taking into account the works as executed by ISJV. The following memorandum documents the results of latest flood modelling completed by WorleyParsons to assess the Work as Executed (WAE) conditions at the North West Rail Link creek channel diversions between Piers 46 and 78.

WAE final survey data of the creek channel diversion was provided to WorleyParsons by ISJV on 25th August 2017. This survey data was used to update the two-dimensional hydrodynamic TUFLOW model of the creek channel diversions near the confluence of Caddies Creek and Elizabeth MacArthur Creeks, and at Tributary 4.

2 IMPACT OF WORKS AS EXECUTED

Modifications to the Flood Model

The TUFLOW flood model was previously used to simulate the existing (base) flooding conditions along Caddies Creek and its tributaries.

This model was updated to incorporate WAE survey data to assess the flood impacts that result from the works completed near the confluence of Caddies Creek and Elizabeth MacArthur Creek, and at Tributary 4. Specifically, the works include the following:

- Creek channel diversions;
- Rock-lining of channels;
- Constructed viaduct piers;
- Bio-swale channels;
- Retention of some sections of haul road;
- Fences.

The WAE drawings are provided in **Attachment A**. The flood model was then used to assess the impacts of the WAE conditions on flood levels and velocities for the 20 year and 100 year ARI events, and the Probable Maximum Flood (PMF).

Flood Level Impacts Associated with the Works as Executed

Flood level impact mapping is shown in **Figures 2.1** to **2.6** for the 20 year and 100 year ARI events and the PMF.

Near the confluence of Caddies Creek and Elizabeth MacArthur Creek, the works are expected to cause minor increases in flood level of up to 50 mm in the 20 year and 100 year ARI events, adjacent to the properties at Swann Place and Austen Place. While there are increases in flood levels, a sufficient freeboard of greater than 500 mm to these properties is maintained. There is a localised increase in flood levels of up to 110 mm expected at the southern end of the haul road beside the T-way in the 100 year ARI event (*refer* **Figure 2.3**). It is understood that the haul roads and fences are required by the Deed for the next phase of the project (*installation of the track, etc.*) and have been retained as little as possible and reshaped to minimise flood impacts. Flood level increases have been moved upstream where the haul road is still present. Flood level increases further downstream (*i.e., near Windsor Road*) have been reduced.

During the PMF, flood level increases are generally 50 mm or less across Old Windsor Road and the T-way, and up to 45 mm at the properties to the east of Caddies Creek. Peak flood level increases across the floodplain are generally 40 mm or less. Localised flood level increases of up to 80 mm occur along the kerbline of Old Windsor Road to the south of Caddies Creek. These are caused by a horizontal shift in the location of the hydraulic jump that forms as PMF floodwaters cascade over the raised road crest. The shift in hydraulic jump location is a result of the downstream increase in flood levels of up to 50 mm (*refer* **Figure 2.5**). The vertical shift in flood levels is generally limited to 50mm apart from at the location of the hydraulic jump. A very localised area of flood level increases of 65 mm also occurs at the edge of the T-Way to the north of Tributary 5.

At Tributary 4, the works are not expected to cause any increase in flood levels across Windsor Road or the T-way during the 20 year and 100 year ARI events. Localised increases in flood levels of up to 300 mm in the 20 year ARI event and 350 mm in the 100 year ARI event are contained within the Tributary 4 channel, and are a function of the relocation of the creek channel as part of the channel diversion works around the viaduct piers; that is, there are new areas of inundation within the realigned channels, while other areas are no longer inundated. The flood level increases within the channel do not propagate onto the adjacent T-way or into adjacent properties.

The increases in flood levels adjacent to the intersection of Windsor Road with Merriville Road are a function of the relocation of the channel in this area. The existing channel has been diverted to the south around Pier 75 and hence the increase in flood levels simply reflects the resultant sheet flow over the raised terrain (*filled channel*) in this area, and does not represent an equivalent increase in flood depth. The impact does not propagate upstream to the T-Way or Windsor Road.

During the PMF the works at Tributary 4 are expected to result in flood level increases across Windsor Road and the T-way of generally less than 20 mm (*refer* **Figure 2.6**). A localised increase in peak flood levels of 100 mm is expected at the T-Way. Other significant increases occur within the channel banks or creek corridor and are caused by the channel diversion works (*channel filling and realignment*). The small increase in flood extent shown adjacent to the Ettamogah Hotel is associated with a flood level increase of less than 10 mm.

Flood Velocity Impacts Associated with the Works as Executed

Flood velocity impact mapping is shown in **Figures 2.7** to **2.12** for the 20 year and 100 year ARI events and the Probable Maximum Flood (*PMF*).

Near the confluence of Caddies Creek and Elizabeth MacArthur Creek flood velocity impacts are generally less than 0.15 m/s in the 20 year and 100 year ARI events. Localised increases of up to 1 m/s are caused by the creek channel diversion works and occur at locations where suitable rock armouring has been installed as a part of the creek channel works in order to minimise scour.

At Tributary 4, flood velocity impacts are generally less than 0.5 m/s in the 20 year and 100 year ARI events. Localised impacts of up to 1 m/s occurs within the relocated creek channels, where suitable rock armour has been installed as a part of the creek channel works to minimise scour.

3 COMPLIANCE WITH SSI-5100 LICENCE CONDITIONS OF APPROVAL

Condition C7:

With respect to flooding, the Minister's Licence Conditions of Approval (SSI-5100) require that the NWRL viaducts, as well as any associated works, be designed, to the extent that is feasible and reasonable, to not worsen the existing flood characteristics in the vicinity of the works. To not worsen is defined as:

- A maximum increase in flood level of not more than 20 mm in the 100 year ARI flood event;
- A maximum increase of not more than 50 mm during the Probable Maximum Flood event;
- A maximum increase in the time of inundation of not more than 1 hour in the 100 year ARI event; and
- Any increase in flow velocity during the 100 year ARI flood event should not increase the potential for soil erosion and scouring.

General

The 20 year and 100 year ARI events and Probable Maximum Floods were modelled as part of the assessment of impacts associated with the Works as Executed. It is understood that the haul road and fences will need to be in operation for a maximum of 5 years following construction completion by ISJV (*as required by TfNSW*).

The work as executed generally shows similar flood level and velocity impacts as previously shown in *Flood Impact Assessment for Creek Channel Diversions (Temporary and Permanent Works),* which was undertaken by WorleyParsons in July 2016. It is understood that the impacts presented in the July 2016 memorandum were approved by TfNSW and Sydney Water as part of ISJV's Works Plan documenting the works in the area.

Impact on 100 Year ARI Flood Levels

Confluence of Caddies Creek and Elizabeth Macarthur Creek
The increases in peak flood levels during the 100 year ARI event upstream of Windsor Road show that the WAE conditions meet the requirements of the Minister's conditions.

The retained sections of haul road and fencing cause flood level increases that exceed the requirements of the approval conditions. It is understood that these haul roads and fences will be removed by the subsequent Contractor. The increases are not expected to increase the number of properties affected by the 100 year ARI flood. More than 500mm height of freeboard is maintained between the peak 100 year ARI flood level and the properties at Fitzroy Place, Swann Place, Austen Place and Lycett Avenue (*typically 0.9 to 1 metre of freeboard is maintained – Refer* **Attachment B**).

Similarly, adequate freeboard is maintained at properties that front to Folkestone Terrace upstream of Old Windsor Road, so there are no additional impacts on residents as a result of the works.

Tributary 4 Site
The Minister's Licence Conditions of Approval are being met upstream of the Tributary 4 crossing at all areas except for immediately at the entrance to the Tributary 4 culvert under Windsor Road. The impacts on flood level and velocity at this location are contained within the channel banks and are the result of the designed redistribution of the flow downstream of Windsor Road around Pier 73.

Downstream of Windsor Road, the impacts on 100 year ARI flood levels are greater than that permitted under the Minister's Conditions, but these are contained within the works/creek corridor.

The Minister's Licence Conditions of Approval refers to the requirement that the NWRL viaduct and associated works be designed to the "extent that is feasible and reasonable", to not worsen existing flood characteristics in the vicinity of the works.

Where there are minor exceedances of the Condition C7 requirements, the viaduct piers and the associated creek diversion works have been designed as much as possible, to the extent that is feasible and reasonable, to reduce and contain flood impacts within the creek corridor. The exceedances predominantly occur where creek channel diversion works were designed to minimise upstream flood impacts, and are the result of the displacement of floodwaters from the existing channel alignment to the diverted channel alignment.

Impact on Probable Maximum Flood Levels

Confluence of Caddies Creek and Elizabeth Macarthur Creek
The flood level increases of up to 50 mm across Old Windsor Road and the T-way and impacts of up to 45 mm at the properties to the east of Caddies Creek are meeting the requirements of the Minister's Conditions.

Localised minor exceedances occur along the Old Windsor Road kerbline and on the T-way. These localised exceedances are unlikely to worsen the existing trafficability of these roads, as peak flood depths are about 1.0 m under pre-construction conditions.

Of primary concern during the PMF is the ability of residents to evacuate safely, including safe passage of vehicles along evacuation routes. The impact of the permanent works will not affect the execution of any existing evacuation arrangements during such an extreme event.

Tributary 4 Site

The flood level impacts at Windsor Road and the T-way are generally less than 20 mm, and hence meet the requirements of the Minister's Conditions. The exception is a very localised area of 100 mm increase on the T-Way, which is considered relatively minor given existing PMF depths are in excess of 0.8 m at this location. The impact of the works are not expected to affect the execution of any existing evacuation arrangements during such an extreme event

Impact on Duration of 100 Year ARI Flooding

Flood level hydrographs have been extracted from the TUFLOW modelling results for base case existing conditions and the WAE scenario in order to demonstrate that the proposed works will not have any significant impact on the duration of flooding.

The hydrographs have been extracted upstream and downstream of the sites at Caddies Creek / Elizabeth Macarthur Creek and Tributary 4 and are shown below in **Figures 3.1** to **3.4**.

As shown in all hydrographs, there are no locations in which the time of inundation during the 100 year ARI event increases by more than 1 hour as a result of the works. Therefore, the Minister's Condition C7 is being met in this regard.

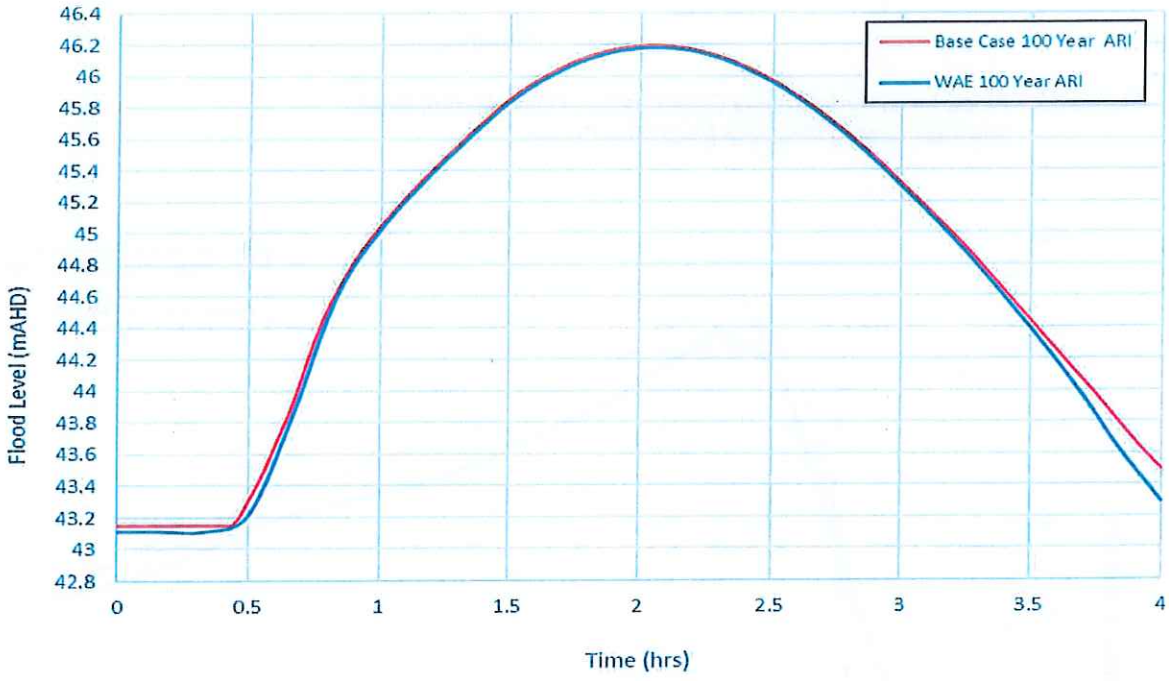

Figure 3.1 – Flood Level Hydrographs Upstream of Old Windsor Road (Caddies Creek / Elizabeth Macarthur Creek)

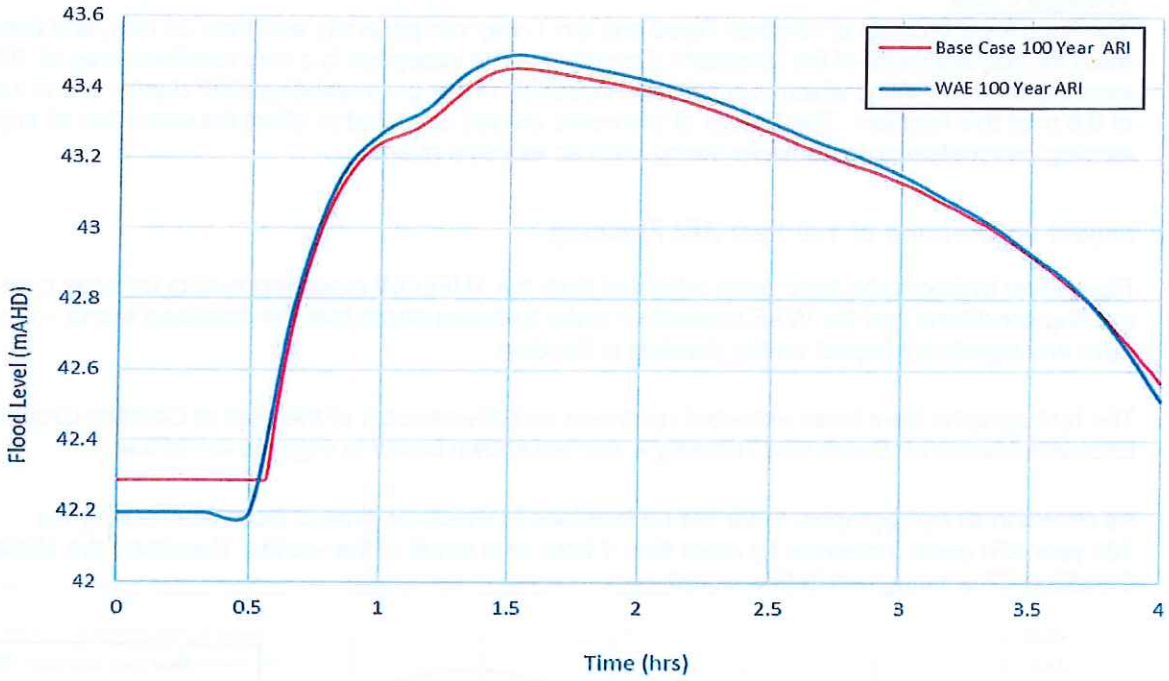

Figure 3.2 – Flood Level Hydrographs Downstream of Old Windsor Road (Caddies Creek / Elizabeth Macarthur Creek)

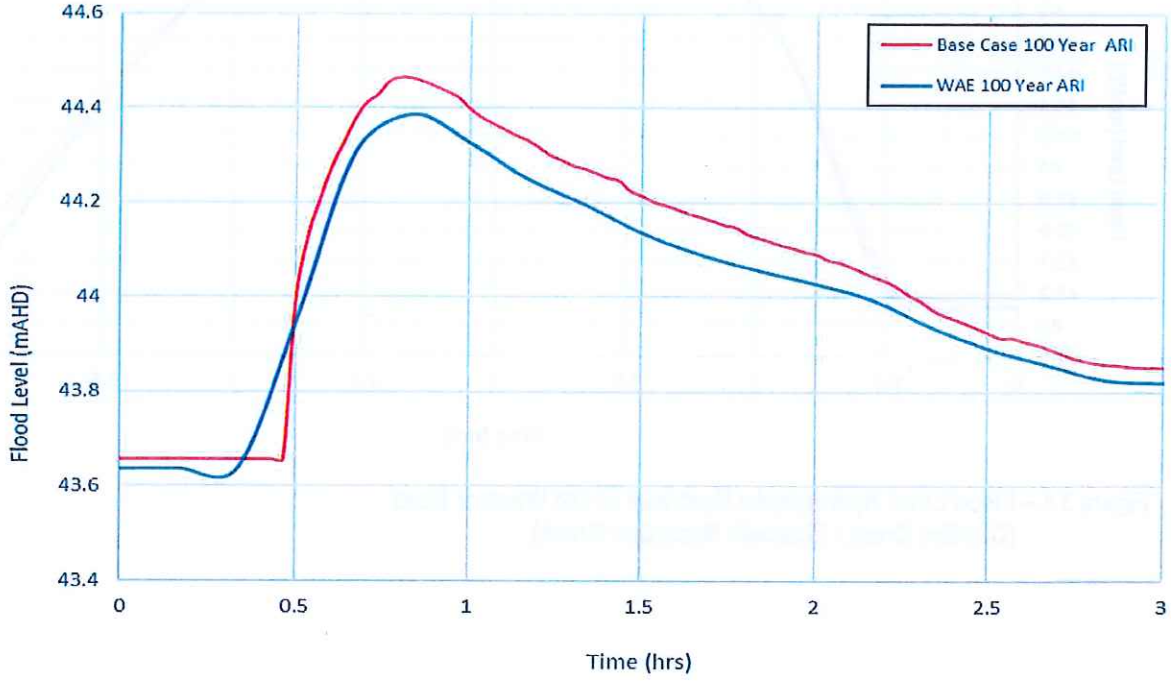

Figure 3.3 – Flood Level Hydrographs Upstream of Windsor Road (Tributary 4 Site)

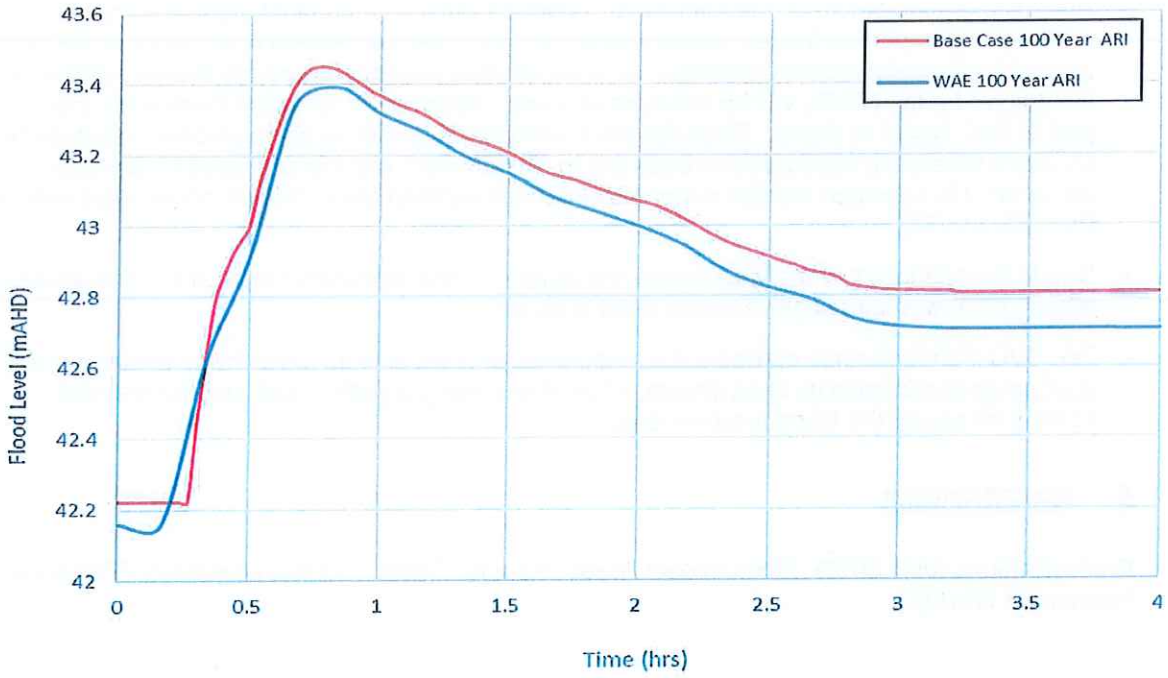

Figure 3.4 – Flood Level Hydrographs Downstream of Windsor Road (Tributary 4 Site)

Impact on 100 Year ARI Flood Velocities

As discussed above, there are predicted to be localised areas of increased flow velocity during the 100 year ARI flood due to the works as executed.

These increases are expected to occur within the creek corridor and across the site of the proposed works. Appropriate measures have been incorporated into the stream diversion works in order to minimise the potential for scour. These measures include sections of concrete channel-lining and rock protection works according to Sydney Water rock specifications.

Accordingly, the potential for soil erosion and scouring is not expected to be increased and the Minister's Condition C7 is being met in this regard.

4 CONCLUSION

The Minister's Licence Conditions of Approval refer to the need to design the NWRL viaducts, as well as any associated works, "to the extent that is feasible and reasonable", such that flood characteristics are not worsened in the vicinity of the works. It is considered that the works as executed conditions have met the requirements of the Conditions of Approval given the following context:

- The predicted flood impacts are not expected to result in a significant impact to nearby residential properties or on the trafficability of roads during flood events;
- The predicted flood impacts are contained mostly within the creek corridor and are predominantly a result of the channel diversion works;

- Any minor exceedances of the Minister's Conditions outside of channel areas are caused by the retained haul road and fences, which will be removed after completion of the work of the NWRL Project by the subsequent Contractor. It is understood that the Temporary Works built by the SVC Contractor for the NWRL will be removed at a later stage by the following Contractor, OpCo, as part of their scope of works. Once the pre-development terrain levels have been reinstated in locations where the residual haul roads are to be removed, and the site fences have been removed, it is expected that the minor exceedances outlined above will no longer exist between Piers 48 and 78.
- Due to the alignment of the viaduct and the location of the associated piers, it is not feasible to redesign the works to achieve lesser flood impacts;
- The SVC Contractor has carried out a reasonable amount of work to re-shape the temporary haul road so as to minimise its flood impact, while also leaving a usable haul road for the next Contractor as per the Deed requirements.

5 REFERENCES

WorleyParsons (*July 2016*), *Flood Impact Assessment for Creek Channel Diversions (Temporary and Permanent Works)*.

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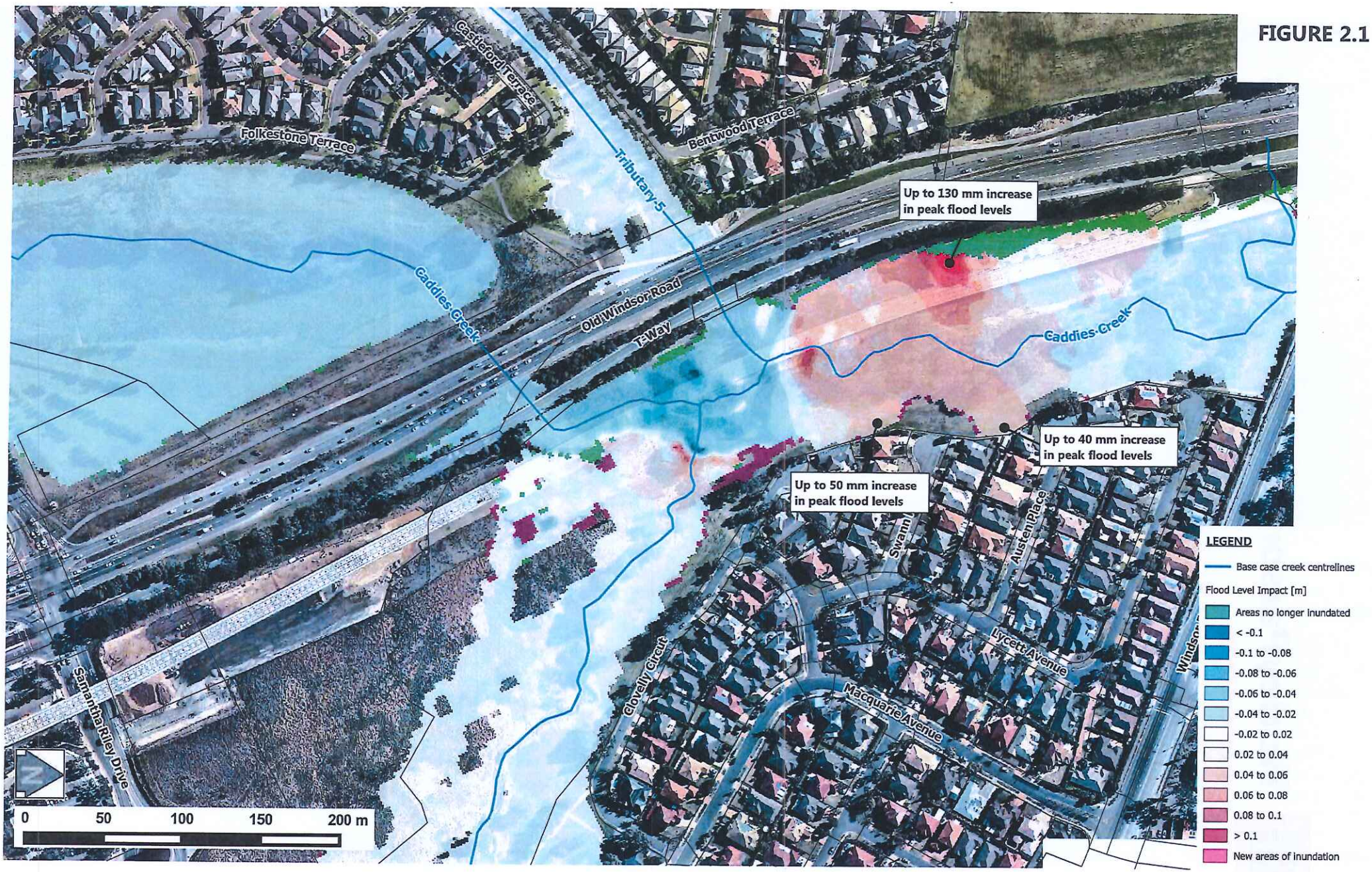
FIGURES

25th August 2017

FIGURE 2.1



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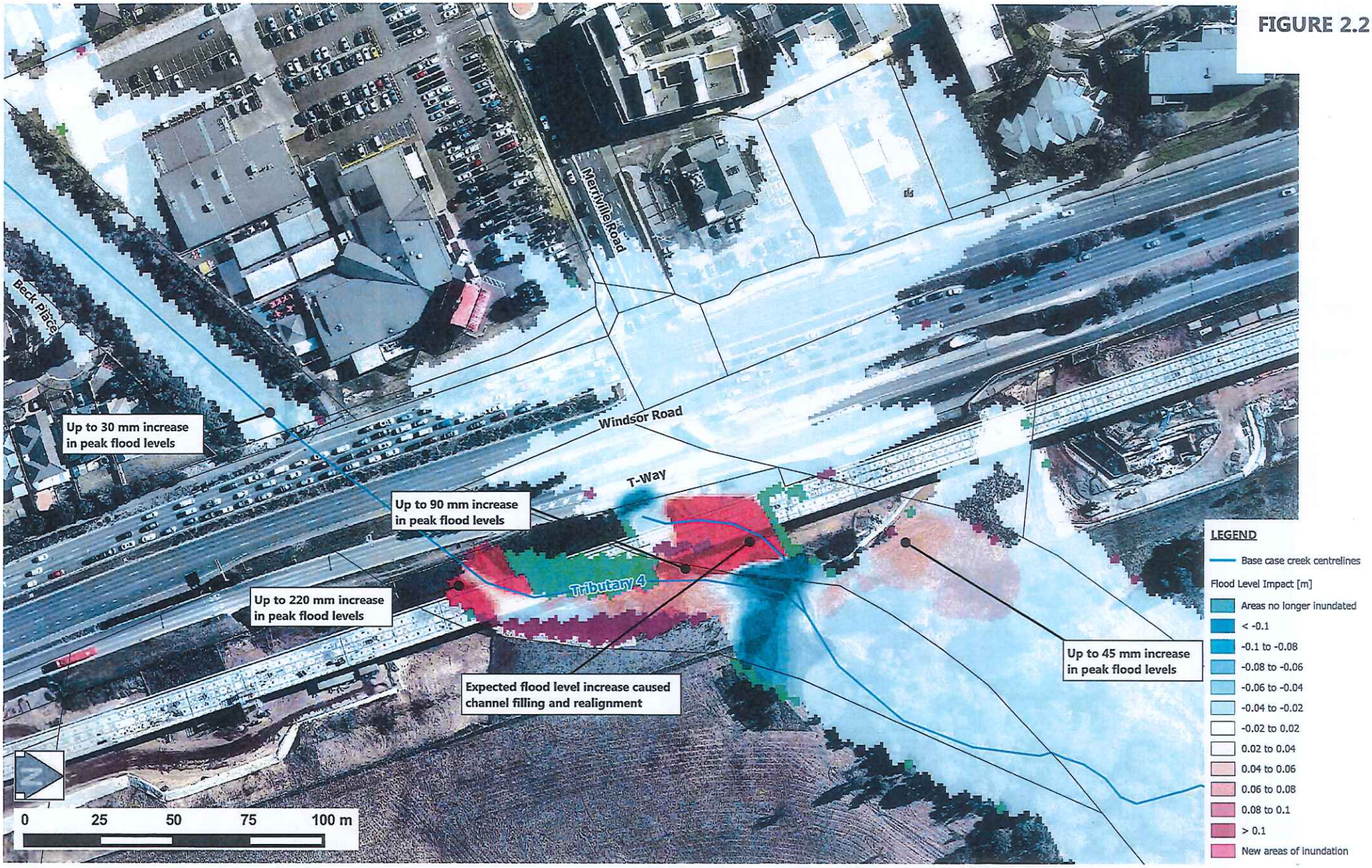
2017-08-18 WAE - Fig 2.1 WAE 20yr Level Impacts [Caddies Ck]
TUFLOW All Results 2017-08-15.qgs

FLOOD IMPACT MAPPING FOR THE 20 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[CADDIES CREEK & ELIZABETH MACARTHUR CREEK]

FIGURE 2.2



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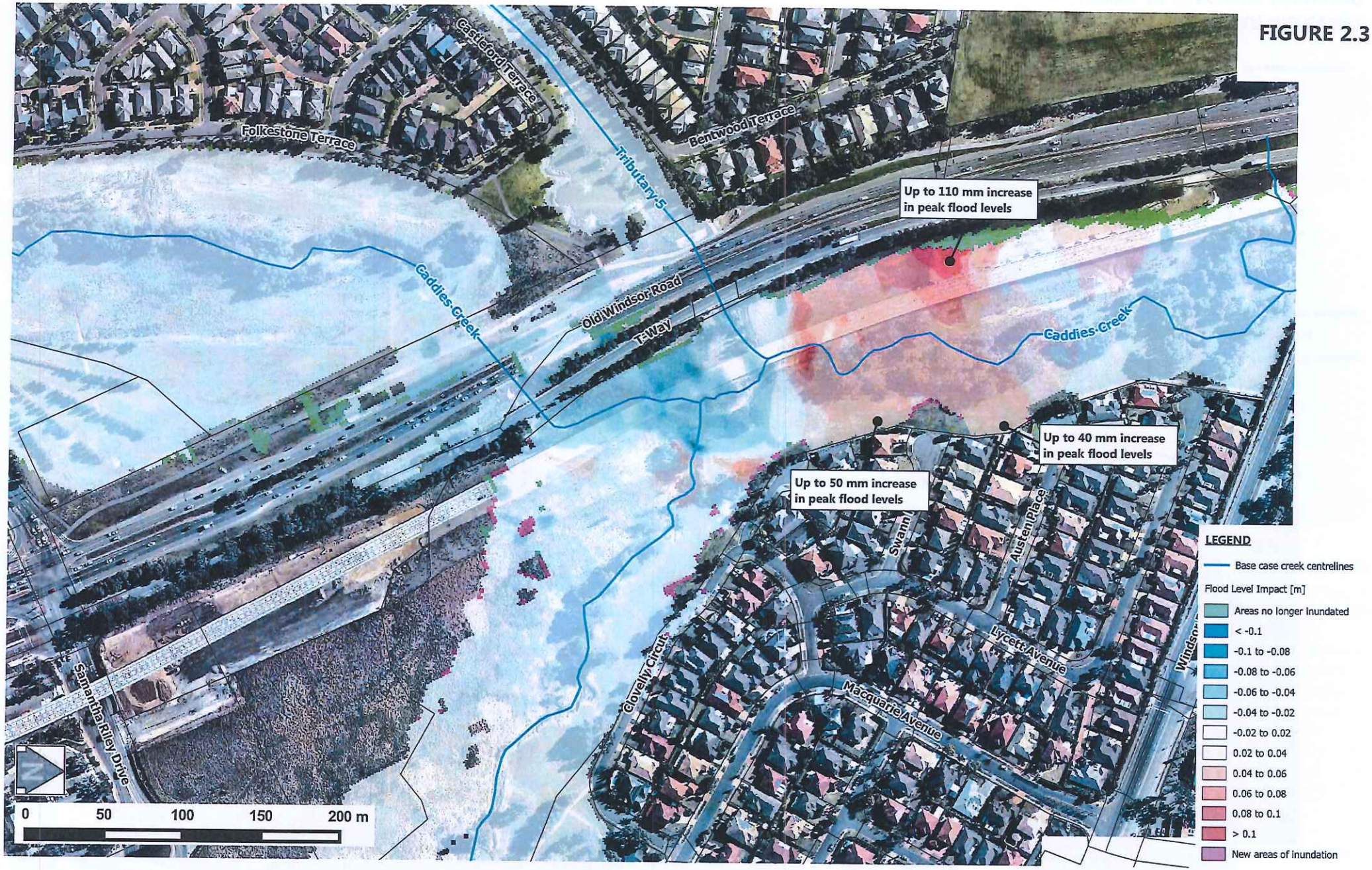
2017-08-15 PropPostWorks - Fig 2.2 Proposed Post Works [Trib 4]

FLOOD IMPACT MAPPING FOR THE 20 YEAR ARI EVENT WORK AS EXECUTED SCENARIO [TRIBUTARY 4]

FIGURE 2.3



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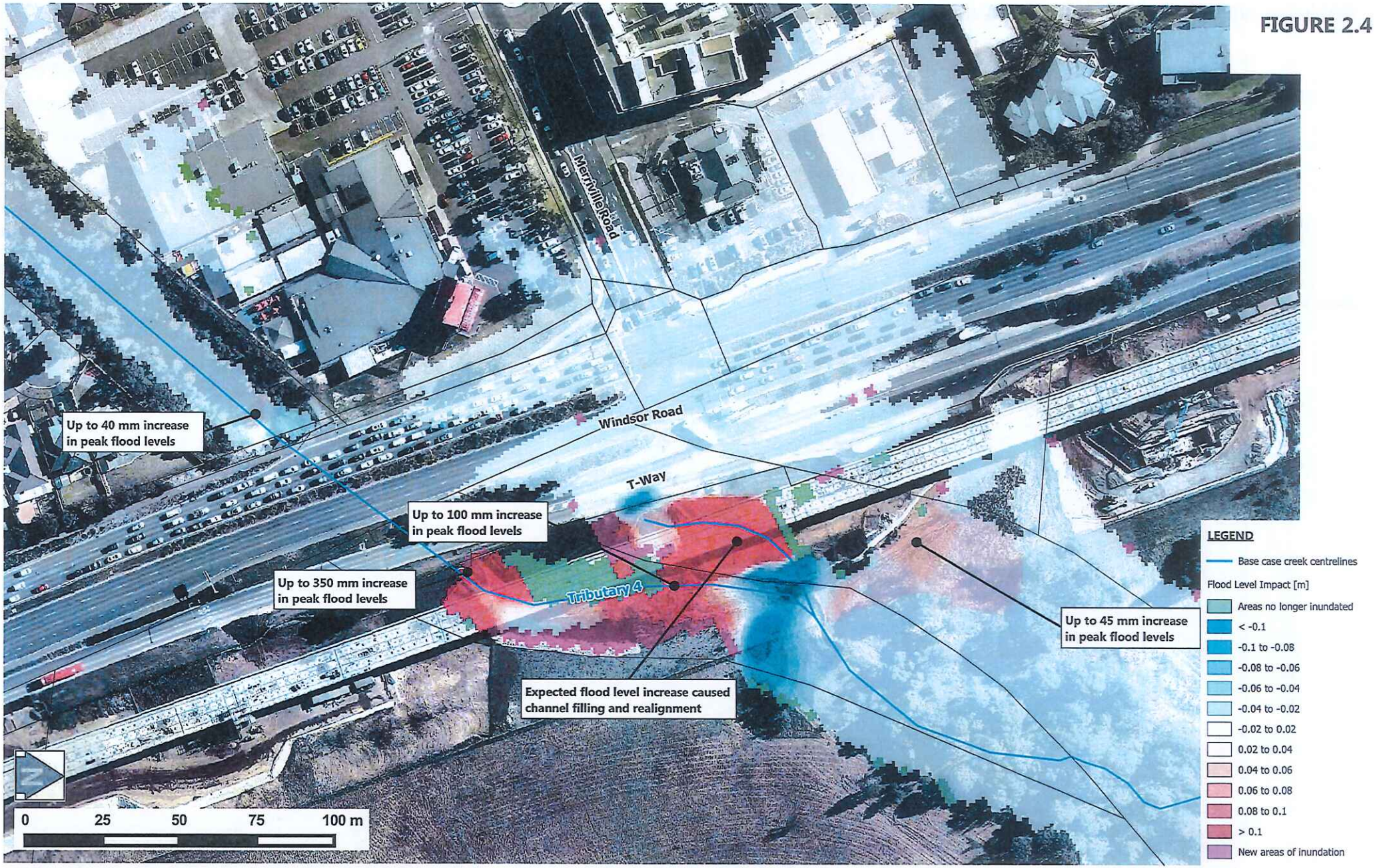
2017-08-18 WAE - Fig 2.3 WAE 100yr Level Impacts [Caddies Ck]
TUFLOW All Results 2017-08-15.oas

FLOOD IMPACT MAPPING FOR THE 100 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[CADDIES CREEK & ELIZABETH MACARTHUR CREEK]

FIGURE 2.4



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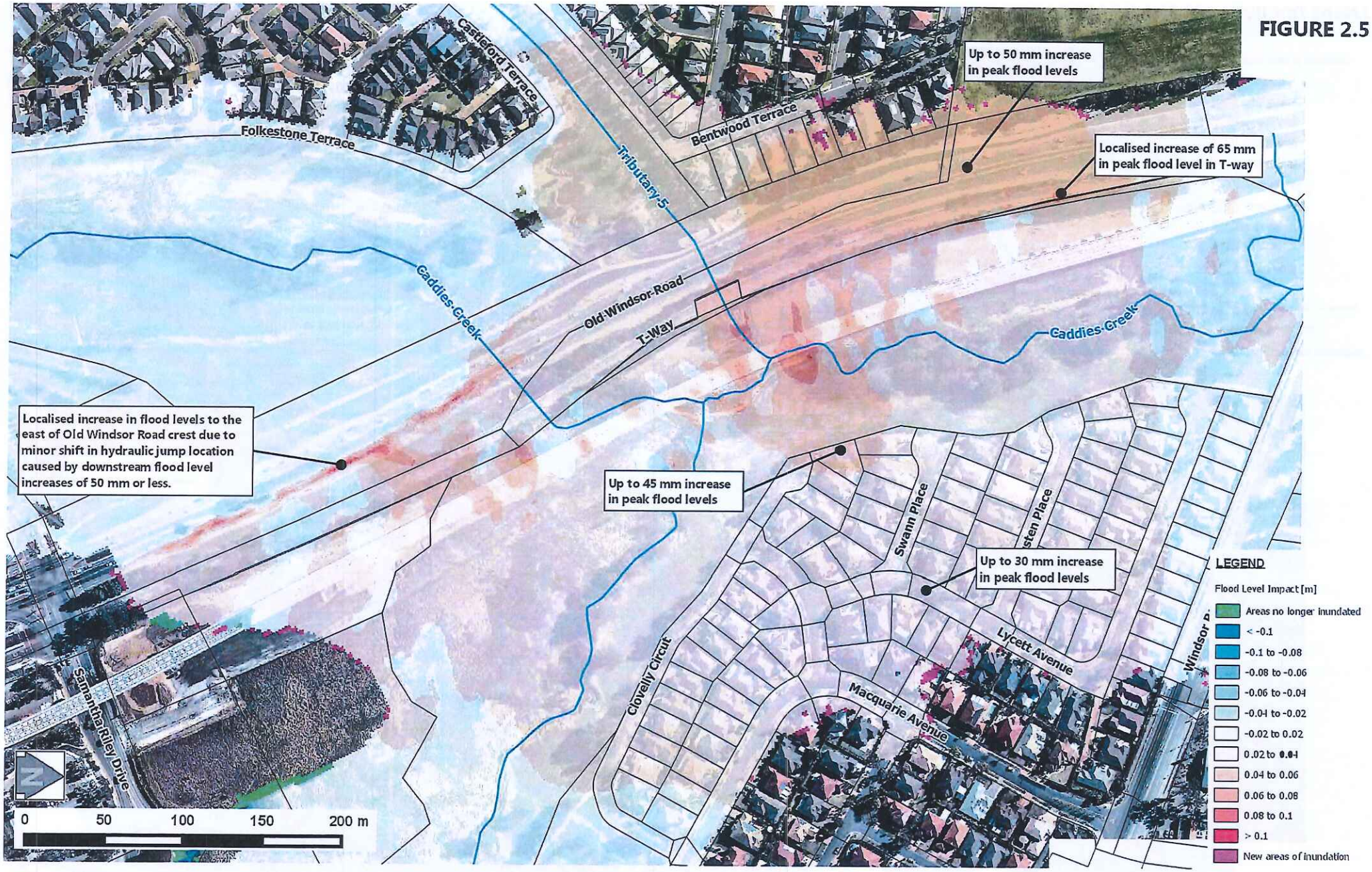
2017-08-18 WAE - Fig 2.4 WAE 100yr Level Impacts [Trib 4]

FLOOD IMPACT MAPPING FOR THE 100 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[TRIBUTARY 4]

FIGURE 2.5



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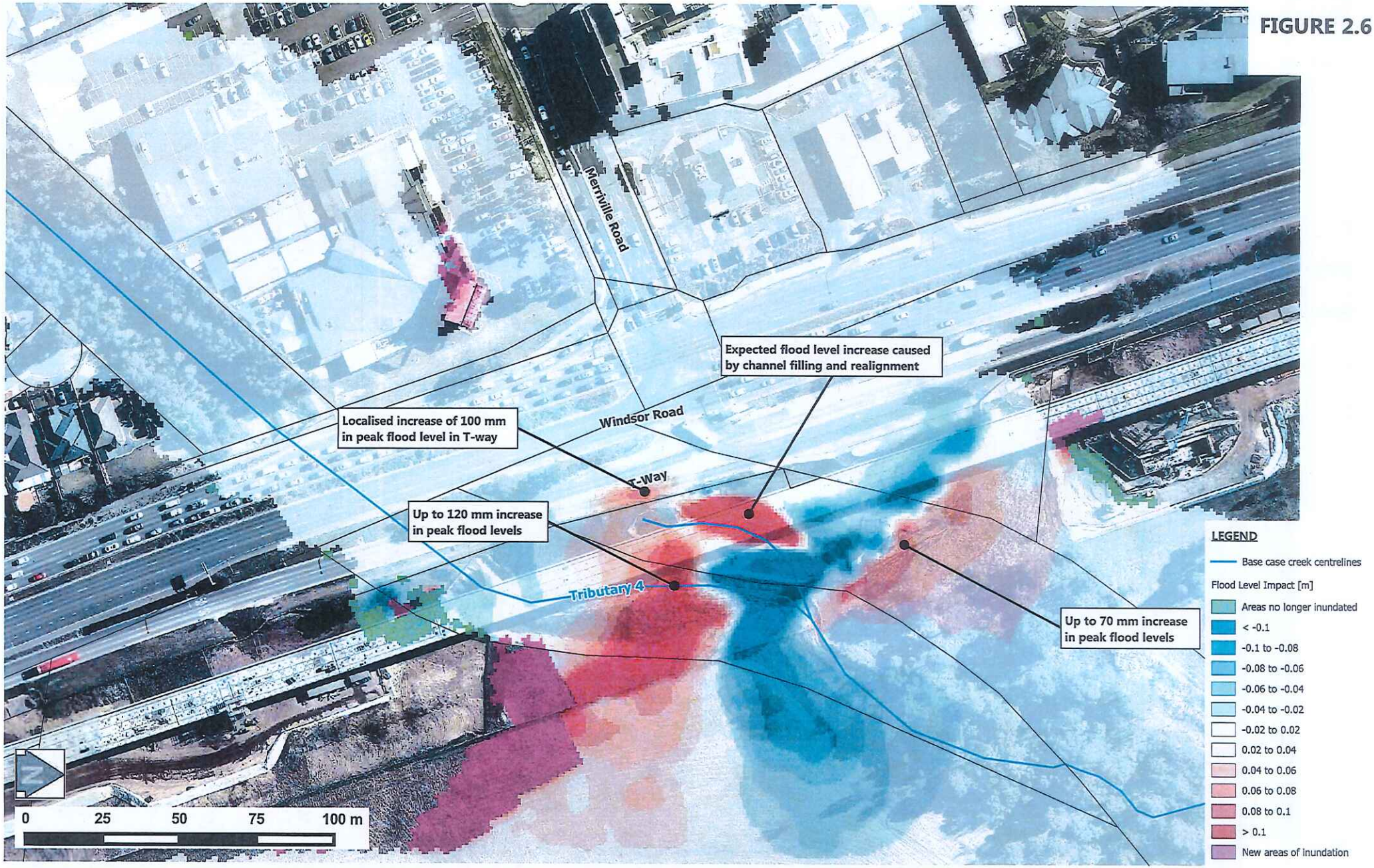
2017-08-18 WAE - Fig 2.5 WAE PMF Level Impacts [Caddies Ck]
TUFLOW All Results 2017-08-15.qgs

FLOOD IMPACT MAPPING FOR THE PROBABLE MAXIMUM FLOOD
WORK AS EXECUTED SCENARIO
[CADDIES CREEK & ELIZABETH MACARTHUR CREEK]

FIGURE 2.6



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2017-08-18 WAE - Fig 2.6 WAE PMF Level Impacts [Trib 4]
TUFLOW All Results 2017-08-15.gpx

FLOOD IMPACT MAPPING FOR THE PROBABLE MAXIMUM FLOOD WORK AS EXECUTED SCENARIO [TRIBUTARY 4]

FIGURE 2.7

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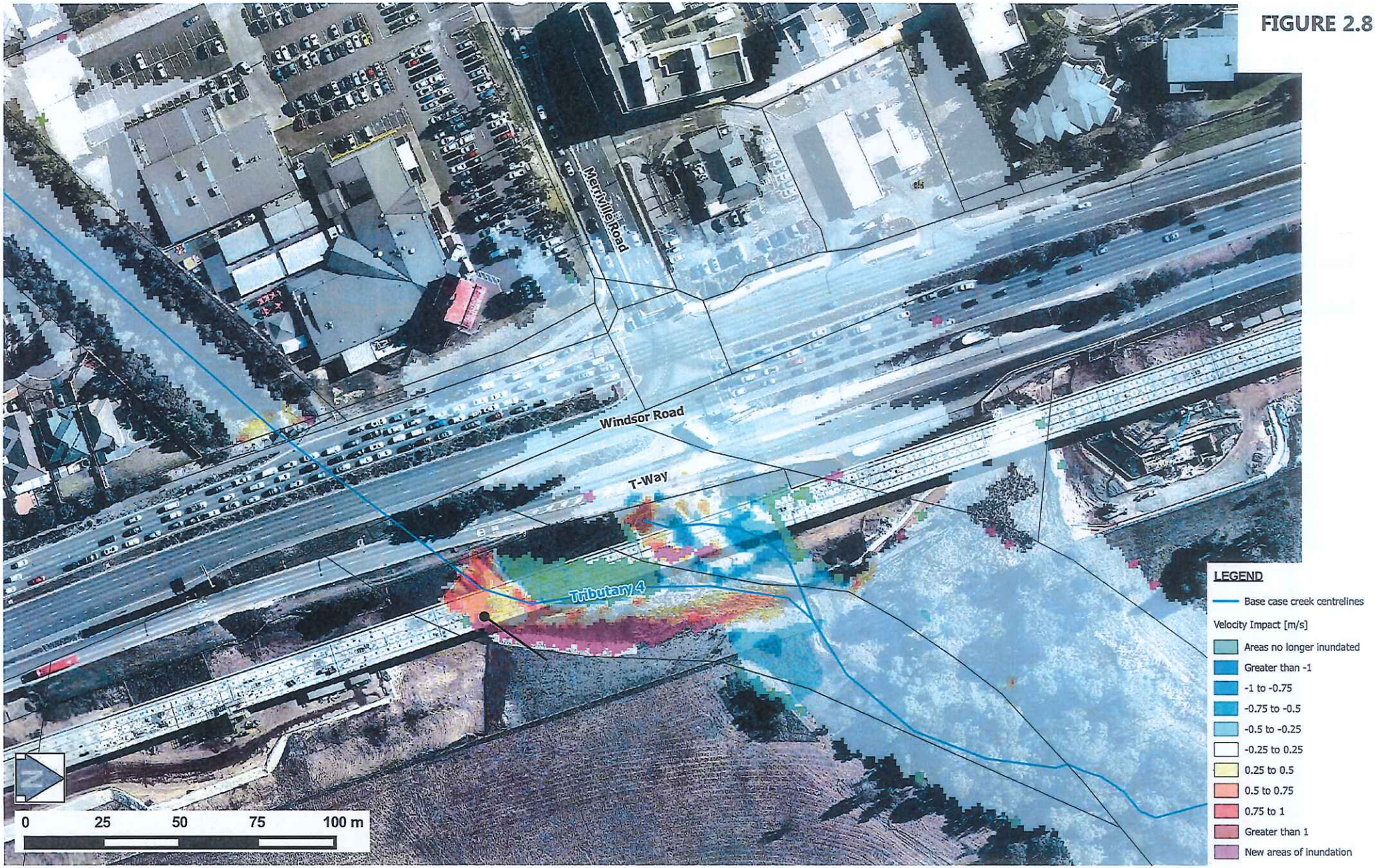
2017-08-18 WAE - Fig 2.07 WAE 20yr Velocity Impacts [Caddies Ck]
TUFLOW 4B Results 2017-08-15.qgs

FLOW VELOCITY IMPACT MAPPING FOR THE 20 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[CADDIES CREEK & ELIZABETH MACARTHUR CREEK]

FIGURE 2.8



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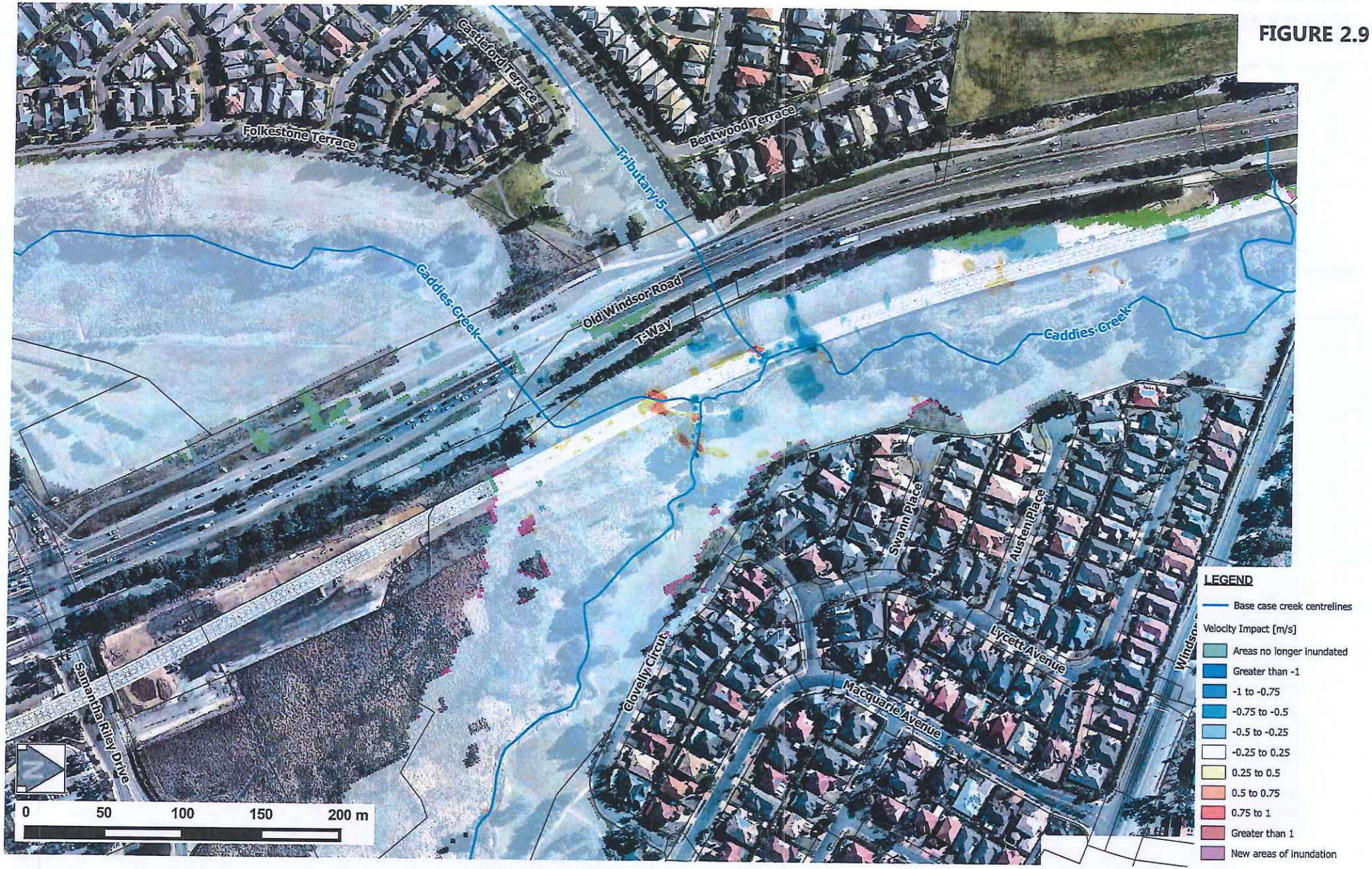
2017-08-18 WAE - Fig 2.8 WAE 20yr Velocityl Impacts [Trib 4]

FLOW VELOCITY IMPACT MAPPING FOR THE 20 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[TRIBUTARY 4]

FIGURE 2.9



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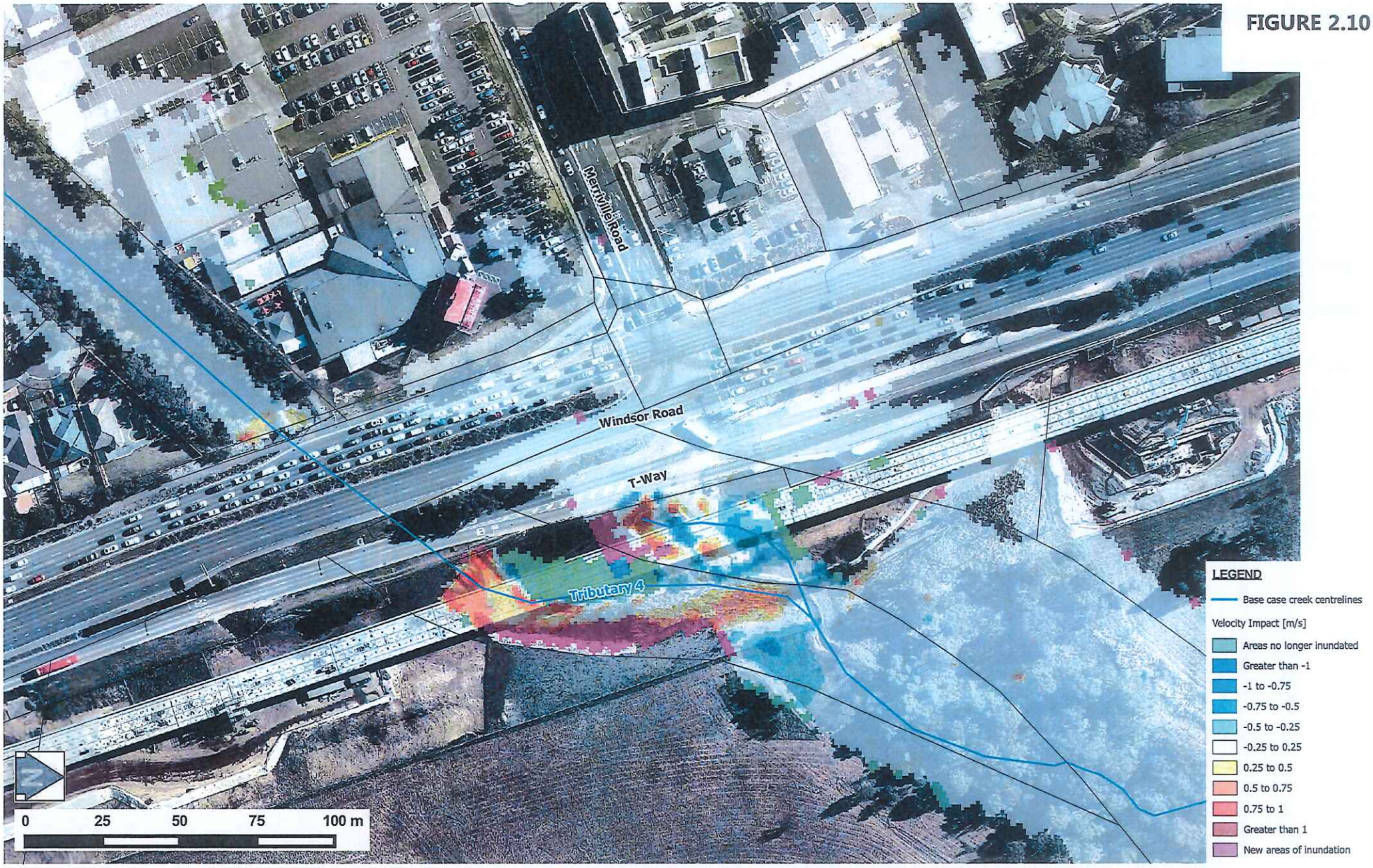
2017-08-18 WAE - Fig 2.9 WAE 100yr Level Impacts [Caddies Ck]
TUFLOW All Results 2017-08-15.qgs

FLOW VELOCITY IMPACT MAPPING FOR THE 100 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[CADDIES CREEK & ELIZABETH MACARTHUR CREEK]

FIGURE 2.10



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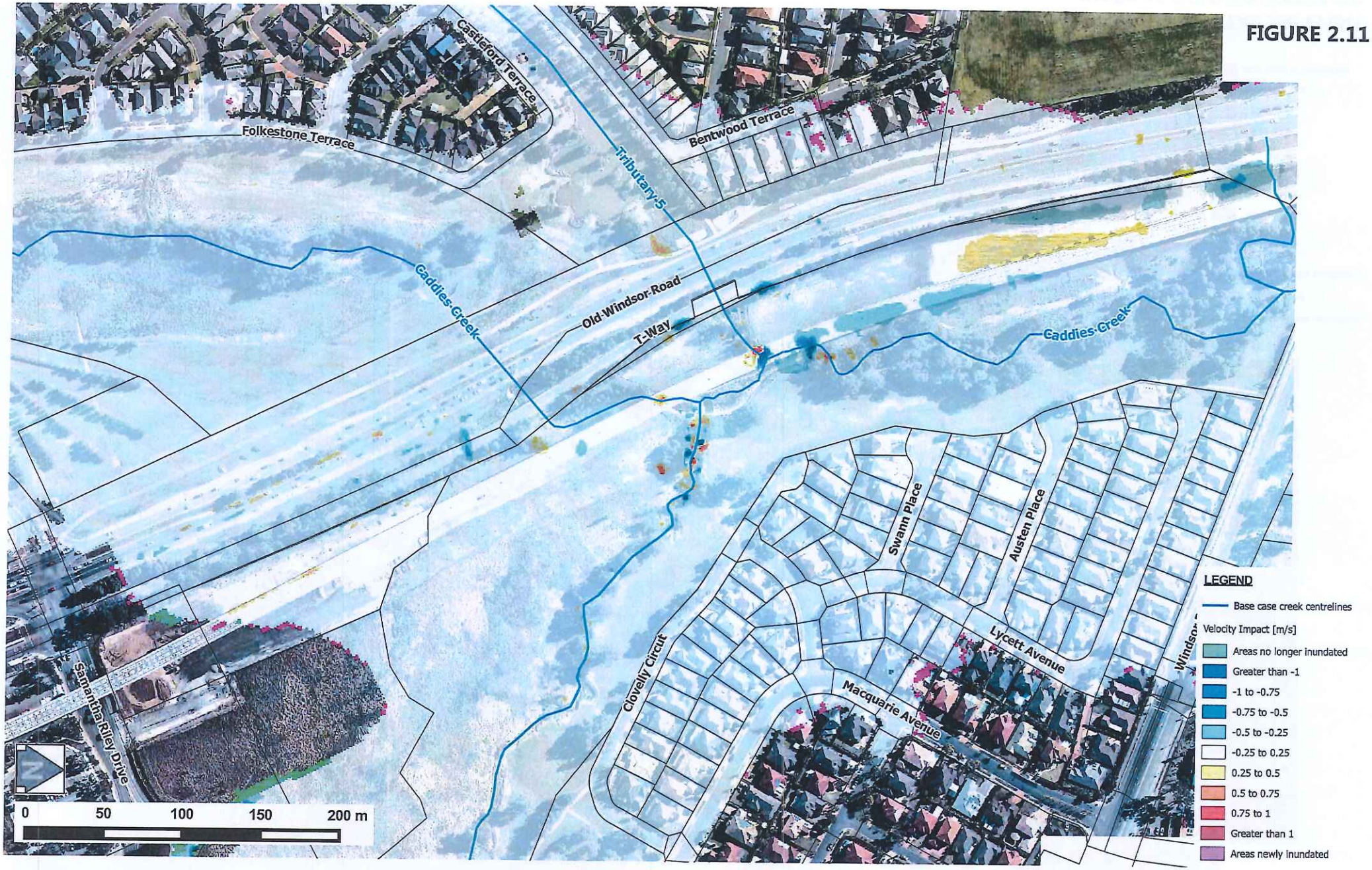
2017-08-18 WAE - Fig 2.10 WAE 100yr Velocity Impacts [Trib 4]
TUFLOW All Results 2017-08-15.gpg

FLOW VELOCITY IMPACT MAPPING FOR THE 100 YEAR ARI EVENT
WORK AS EXECUTED SCENARIO
[TRIBUTARY 4]

FIGURE 2.11



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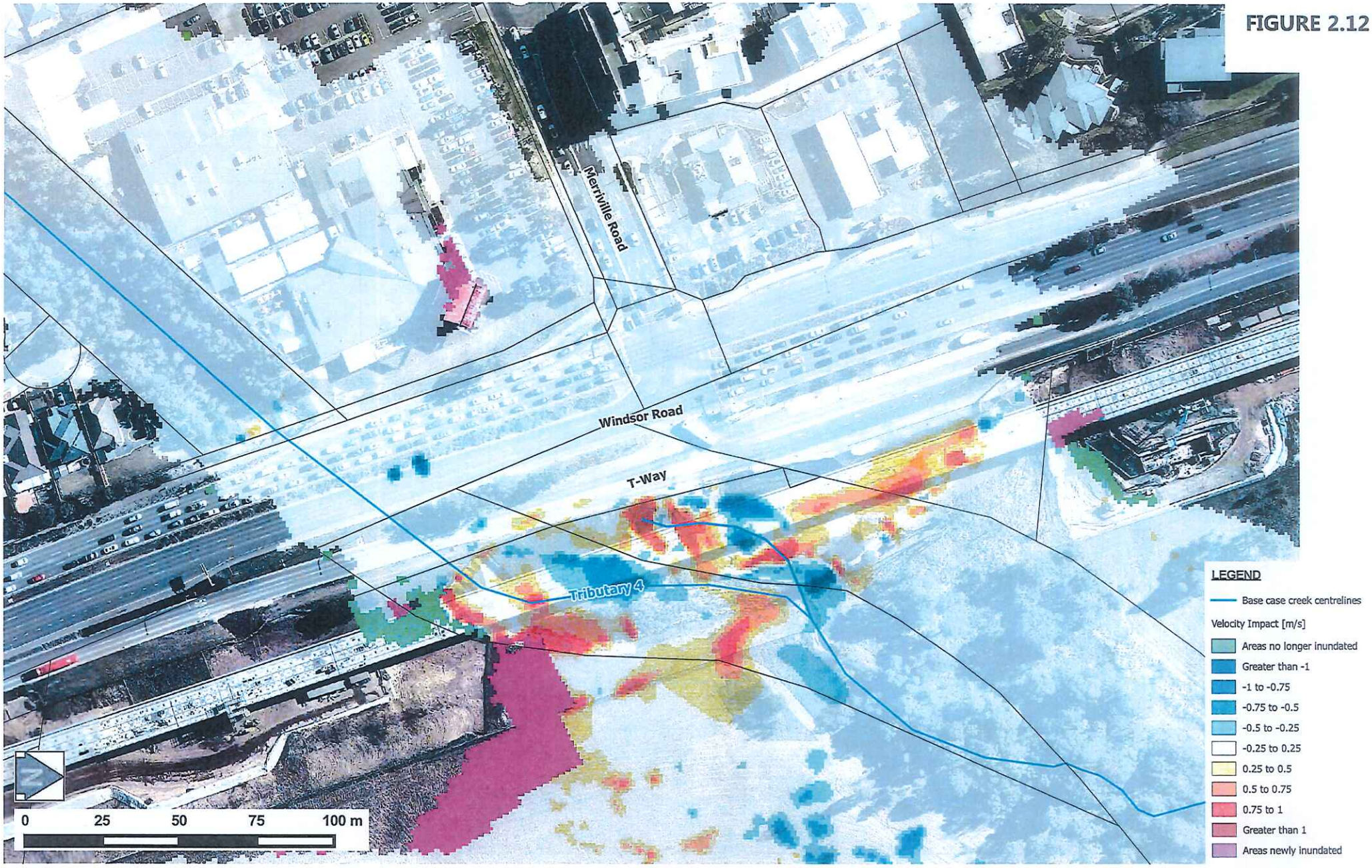
2017-08-18 WAE - Fig 2.11 WAE PMF Velocity Impacts [Caddies Ck]
TUFLOW All Results 2017-08-15.qgs

FLOW VELOCITY IMPACT MAPPING FOR THE PROBABLE MAXIMUM FLOOD
WORK AS EXECUTED SCENARIO
[CADDIES CREEK & ELIZABETH MACARTHUR CREEK]

FIGURE 2.12



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2017-08-18 WAE - Fig 2.12 WAE PMF Velocity Impacts [Trib 4]

FLOW VELOCITY IMPACT MAPPING FOR THE PROBABLE MAXIMUM FLOOD
WORK AS EXECUTED SCENARIO
[TRIBUTARY 4]

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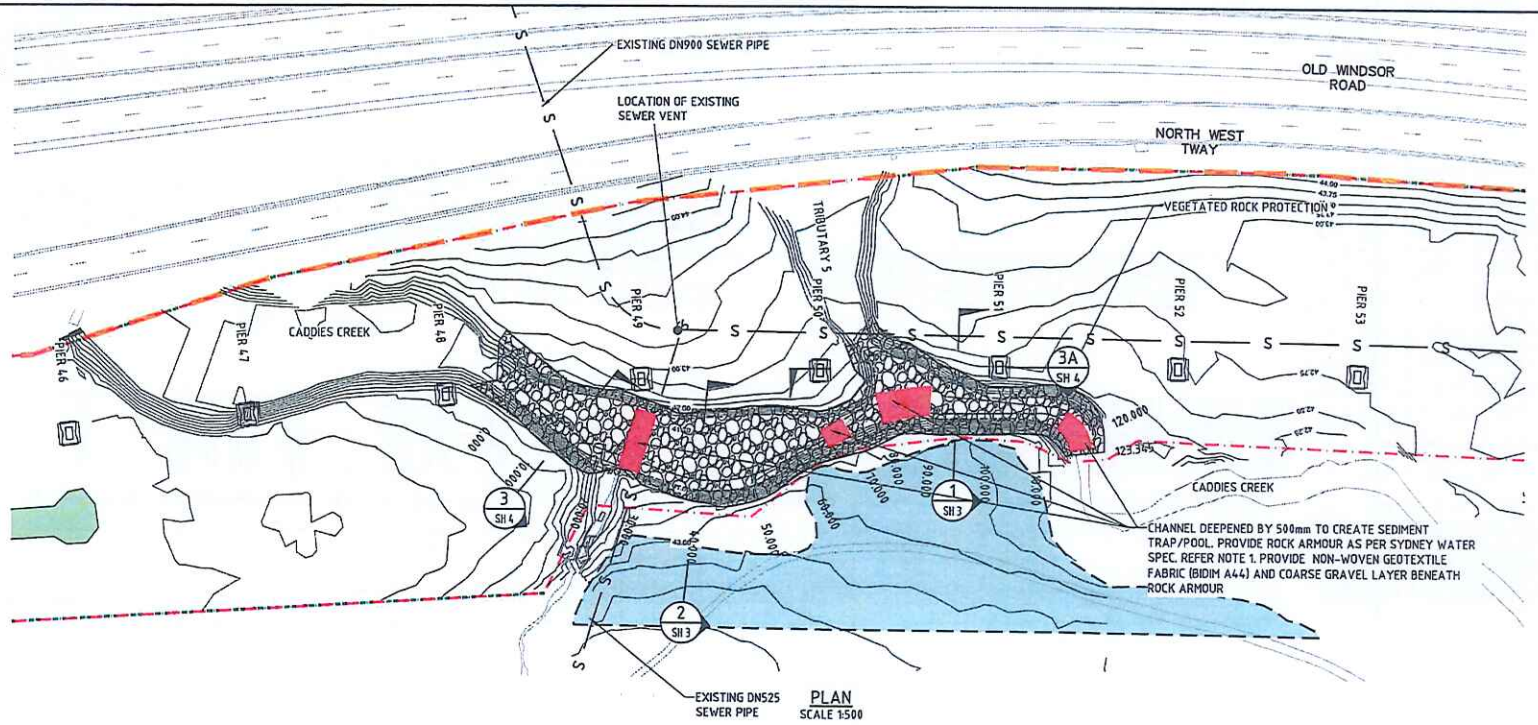
ATTACHMENT A – WORK AS EXECUTED DRAWINGS

A1

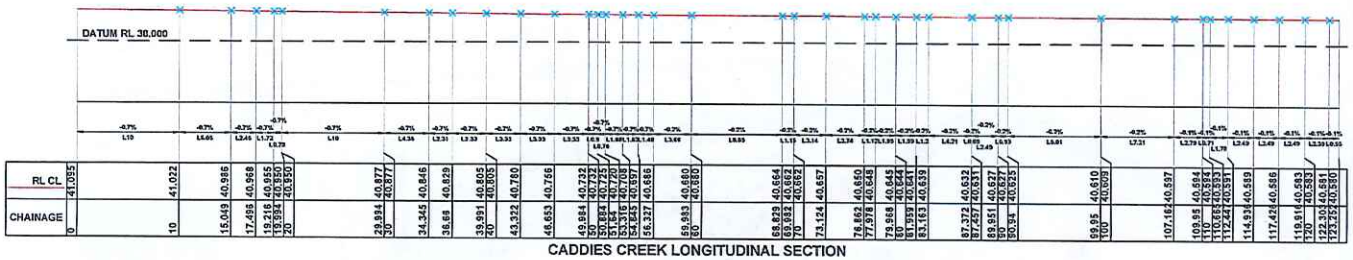


PLAN
SCALE 1:500

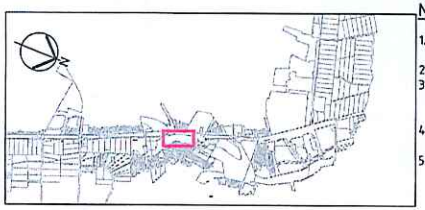
CONTRACT PLAN

LEGEND

- EXISTING SEWER PIPE
- CHANNEL CENTRELINE AND CHAINAGES
- BOTTOM OF BANK (BASE)
- TOP OF BANK
- SYDNEY WATER PROPERTY BOUNDARIES
- HERITAGE AREA
- HAUL ROAD
- PROJECT BOUNDARIES
- SURFACE CONTOURS (0.25m INTERVAL)
- ROCK
- CONCRETE SLAB
- FENCE



CADDIES CREEK LONGITUDINAL SECTION



KEY PLAN
NTS

NOTES:

1. HIGHER PORTION OF MEDIUM AND SMALL SIZE ROCKS USED FOR CHANNEL BED AND BANKS. MINIMUM 50% LARGE ROCKS REQUIRED.
2. ROCK VOIDS FILLED WITH LOCAL TOPSOIL FOR PLANTINGS.
3. TOPSOIL INSTALLED ON ALL EARTH BATTERS AND CHANNEL BED FOR PLANTING AND PROTECT WITH JUTE MATTING. INSTALLED TO MANUFACTURER'S SPECIFICATION WITH APPROPRIATE ANCHORING.
4. REFER TO ErSed ESCP FOR TREATMENT OF OUT-OF-BANK SURFACES (REF. 14007)
5. REFER TO VEGETATION MANAGEMENT PLAN FOR PLANTING DETAILS (REF. ISJV 003/2015 AND ISJV_P12-76/2015)
6. THESE WORK AS EXECUTED DRAWINGS HAVE BEEN BASED ON WAE SURVEY AND MARK UPS PROVIDED BY ISJV. NO DETAILED SITE INSPECTIONS, EITHER DURING OR AFTER CONSTRUCTION, HAVE BEEN UNDERTAKEN BY WORLEYPARSONS TO CONFIRM THE ACCURACY OF THE INFORMATION PROVIDED.

SYDNEY WATER ROCK SPECIFICATION

MIXTURE OF HARD SANDSTONE ROCK SIZES USED:

1. 70% LARGE ROCKS BETWEEN 200kg & 500kg WITH A REGULAR SHAPE 0.75m TO 1.2m (L) x 0.5m (W) x 0.25 TO 0.45m (H)
2. 15% MEDIUM SIZE ROCKS BETWEEN 4kg & 33kg ("SOCCER BALL" SIZE)
3. 15% SMALL ROCKS LESS THAN 4kg ("CLOSED FIST" SIZE)

WORK AS EXECUTED

CADDIES CREEK PERMANENT WORKS DESIGN CL SETOUT TABLE

Pt	Chainage	Easting	Northing	Rad
IP1	0.00	308399.90	6268246.60	
CH	10.00	308402.88	6268256.14	
TC	15.05	308404.39	6268260.96	
IP2	17.14	308405.01	6268262.97	-12
CT	19.22	308404.92	6268265.08	
CH	20.00	308404.88	6268265.86	
CH	30.00	308404.43	6268275.85	
TC	34.35	308404.23	6268280.19	
CH	40.00	308403.35	6268285.76	
IP3	42.63	308403.85	6268288.77	-25
CH	50.00	308398.84	6268294.61	
CT	50.90	308398.27	6268295.31	
TC	51.66	308397.77	6268295.88	
IP4	53.26	308396.73	6268297.10	-20
CT	54.86	308395.51	6268298.14	
CH	60.00	308391.59	6268301.46	
TC	68.85	308384.84	6268307.18	
CH	70.00	308383.94	6268307.90	
IP5	71.00	308383.19	6268308.58	-20
CT	73.14	308381.29	6268309.59	
TC	76.88	308377.99	6268311.35	
CH	80.00	308375.73	6268313.44	
IP6	80.04	308374.91	6268312.98	6
CT	83.21	308374.81	6268316.47	
TC	87.42	308374.69	6268320.68	
IP7	89.20	308374.63	6268322.49	-10
CH	90.00	308374.28	6268323.23	
CT	90.99	308373.95	6268324.16	
CH	100.00	308370.56	6268332.51	
CH	110.00	308366.80	6268341.77	
TC	110.71	308366.53	6268342.43	
IP8	116.56	308363.83	6268349.07	8
CH	120.00	308368.22	6268351.04	
CT	122.40	308370.13	6268352.48	
IP9	123.34	308370.96	6268352.93	

1:500 FULL SIZE A1

NORTH WEST RAIL LINK

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS
SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT :-
DIAL BEFORE YOU DIG Ph. 1100
ELECTRICITY Ph.
GAS Ph.
TELECOMMUNICATIONS Ph.
Ph.
GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER
WATER SERVICE CO-ORDINATOR
CONSTRUCTOR
COMPLETED W.A.C. PREPARED
DESIGNER
I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

SIZE (DI'D	TYPE	CLASS	LENGTH	PIPE JOINTING METHOD/NOTES

DESIGN HEAD ___ m
NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES
PLAN 1:500 SECTION { HOR. 1:500 VERT. 1:500
CROSS SECTIONS ___ NATURAL
LENGTHS, DEPTHS & LEVELS ARE IN METRES

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

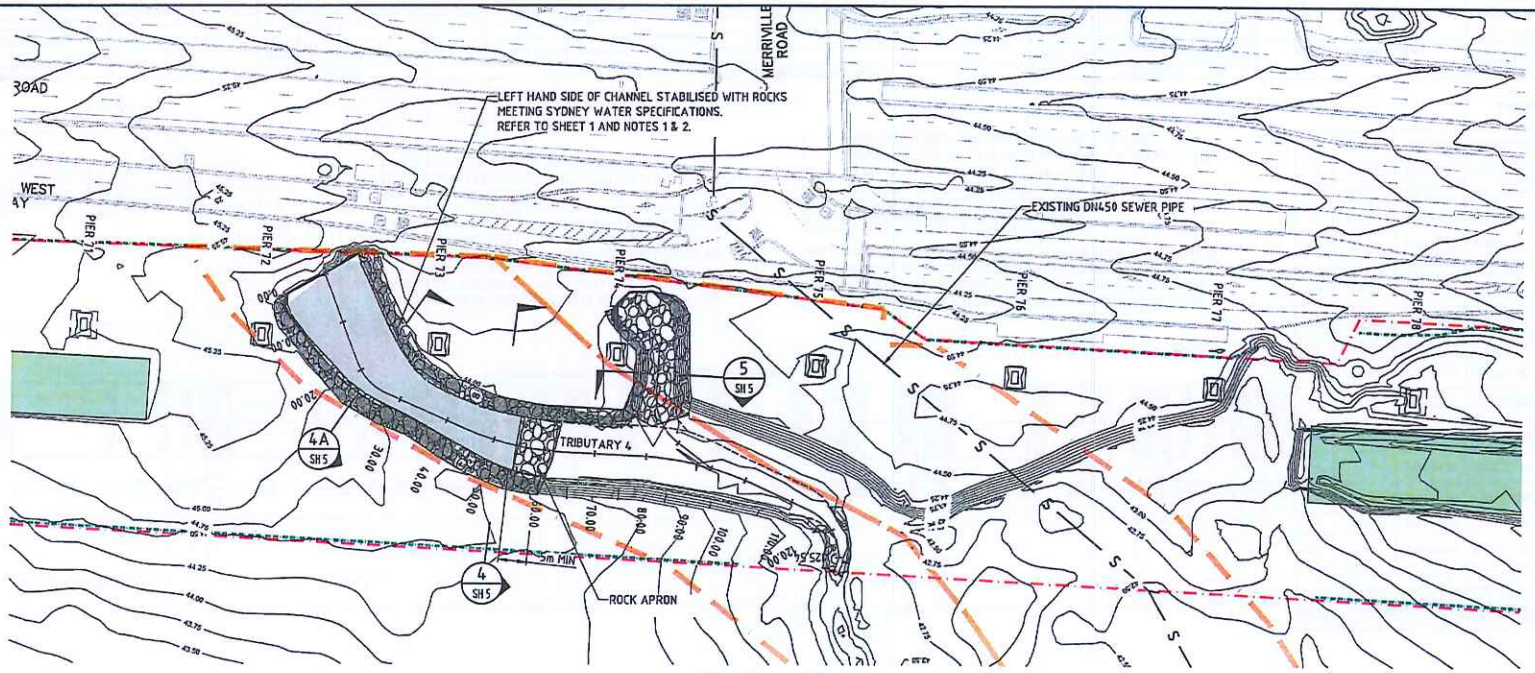
U.D. DIRECTORY Version 6 Digital
SHEET 1 OF 7 File No. N/A

SYDNEY WATER CORPORATION
Case No. 141755SW

NWRL - CONSTRUCTION AREA 2
STREAM DIVERSION - PERMANENT WORKS
CADDIES CREEK PLAN AND LONG SECTION

PLAN DRAWN DATE: 07.04.16 VERSION: 1 SHEET 1 OF 7 SHEETS

A1

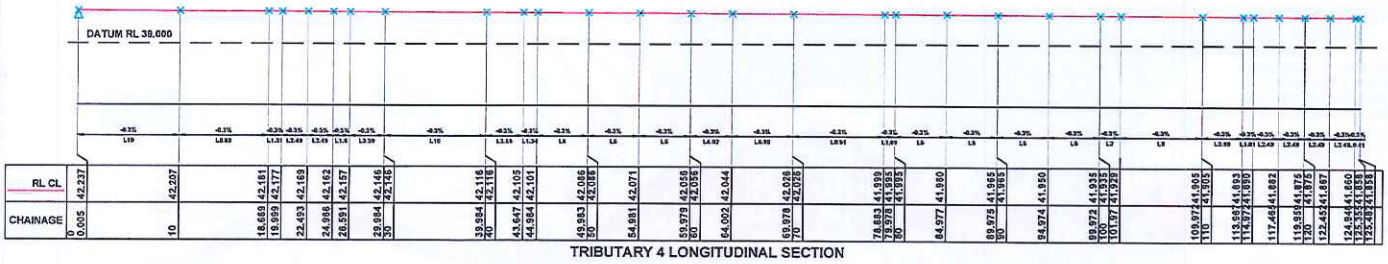


PLAN
SCALE 1:500

CONTRACT PLAN

LEGEND

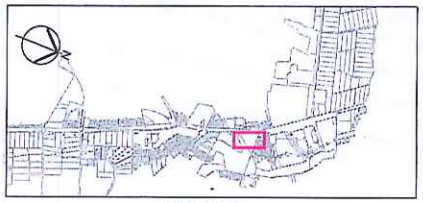
- EXISTING SEWER PIPE
- CHANNEL CENTRELINE AND CHAINAGES
- BOTTOM OF BANK (BASE)
- TOP OF BANK
- SYDNEY WATER PROPERTY BOUNDARIES
- HERITAGE AREA
- HAUL ROAD
- PROJECT BOUNDARIES
- SURFACE CONTOURS (0.25m INTERVAL)
- ROCK
- CONCRETE SLAB
- FENCE



TRIBUTARY 4 LONGITUDINAL SECTION

TRIBUTARY 4 PERMANENT WORKS DESIGN CL SETOUT TABLE				
Pt	Chainage	Easting	Northing	Rad
IP1	0.00	308100.43	6269101.17	
CH	10.00	308107.84	6269107.89	
TC	18.69	308114.27	6269113.72	
CH	20.00	308115.18	6269114.67	
IP2	22.65	308117.37	6269116.53	-10
CT	26.61	308117.55	6269120.71	
CH	30.00	308117.69	6269124.10	
CH	40.00	308118.11	6269134.09	
TC	43.66	308118.27	6269137.75	
CH	50.00	308118.17	6269144.08	
IP3	53.84	308118.70	6269148.04	-55
CH	60.00	308116.54	6269153.93	
CT	64.02	308115.39	6269157.79	

CH	70.00	308113.46	6269163.44	
TC	78.91	308110.60	6269171.88	
CH	80.00	308110.25	6269172.92	
CH	90.00	308108.01	6269182.65	
IP4	90.45	308106.83	6269182.94	60
CH	100.00	308107.42	6269192.62	
CT	102.00	308107.50	6269194.62	
CH	110.00	308107.95	6269202.60	
TC	113.99	308108.18	6269206.59	
IP5	119.70	308108.55	6269213.00	10
CH	120.00	308110.25	6269212.13	
CT	125.41	308114.53	6269215.34	
IP6	125.54	308114.64	6269215.38	



KEY PLAN
NTS

NOTES:

1. HIGHER PORTION OF MEDIUM AND SMALL SIZE ROCKS USED FOR CHANNEL BED AND BANKS. MINIMUM 50% LARGE ROCKS REQUIRED.
2. ROCK VOIDS FILLED WITH LOCAL TOPSOIL FOR PLANTINGS.
3. TOPSOIL INSTALLED ON ALL EARTH BATTERS AND CHANNEL BED FOR PLANTING AND PROTECT WITH JUTE MATTING. INSTALLED TO MANUFACTURER'S SPECIFICATION WITH APPROPRIATE ANCHORING.
4. REFER TO ErSed ESCP FOR TREATMENT OF OUT-OF-BANK SURFACES (REF. 14007)
5. REFER TO VEGETATION MANAGEMENT PLAN FOR PLANTING DETAILS (REF. ISJV 003/2015 AND ISJV_P12-76/2015)
6. THESE WORK AS EXECUTED DRAWINGS HAVE BEEN BASED ON WAE SURVEY AND MARK UPS PROVIDED BY ISJV. NO DETAILED SITE INSPECTIONS, EITHER DURING OR AFTER CONSTRUCTION, HAVE BEEN UNDERTAKEN BY WORLEYPARSONS TO CONFIRM THE ACCURACY OF THE INFORMATION PROVIDED.

WORK AS EXECUTED

1:500 FULL SIZE A1

NORTH WEST RAIL LINK

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS
SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT :-

DIAL BEFORE YOU DIG	Ph. 1100
ELECTRICITY	Ph.
GAS	Ph.
TELECOMMUNICATIONS	Ph.
	Ph.

GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER
WATER SERVICE CO-ORDINATOR
CONSTRUCTOR
COMPLETED W.A.C. PREPARED
DESIGNER

I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

SIZE DN	TYPE	CLASS	LENGTH	PIPE JOINING METHOD/NOTES

DESIGN HEAD m

NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES

PLAN 1:500 SECTION HOR. 1:500 VERT. 1:500
CROSS SECTIONS NATURAL
LENGTHS, DEPTHS & LEVELS ARE IN METRES.

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

U.D. DIRECTORY Version 6 Digital

SHEET 2 OF 7 File No. N/A

SYDNEY WATER CORPORATION

Case No. 141755SW

NWRL - CONSTRUCTION AREA 2
STREAM DIVERSION - PERMANENT WORKS
TRIBUTARY 4 PLAN AND LONG SECTION

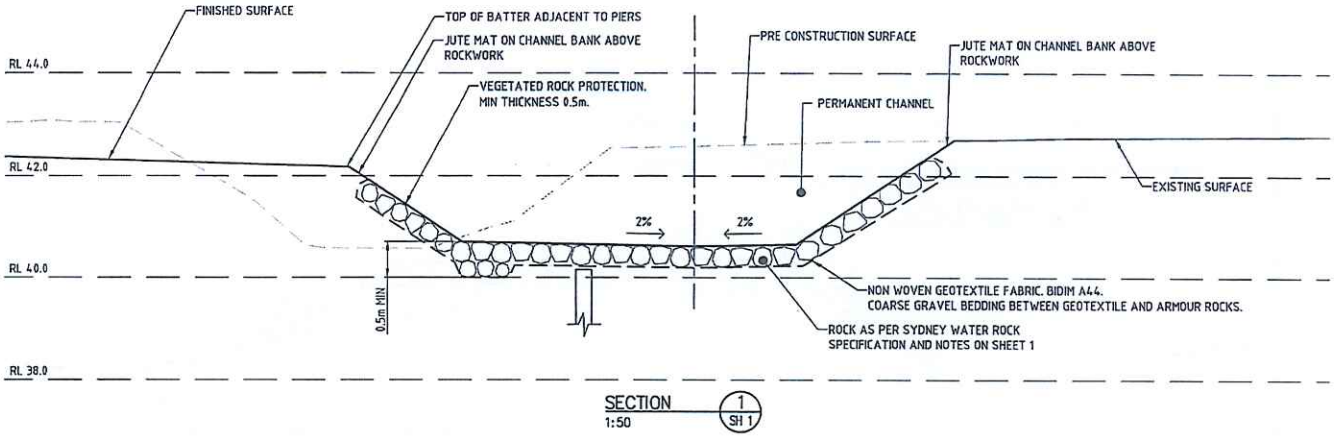
PLAN DRAWN DATE: 07.04.16 VERSION: 1 SHEET 2 OF 7 SHEETS

A1

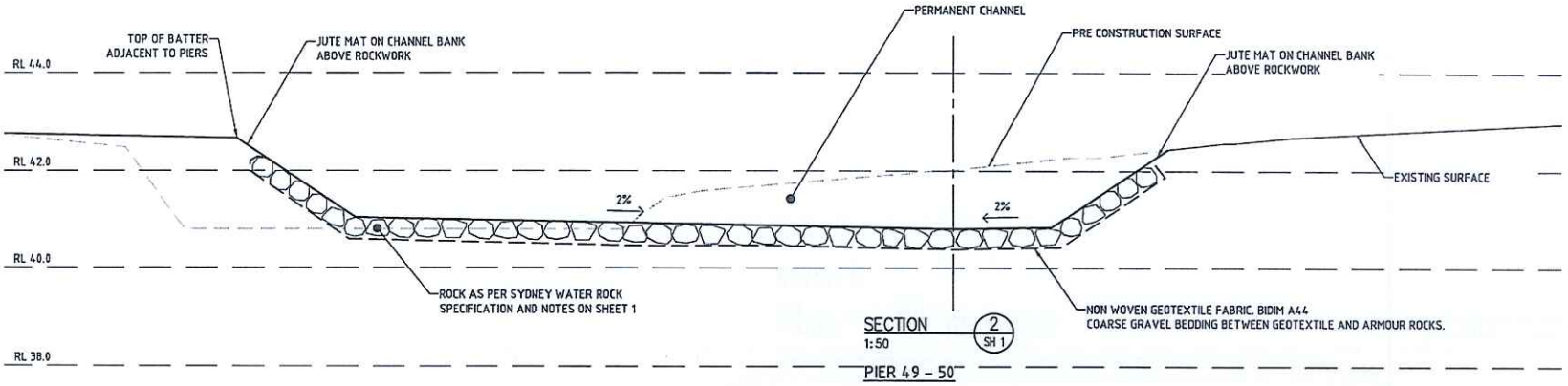
CONTRACT PLAN

NOTES:

1. FINISHED LEVELS AND CHANNEL GEOMETRY SHOWN INDICATIVELY.
2. REFER TO SHEETS 6 AND 7 FOR SURVEYED CHANNEL GEOMETRY.



SECTION 1 / SH 1
1:50



SECTION 2 / SH 1
1:50

PIER 49 – 50

WORK AS EXECUTED

0.5 0 0.5 1 1.5m
1:50 FULL SIZE A1

NORTH WEST RAIL LINK

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS
SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT:-

DIAL BEFORE YOU DIG	Ph. 1100
ELECTRICITY	Ph.
GAS	Ph.
TELECOMMUNICATIONS	Ph.
	Ph.

GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER
WATER SERVICE CO-ORDINATOR
CONSTRUCTOR
COMPLETED W.A.C. PREPARED
DESIGNER

I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

SIZE (DIA)	TYPE	CLASS	LENGTH	PIPE JOINTING METHOD NOTES

DESIGN HEAD ___ m
NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES
PLAN NA SECTION HOR. 1:50 VERT. 1:50
CROSS SECTIONS — NATURAL

LENGTHS, DEPTHS & LEVELS ARE IN METRES

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

U.S. DIRECTORY Version 6 Digital

SHEET 3 OF 7 File No. N/A

SYDNEY WATER CORPORATION

Case No. 141755SW

NWRL - CONSTRUCTION AREA 2
STREAM DIVERSION - PERMANENT WORKS
TYPICAL SECTIONS - 1 of 3

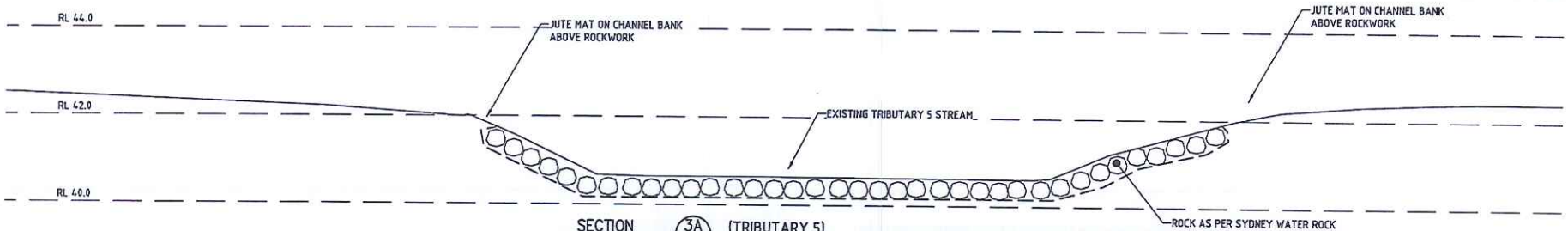
PLAN DRAWN DATE: 07.04.16 VERSION: 1 SHEET 3 OF 7 SHEETS

A1

CONTRACT PLAN

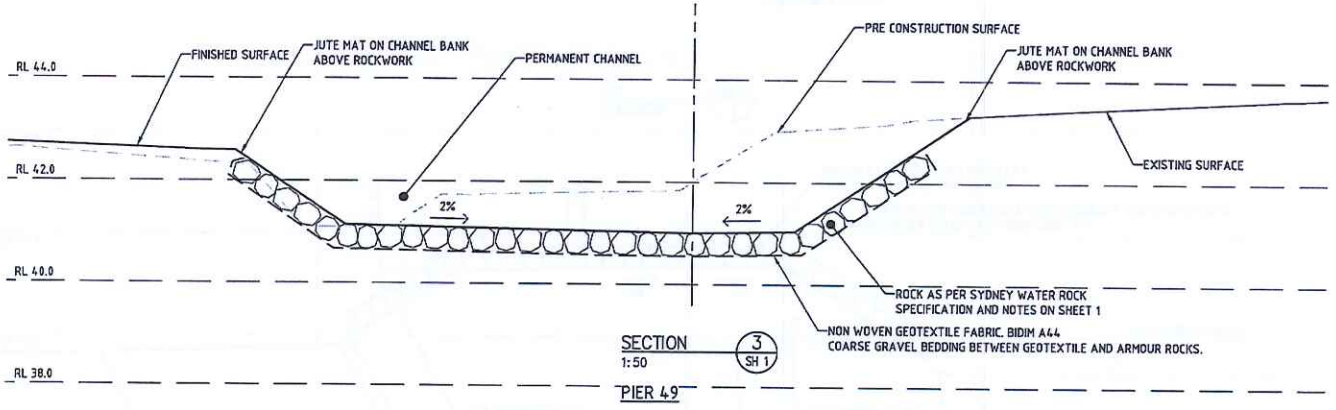
NOTES:

1. FINISHED LEVELS AND CHANNEL GEOMETRY SHOWN INDICATIVELY.
2. REFER TO SHEETS 6 AND 7 FOR SURVEYED CHANNEL GEOMETRY.



SECTION 3A SH 1 (TRIBUTARY 5)
1:50

PIER 50 - 51



SECTION 3 SH 1
1:50

PIER 49

WORK AS EXECUTED

0.5 0 0.5 1 1.5m
1:50 FULL SIZE A1

NORTH WEST RAIL LINK

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS
SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT:-

DIAL BEFORE YOU DIG	Ph. 1100
ELECTRICITY	Ph.
GAS	Ph.
TELECOMMUNICATIONS	Ph.
	Ph.

GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER
WATER SERVICE CO-ORDINATOR
CONSTRUCTOR
COMPLETED W.A.C. PREPARED
DESIGNER

I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

SIZE (DN)	TYPE	CLASS	LENGTH	PIPE JOINING METHOD/SEALS

DESIGN HEAD ___ m

NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES
PLAN N/A SECTIONS HOR. 1:50 VERT. 1:50
CROSS SECTIONS ___ NATURAL
LENGTHS, DEPTHS & LEVELS ARE IN METRES

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

U.D. DIRECTORY Version 6 Digital

SHEET 4 OF 7 File No. N/A

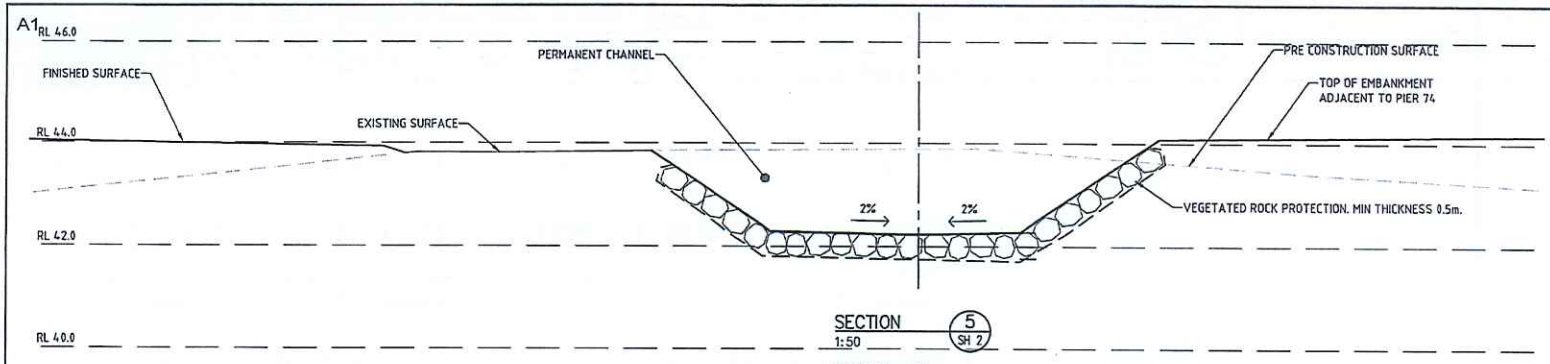
SYDNEY WATER CORPORATION

Case No. 141755SW

NWRL - CONSTRUCTION AREA 2
STREAM DIVERSION - PERMANENT WORKS
TYPICAL SECTIONS - 2 of 3

PLAN DRAWN DATE: 07.04.16 VERSION: 1 SHEET 4 OF 7 SHEETS

A1



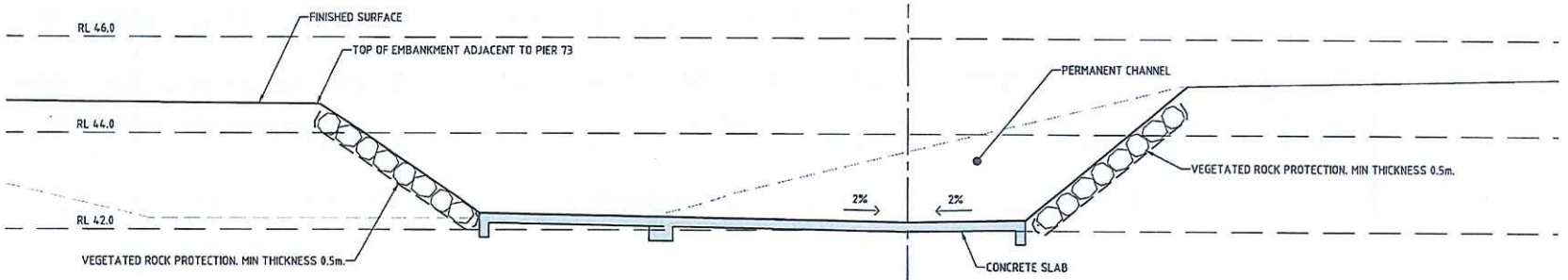
SECTION 5 SH 2
1:50

PIER 74 - 75

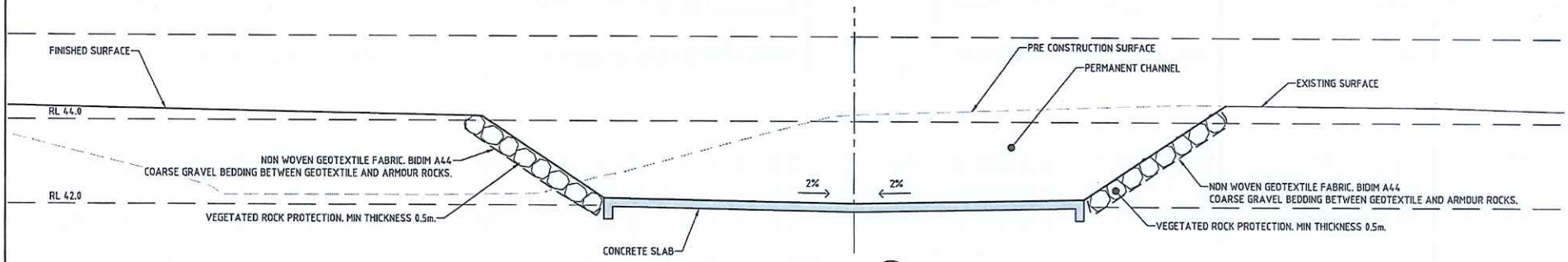
CONTRACT PLAN

NOTES:

1. FINISHED LEVELS AND CHANNEL GEOMETRY SHOWN INDICATIVELY.
2. REFER TO SHEETS 6 AND 7 FOR SURVEYED CHANNEL GEOMETRY.



SECTION 4A SH 2
1:50



SECTION 4 SH 2
1:50

PIER 73 - 74

WORK AS EXECUTED

0.5 0 0.5 1 1.5m
1:50 FULL SIZE A1

NORTH WEST RAIL LINK

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS
SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT >

DIAL BEFORE YOU DIG	Ph. 1100
ELECTRICITY	Ph.
GAS	Ph.
TELECOMMUNICATIONS	Ph.
	Ph.

GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER
WATER SERVICE CO-ORDINATOR
CONSTRUCTOR
COMPLETED W.A.C. PREPARED
DESIGNER

I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

SIZE (DIA)	TYPE	CLASS	LENGTH	PIPE JOINING METHOD (NOTES)

DESIGN HEAD ___ m

NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES
PLAN NA SECTION HOR 1:50 VERT 1:50
CROSS SECTIONS ___ NATURAL
LENGTHS, DEPTHS & LEVELS ARE IN METRES

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

U.S. DIRECTORY Version 6 Digital

SHEET 5 OF 7 File No. NIA

SYDNEY WATER CORPORATION

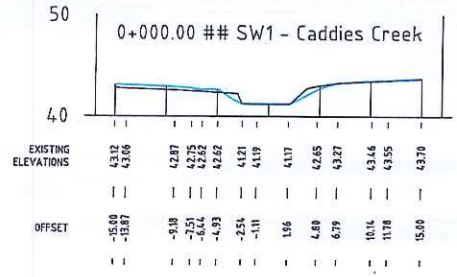
Case No. 141755SW

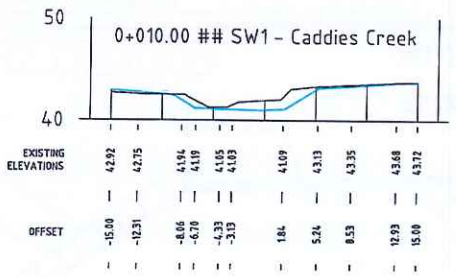
NWRL - CONSTRUCTION AREA 2
STREAM DIVERSION - PERMANENT WORKS
TYPICAL SECTIONS - 3 of 3

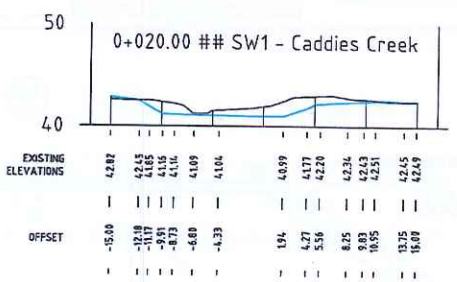
PLAN DRAWN DATE: 07.04.16 VERSION: 1 SHEET 5 OF 7 SHEETS

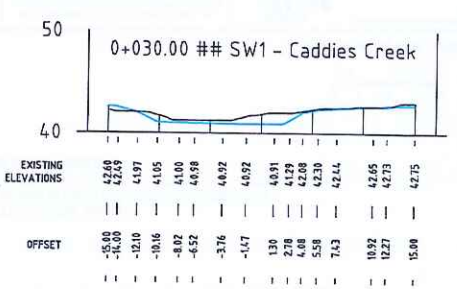
A1

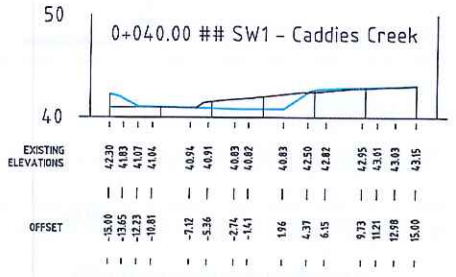
CONTRACT PLAN

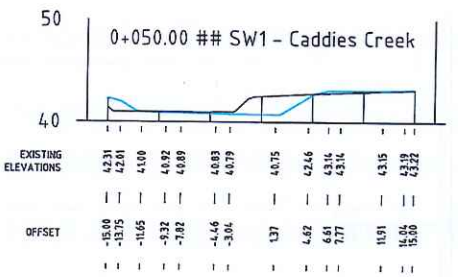


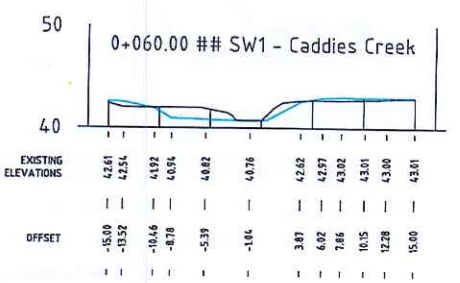


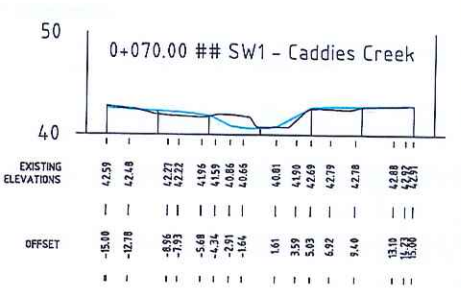


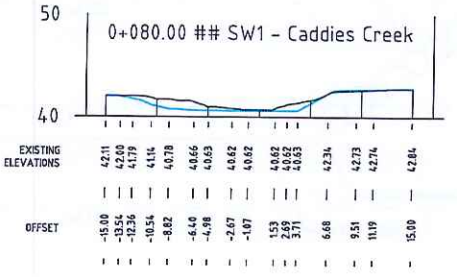


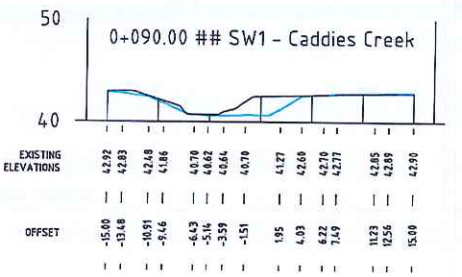


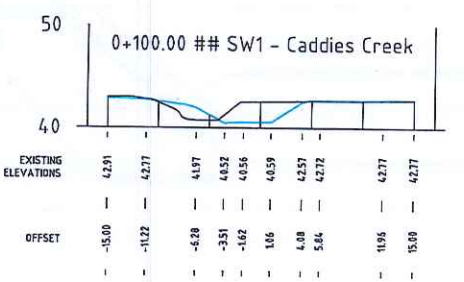


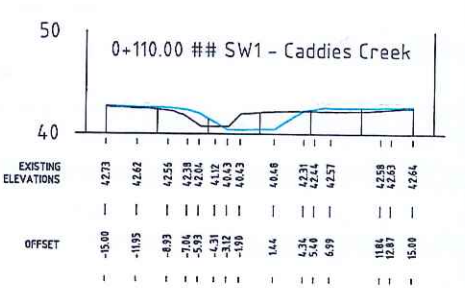


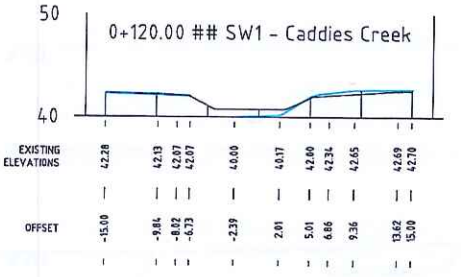


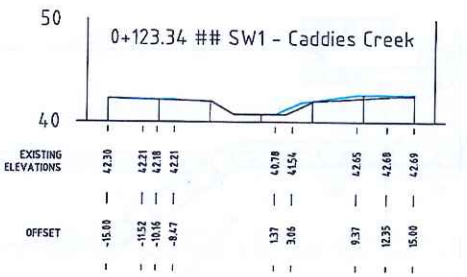












LEGEND:

EXISTING SURFACE

ORIGINAL GROUND

WORK AS EXECUTED

NORTH WEST RAIL LINK

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS
SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT :-

DIAL BEFORE YOU DIG — Ph. 1100
ELECTRICITY — Ph
GAS — Ph
TELECOMMUNICATIONS — Ph
— Ph

GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER
WATER SERVICE CO-ORDINATOR
CONSTRUCTOR
COMPLETED — W.A.C. PREPARED
DESIGNER

I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

INCH IDIA	TYPE	CLASS	LENGTH	PIPELAYING METHOD / NOTES

DESIGN HEAD ___ m

NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES

PLAN NA — SECTION HOR. 1:100 VERT. 1:100

CROSS SECTIONS — NATURAL

EXISTING ENTRIES & LEVELS ARE REFERENCE

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

SYDNEY WATER CORPORATION

Case No. 141755SW

U.S. DIRECTORY — Version 6 Digital

SHEET 6 OF 7 — File No. N/A

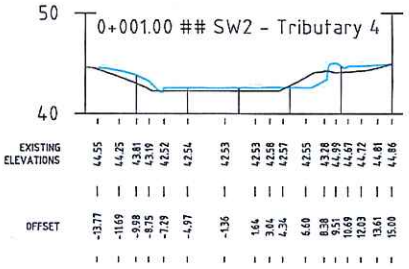
NWRL - CONSTRUCTION AREA 2
STREAM DIVERSION - PERMANENT WORKS
CADDIES CREEK DESIGN CROSS SECTIONS

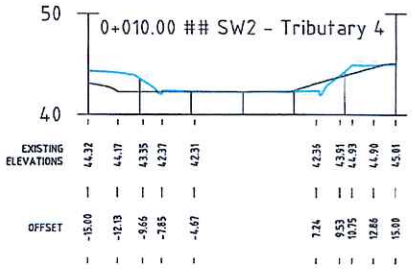
REFERENCE:

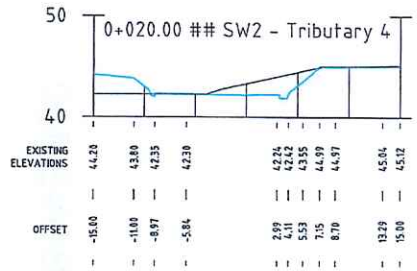
PLAN DRAWN DATE: 28.04.15 VERSION: 0 SHEET 6 OF 7 SHEETS

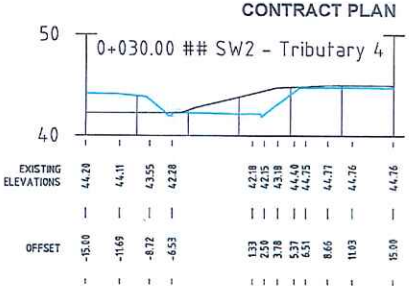
A1

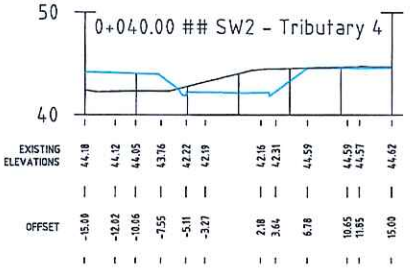
CONTRACT PLAN

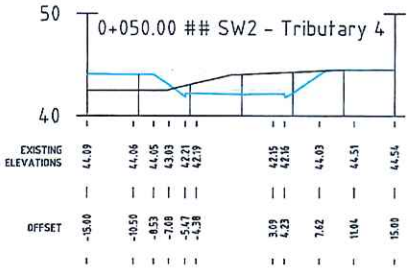


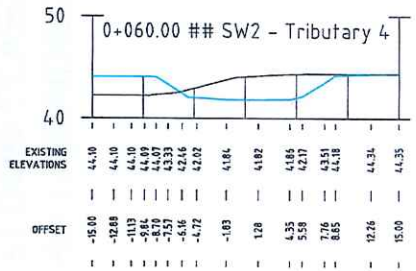


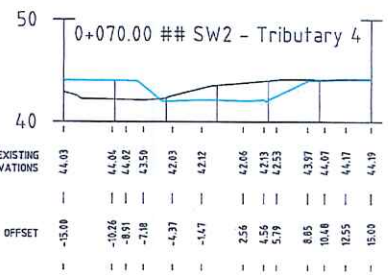


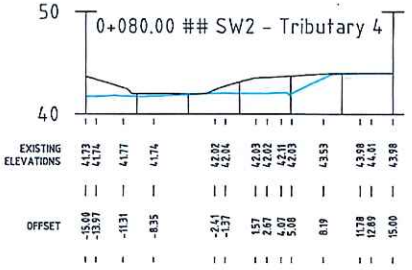


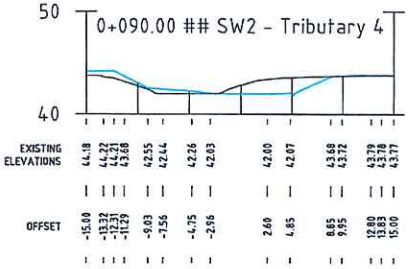


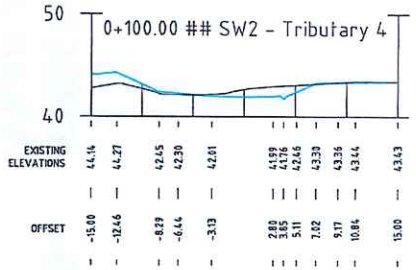


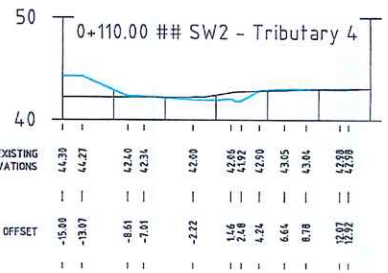


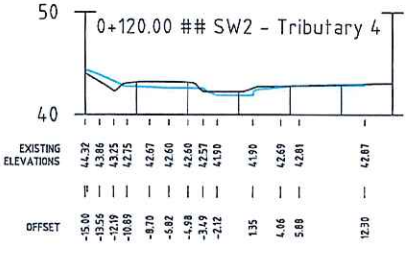












LEGEND:

EXISTING SURFACE

ORIGINAL GROUND

WORK AS EXECUTED

NORTH WEST RAIL LINK

PLAN DRAWN DATE: 26.07.12 VERSION: 0 SHEET 7 OF 7 SHEETS

PLAN TO BE READ IN CONJUNCTION WITH CURRENT SYDNEY WATER STANDARDS

SYDNEY WATER CORPORATION

PRIOR TO COMMENCEMENT OF EXCAVATION FOR PROPOSED AND EXISTING SERVICES CONTACT >

DIAL BEFORE YOU DIG	Ph. 1100
ELECTRICITY	Ph.
GAS	Ph.
TELECOMMUNICATIONS	Ph.
	Ph.

GIVING AT LEAST 48 HOURS NOTICE.

UTILITIES

TYPE	DATE	REF.	TYPE	DATE	REF.

WORK AS CONSTRUCTED CERTIFICATION

DEVELOPER

WATER SERVICE CO-ORDINATOR

CONSTRUCTOR

COMPLETED W.A.C. PREPARED

DESIGNER

I CERTIFY THAT THE WORKS HAVE BEEN CONSTRUCTED IN ACCORDANCE WITH THE WORK AS CONSTRUCTED DRAWINGS.

PIPE SCHEDULE

SIZE (DN)	TYPE	CLASS	LENGTH	PIPE JOINING METHOD (NOTES)

DESIGN HEAD ___ m

NO BOUNDARY TRAPS REQUIRED.

AUSTRALIAN HEIGHT DATUM

SCALES

PLAN NA SECTION HOR. 1:100 VERT. 1:100

CROSS SECTIONS — NATURAL

LENGTHS, DEPTHS & LEVELS ARE IN METRES

NO AMENDMENTS ARE TO BE MADE TO THIS PLAN WITHOUT REFERENCE TO SYDNEY WATER. THIS PLAN IS NOT NECESSARILY UP TO DATE OR CORRECT AND SYDNEY WATER ACCEPTS NO RESPONSIBILITY.

U:\ DIRECTORY Version 6 Digital

SHEET 7 OF 7 File No. N/A

SYDNEY WATER CORPORATION

Case No. 141755SW

NWRL - CONSTRUCTION AREA 2

STREAM DIVERSION - PERMANENT WORKS

TRIBUTARY 4 DESIGN CROSS SECTIONS

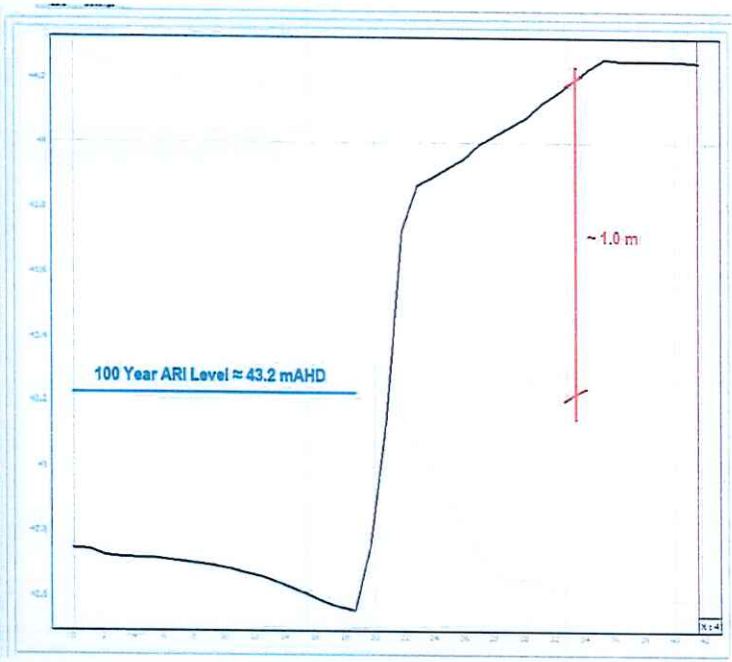
WorleyParsons

resources & energy

ATTACHMENT B – FREEBOARD PROVIDED ABOVE 100 YEAR ARI FLOOD LEVELS

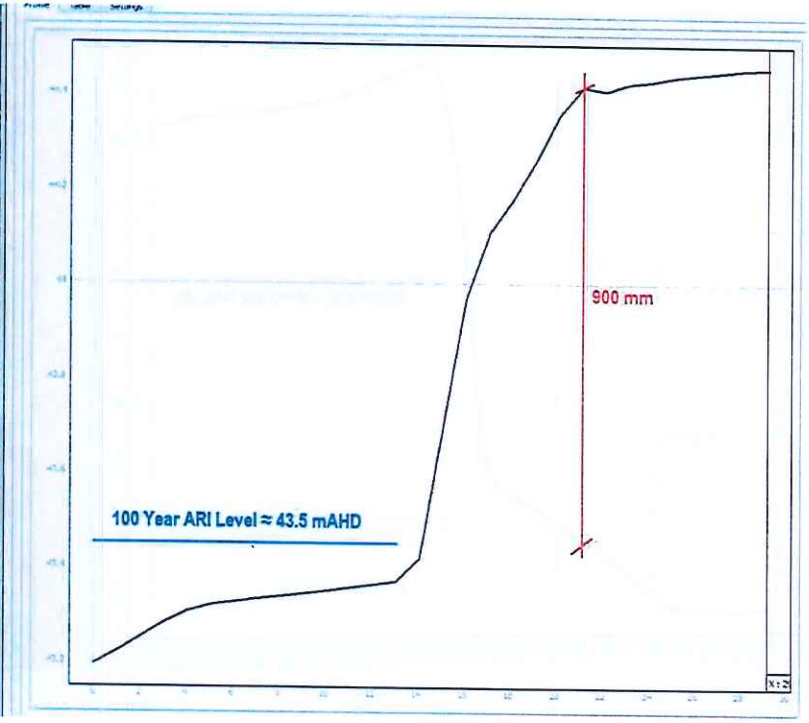
WorleyParsons
resources & energy

EcoNomics



WorleyParsons
resources & energy

EcoNomics



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EcoNomics™