



Appendix 5

Newell Highway 100% Concept Design Report

prepared by

Constructive Solutions Pty Ltd

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Newell Highway (HW17) – Kyalite Deviation

Design Report

100% Concept Design

Prepared for
Tomingley Gold Operations
(Alkane Resources Ltd)

December 2021

Report prepared by Constructive Solutions Pty Ltd

PO Box 1498
TAMWORTH NSW 2340

Phone: 02 6762 1969
Fax: 02 6762 1969
Email: admin@constructivesolutions.com.au

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Author: Steve O'Rourke
Project Manager: Steve O'Rourke
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Project Number: 2019116
Name of Client: Tomingley Gold Operations (Alkane Resources Ltd)



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1 Introduction

Constructive Solutions Pty Ltd (CSPL) has been engaged by Tomingley Gold Operations (TGO) to complete the design for the Newell Highway (HW17) - Kyalite Deviation located south of the village of Tomingley (referred herewith as “the Project”). The location of the Project is shown in **Figure 1**.

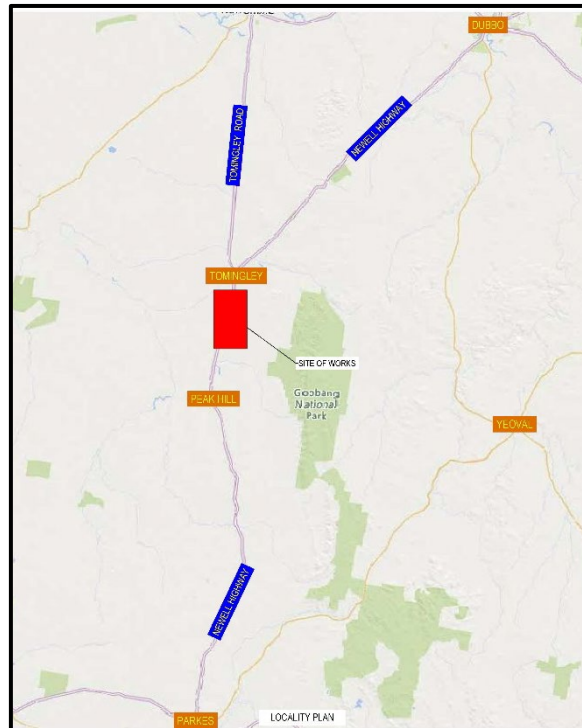


Figure 1 – Locality Map

1.1 Project Description

TGO have successfully operated a gold mine and processing plant at Tomingley since 2014. Following extensive investigations, TGO has located significant gold deposits south of their existing site. The new deposits lie directly beneath HW17.

To enable extraction of the newly discovered gold resources, HW17 will need to be relocated over an approximately 8km stretch (referred herewith as “the HW17 - Kyalite Deviation”). In conjunction with HW17-Kyalite Deviation, there are several alterations to be made to local roads of which Narromine Shire Council (NSC) is the road authority. The local roads have not been addressed in this report.

TGO will enter into a Works Authorisation Deed (WAD) with Transport for NSW (TfNSW) which will set technical criteria for the design and construction of the HW17 - Kyalite Deviation, inclusive of a number of submission points for TfNSW to review the design. The first review point was the 50% Concept Design (50%CD).

1.2 Project Objectives

The objectives of the Project are to:

- Enable TGO to undertake mining operations in the nominated area, including blasting where necessary, without impacting on the traffic flow of HW17;
- Maintain or improve existing flood immunity for HW17;
- Minimise disturbance to the environment; and
- Be safe to build, operate and maintain.

1.3 Project Status

The Project is now at the 100% Concept Design (100% CD) stage for the TfNSW related works and the 50% CD stage for the NSC local roads. The 100% CD plans for TfNSW related works are attached to this submission, which generally does not include consideration of the NSC local roads.

The attached drawings have been reviewed internally and also by an Independent Verifier with the outcomes of these reports is discussed later in this document. A Road Safety Audit (RSA) has also been completed for the 100% CD of which all comments have been closed out.

A Works Authorisation Deed (WAD) had now been issued inclusive of the technical requirements for the design. A Project Verifier has been appointed and they have reviewed this submission, their comments have been closed out and they have issued Schedule 8 – Design Document Certification (refer to **APPENDIX 10**).

Geotechnical investigations have now been completed and the final report received. The investigation was delayed by prolonged wet weather and the subsequent testing was impacted by COVID related delays. As this report was very recently received, the pavement design on the submitted plans is still based on the “Trewilga pavement”, as per the 50% CD submission.

A hydrological study has been completed by others and has been included with this design submission. Output from this study has been used for the design of the culverts.

An Environmental Impact Statement (EIS) is currently in preparation by others for the expansion of the mine and this includes consideration of the environmental impact of the associated roadworks.

1.4 Summary of Changes Since the Previous Submission

Table 1 summarises the design changes that have been made since the 50% CD and the more significant changes are discussed in the following sections. Various items have been added or detailed in the 100% CD submission, which were not included in the 50% CD e.g. safety barrier, culvert details etc.

Table 1 – Summary of changes since previous design submission

Item	Description of Change	Reasons	Reference
1	Southern end alignment – limit of works moved north and curve radius reduced.	Reduced impacts on heritage sites. Reduces impacts on adjacent properties. Provides longer straight to accommodate new Back Tomingley West Road intersection.	
2	Acceleration lane south of Kyalite Road deleted.	TfNSW request	50% CD comments
3	Channelised Right (CHR) treatment to be provided at the Back Tomingley West Road and McNivens Lane intersections.	TfNSW request	50% CD comments
4	General fill batters flattened to 6:1	TfNSW request	50% CD comments

1.4.1 Changes to southern end alignment

The identification of a number of heritage sites as part of the EIS investigations triggered actions to mitigate the impact of the proposed HW17- Kyalite Deviation. Moving the southern end of the deviation further north, resulted in the alignment passing between two concentrations of heritage locations, whilst still maintaining the overall 50% CD alignment. This change also removed the need to acquire a minor area of private property to the south west of the Back Tomingley West Road intersection.

The above change to the alignment and the change to a CHR at the Back Tomingley West Road intersection (refer Item 3 from Table 1) resulted in part of the proposed intersection being located on a slight curve on HW17. To overcome this and ensure that the full intersection was located on a straight, the radii of the two southernmost curves for the HW17 deviation have been reduced from 2000m to 1500m. This increases the length of straight between these curves.

1.4.2 CHR Intersections at minor junctions

It is noted that there is no warrant for the inclusion of CHR turn treatments at the intersection of Back Tomingley West Road and McNivens Lane however, TGO has agreed to TfNSW's request to incorporate this higher standard of intersection.

1.4.3 Batter Slopes

It is noted that the inclusion of 6:1 batter slopes is listed as desirable in the Austroads guidelines, however, in view of the heavy freight volumes and a commitment to the Safer Roads design principles, TGO has agreed to TfNSW's request to incorporate the flatter batter profile.

2 Scope of Works

The scope of works for this engagement is as follows:

- Relocate HW17 such that it is situated at least 650m to the west from the existing HW17 alignment;
- Provide new intersections to existing NSC local roads inclusive of Back Tomingley West Road, Kyalite Road and McNivens Lane;
- Provide at least the existing level of flood immunity of the existing HW17 alignment through the HW17 - Kyalite Deviation;
- Reinstate existing passing lanes on the HW17 - Kyalite Deviation;
- Provide rural property accesses on the HW17 - Kyalite Deviation to match those on the existing, or as agreed with the landholder; and
- Comply with standard TfNSW road design requirements.

3 Design Description

3.1 Design Standards

The following Codes, Standards and Guidelines to be used for the Project are provided in **Table 2**.

Table 2 – Design Standards

Design Standard	Document Title and Description	Date
Austroads Guide to Road Design (AGRD)	Part 1: Introduction to Road Design	2021
	Part 2: Design Considerations	2015
	Part 3: Geometric Design	2016
	Part 4: Intersections and Crossings	2017
	Part 5: Drainage - General and Hydrology Considerations.	2013
	Part 6: Roadside Design, Safety and Barriers	2020
	Part 6B: Roadside Environment	2015
RMS	AS 1742 Supplement (Version 2.4)	2016
RMS	Delineation – Section 3 Pavement markings	2008
RMS	Delineation – Section 4 Longitudinal markings	2010
RMS	Delineation – Section 6 Transverse markings	2011
RMS	Delineation – Section 7 Transverse lines pedestrian facilities	2012
RMS	Delineation – Section 10 Pavement arrows	2014
TfNSW Supplements to Austroads Guides	Part 1 (2015) – Introduction to Road Design	2015
	Part 2 (2015) – Design Considerations	2015
	Part 3 (2016) – Geometric Design	2017
	Part 4 (2017) – Intersections and Crossings	2017
	Part 4A (2017) – Unsignalised and Signalised Intersections	2017
	Part 5 (2013) – Drainage – General and Hydrology Considerations	2017
	Part 5A (2013): Drainage – Road Surface, Network, Basins and Subsurface	2017
	Part 6 (2009) – Roadside Design, Safety and Barriers	2020
Part 6B (2015) – Roadside Environment	2016	

3.2 Design Constraints

The following design constraints have been identified:

- Minimise the overall extent of the HW17 - Kyalite Deviation;
- Avoid encroaching on parcels of Crown Land located at the northern end of the HW17-Kyalite Deviation due to potential Project delays relating to Native Title; and
- Minimise interruption to traffic flow on existing roads i.e. HW17 and NSC local roads.

3.3 Other Design Considerations

The following design considerations have been considered:

- Ensure the underside of pavement of the HW17- Kyalite Deviation is no lower than the 1:20 year flood level, such that pavement saturation issues are avoided;
- Topography and therefore design vertical alignment is very flat, requiring aquaplaning issues to be considered and addressed as necessary; and
- Consider traffic staging at each end of the works during construction.

4 Road Design Parameters

4.1 Specific Design Criteria

Table 3 and **Table 4** provide the specific design criteria used for determining the HW17 - Kyalite Deviation design.

Table 3 – HW17- Kyalite Deviation Design Criteria

Parameter	Design
Road classification	National Highway
Design speed	120km/h
Posted speed	110km/h
Number of lanes	2 - 3
Lane width	3.5m
Shoulder	2.0m (sealed)
Crossfall	3%
Min horizontal curve radius (desirable)	1000m
Reaction time	2.5
Min K value crest	202.9
Min K value sag	112
Maximum grade	7%
Cut batter slopes	1:2 min
Fill batter slopes	1:6
Design vehicle	B Triple (36.5m)

Table 4 – Intersection Design Criteria

Parameter	Kyalite Road Intersection	Back Tomingley West Road Intersection	McNivens Lane Intersection
Turn treatment	CHR and AUL	CHR and BAL	CHR and BAL
Design speed	120km/h	120km/h	120km/h
Lane widths	3.5m	3.5m	3.5m
Shoulder	2.0m (sealed)	2.0m (sealed)	2.0m (sealed)
Crossfall	3%	3%	3%

4.2 Design Vehicle

The design vehicle used to determine the minimum design requirements for road and intersection upgrades for the HW17 - Kyalite Deviation is a B-Triple (36.5m). Refer **APPENDIX 3** for swept path diagrams.

4.3 Horizontal and Vertical Alignment

- The horizontal alignment for the HW17 - Kyalite Deviation has been developed to provide a minimum 650m clearance from the proposed mining operations, to enable blasting to be undertaken without the need to stop traffic. The HW17 - Kyalite Deviation connects to the existing HW17 alignment at the most suitable locations, given existing intersections and curves.

At the request of TfNSW, a minimum curve radius of 1000m has been adopted;

- The vertical geometry is based on maintaining the underside of pavement above the 1:20 year flood level whilst achieving the required clearance over drainage culverts. The vertical geometry is very flat, which reflects the topography of the Project area;
- The intersection with Back Tomingley West Road has been relocated to the north to achieve an improved angle of intersection with the HW17 - Kyalite Deviation;
- The intersection with Kyalite Road has been relocated to the north to reflect a realignment of this road which is necessary to achieve the 650m minimum clearance of the HW17- Kyalite Deviation from mining operations;
- The intersection with Mc Nivens Lane remains essentially in the same location other than being connected to the HW17 - Kyalite Deviation; and
- The proposed horizontal alignment contains six horizontal curves with radii ranging from 1000m to 6000m and multiple straight segments to achieve compliance with the 120km/h design speed. Horizontal curve details are provided in **Table 5**.

Table 5 – Horizontal Curve Details

Radius	Superelevation	Superelevation Development Length
1500m	3%	80m
1500m	3%	80m
1500m	3%	80m
1000m	3%	120m
6000m	N/A	N/A
1500m	3%	80m

4.4 Cross Section

Details regarding the cross section for the HW17-Kyalite Deviation are provided below:

- 3.5m lane widths;
- 2m wide sealed shoulders;
- 1m wide verge;
- 6:1 fill batters; and
- Safety barrier required over culverts and where batters are steeper than 2:1.

4.5 Side Roads

The design criteria for the side roads shall be in accordance with NSC requirements and are summarised in **Table 6**. Limited Project related traffic is anticipated to use Back Tomingley West Road and McNiven’s Lane during construction. Use by vehicles accessing the proposed new mine administration area (to be located north of Kyalite Road) will occur with the main traffic consisting of light vehicles to the site offices, plus the occasional B-double fuel trucks and service vehicles.

There will be no haulage of mine ore on public roads. This will occur via a separate dedicated off road haulage route which will be used to transport ore back to the existing processing plant. This haulage route will utilise the existing underpass of HW17 to gain access to the existing processing plant.

Further discussion on the impacts on local roads can be found within the Integrated Transport Assessment (Constructive Solutions - August 2021), which is appended to the EIS for the Project.

Table 6 – Design Criteria - Side Roads

Parameter	Design
Road classification	Local access road
Design speed	110km/h
Posted speed	100km/h
Number of lanes	2
Lane width	3.5m
Shoulder	2.0m (unsealed)
Crossfall	3%
Min horizontal curve radius (desirable)	600m
Reaction time	2.5
Min K value crest	150
Min K value sag	84
Maximum grade	7%
Cut batter slopes	1:2 min
Fill batter slopes	1:4 > 2m high 1:6 ≤ 2m high
Design vehicle	B-Triple

Existing and anticipated traffic volumes on local roads intersecting with the HW17 - Kyalite Deviation (excluding normal growth) are set out in **Table 7**.

Table 7 – Traffic Volumes – Side Roads

Road	Existing AADT (2020)	Anticipated AADT
Kyalite Road ¹	22 (44% HV)	270 (7% HV)
Back Tomingley West Road	34 (10% HV)	No change
McNivens Lane	15 (10% HV)	No change

Note that the HW17 - Kyalite Deviation design package does not contain the full design for all side roads. Design included in this package only extends approximately 50m off the HW17 - Kyalite Deviation for each side road.

Local roads form a separate design package and will be issued to NSC for approval.

¹ Traffic volumes are from HW17 to the intersection of the proposed mine administration area

5 Road Design Inputs

5.1 Configuration and Intersections

The proposed design generally follows that of the 50% CD, other than as detailed in Section 1.4 of this report.

5.2 Survey

Survey information has been obtained via LIDAR. This is considered satisfactory for the concept design, in view of the generally green field nature and flat terrain of the Project area, which contains little vegetation.

Ground survey is being commissioned and the detailed design will be based upon this. Survey control will also be established as part of this process.

5.3 Geotechnical Investigation

A geotechnical investigation has been completed however, there were delays to the field work due to prolonged wet weather and then the subsequent testing was impacted by COVID related delays. The final report has recently been received to date and this is included as **APPENDIX 1**. As this report was received very recently, the pavement design for the 100% CD is still based on the “Trewilga pavement”, as discussed in Section 5.5 of this report.

The final geotechnical report will be available to support the 50% Detailed Design (50% DD) submission.

5.4 Drainage and Flooding

The presence of the proposed open cut mine, which is located upstream of the HW17 - Kyalite Deviation, may have an effect on the drainage flows across the surrounding area as flows will have to be diverted either to the north or the south of the open cut mine. Accordingly, a hydrological study has been undertaken as part of the EIS² for the Project.

The 100% CD has used results from this hydrological study to locate and dimension the drainage culverts. The final report for the hydrological study is included as **APPENDIX 4**.

The drainage design is based on a 5% AEP, which is an improvement on the existing level of service for HW17 which is estimated as 10% AEP, with water cutting the existing HW17 alignment between the Truck Parking Area and McNivens Lane.

5.4.1 Proposed drainage

The transverse drainage design proposed for the HW17 - Kyalite Deviation is set out in **Table 8**. Note that both the culvert number as shown on the plans and as shown in the hydrology report have been included to assist in interpretation. Whilst some culverts were calculated as only requiring 450mm in height, a minimum of 600mm was adopted in order to minimise ongoing maintenance.

² EIS is being prepared by RW Corkery & Co

Table 8 – Design Criteria - Culverts

Culvert	Hydrological Report ID	Type	Width (m)	Height (m)	No. Cells	US Invert RL	DS Invert RL	5% AEP Velocity (m/s)	5% AEP Flow (m3/s)
1.20	20	RCBC	1.2	0.60 ³	1	263.80	263.75	1.7	0.73
1.01	1	RCBC	1.8	0.9	10	260.75	260.71	2.3	20.50
1.02	2	RCBC	1.8	0.9	3	260.17	260.10	2.4	10.90
1.03	3	RCBC	1.8	1.2	10	260.14	260.00	2.9	38.10
1.04	4	RCBC	1.8	0.9	14	260.46	260.38	2.4	29.80
1.05	5	Pipe	0.75		1	261.69	261.62	1.1	0.17
1.16	16	RCBC	1.8	0.9	4	264.21	264.16	2.2	9.64
1.07	7	RCBC	1.8	1.2	5	264.60	264.50	2.7	18.53
1.08	8	RCBC	1.8	0.9	4	267.51	267.35	2.5	10.71
1.18	18	RCBC	1.8	0.60 ⁴	2	267.40	267.37	1.9	3.08
1.09	9	RCBC	1.8	1.2	4	267.62	267.48	2.8	14.08
1.19	19	RCBC	1.8	0.6	5	267.55	267.50	2.0	10.53

³ Design requirement was 450mm high, however 600mm adopted for maintenance reasons

⁴ Design requirement was 450mm high, however 600mm adopted for maintenance reasons

5.5 Pavement

As noted in Section 5.3, whilst a geotechnical investigation has been completed, the final report has only recently been received and this is included as **APPENDIX 1**. As this report was received very recently, the pavement design on the submitted plans is still based on the “Trewilga pavement”, as per the 50% CD submission.

The Trewilga Project, located approximately 20km to the south of this Project, was constructed three years ago and carries the same traffic volumes in similar environmental conditions and soil types. The assumption of the “Trewilga pavement” is considered to be conservative, as that design is based on a CBR of 4%⁵, whereas based on the extract below from the geotechnical report⁶ for this Project, it would appear as though a design CBR of 5% may be generally appropriate, noting that the traffic loading would be the same given the proximity of the two sites.

CBR results along the Proposed Newell Highway alignment generally range from 5% to 11% with two outliers (TP18 and TP21) of 2.5% and 3%. The lower CBR results generally correlate with a high swell / reactive subgrade. Based on the results a design CBR of 5% is considered appropriate for the Newell Highway pavement design. Specific subgrade treatments will be required around TP18 and TP21 where lower CBR values were encountered. It is noted that other localised areas with lower CBRs could also be encountered along the alignment.

The full pavement design report will be available to support the 50% DD submission.

5.6 Traffic

There will be no haulage of mine ore on public roads. This will occur via a separate dedicated off road haulage route which will take ore back to the existing processing plant. This haulage route will utilise the existing underpass of HW17.

Mine use of HW17 will consist of vehicles accessing the proposed mine administration area to be located north of Kyalite Road, with the main traffic being light vehicle traffic to the site offices, plus occasional B-double fuel trucks and service vehicles. It is estimated that an additional 248 vehicles per day (8 heavy vehicles and 240 light vehicles) will use the HW17 - Kyalite Deviation and the new alignment of Kyalite Road up to its intersection with the mine administration area.

Existing and anticipated traffic volumes on HW17 (excluding normal growth) are set out in **Table 9**.

Table 9 – Traffic Volumes

Road	Existing AADT (Aug 2020)	Anticipated AADT
HW17	4448 (45% HV)	4696 (45% HV)

5.7 Environmental Assessment

An EIS is currently being prepared by RW Corkery & Co on behalf of TGO for the proposed mine expansion, inclusive of all road related impacts. This is being undertaken in parallel with the road design for the HW17 - Kyalite Deviation and it is expected that the 100% CD will be included in the EIS when it is displayed later in 2021.

5.8 Design Requests for Information

A Design Request for Information (RFI) register has been maintained and is included in **APPENDIX 8**, along with the actual RFIs and responses received.

At the time of writing this report, all RFIs had been responded to, with most issues closed.

⁵ TfNSW Plans DS2014/000354 Sheet PV-0021

⁶ Summary of Geotechnical Investigations – Regional Geotechnical Solutions (10/11/2021) Section 4.2

6 Road Geometric Design

6.1 Horizontal Alignment

As noted in Section 4.3, the horizontal alignment for the HW17 - Kyalite Deviation has been developed to provide a minimum 650m clearance from the proposed mining operations, to enable blasting operations at the mine to be undertaken without impacting traffic movements. The HW17 - Kyalite Deviation connects to the existing HW17 alignment at the most suitable locations, given existing intersections and curves.

A series of 1500m radius reverse curves are included in the HW17 - Kyalite Deviation design from the existing HW17 alignment in the vicinity of the existing Back Tomingley West Road intersection. The HW17-Kyalite Deviation will then run parallel with the existing HW17 alignment, displaced approximately 650m to the west. North of McNiven's Lane, a series of curves return the HW17 - Kyalite Deviation to the existing HW17 alignment to the north of the rest area. The proposed alignment through this section is complicated given the need to avoid encroachment on Crown Land.

All horizontal curves are 1000m radius or greater.

An 80m wide road corridor has been provided for much of the Project, other than from chainage 7500 to 7535, where there is a pinch point which results from a parcel of crown land (DP 1020605). Consequently, the corridor width at this location will be reduced to a minimum of 60.6m however, the full footprint of the formation inclusive of table drains can be easily accommodated. Future acquisition of the crown land will provide the full 80m wide corridor in this location.

Sight distance checks have been undertaken at key locations and are included in **APPENDIX 11**.

6.2 Vertical Alignment

As noted in Section 4.3, the vertical geometry is based on maintaining the underside of pavement above the 1:20 year flood level whilst achieving the required clearance over drainage culverts. As the pavement design has not been finalised, there may be some minor changes to the finished surface levels however, the design is generally a relatively level section of road to be constructed upon an embankment of between 1m and 3m above natural surface.

Aquaplaning checks have been undertaken at key locations and are included in **APPENDIX 9**.

6.3 Typical Cross Section

The typical cross section reflects the National Highway requirements of 3.5m lane widths with 2m wide sealed shoulders, a 1m wide verge and, northbound and southbound passing lanes.

In accordance with TfNSW requirements, a 1m wide centreline treatment (WCT) has been provided for the full length of the HW17 - Kyalite Deviation.

There are no cut batters. Fill batter slopes are 6:1 unless protected by safety barrier.

6.4 Property Accesses

The land adjacent to the Project area has been purchased by TGO. Whilst some land will be used for mining operations, other components (e.g. the western side of HW17), will be used for traditional rural cropping/grazing purposes. A feature of the Project is the reduction in rural property accesses, which in turn will have beneficial safety impacts.

Typical rural property accesses will be constructed at locations as shown on the 100% CD.

7 Roadside Furniture and Signposting

7.1 Signposting

Signposting design has not been undertaken at this stage however, it is anticipated that it will essentially consist of existing signposting being relocated onto the new alignment.

8 Pavement Design

As noted in Section 5.5, the pavement design on the submitted plans is still based on the “Trewilga pavement”, as per the 50% CD submission.

The Pavement Design Report will be included the 50% DD submission.

9 Existing Services

Utility investigations and redesign are being undertaken in parallel with the concept design. **Figures 2 a), b) and c)** set out existing utilities and proposed relocations of these utilities. Detail design of these are currently being undertaken by others and will be included, when available, in future detailed design submissions.

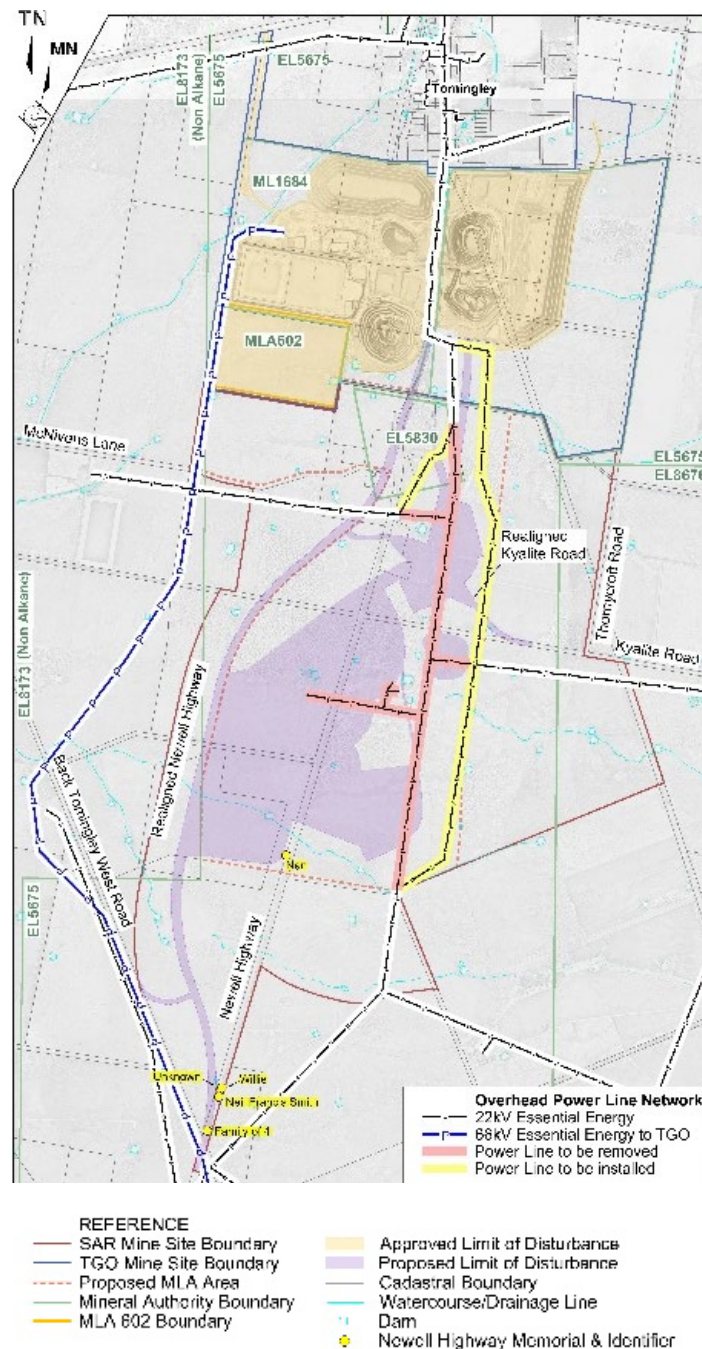
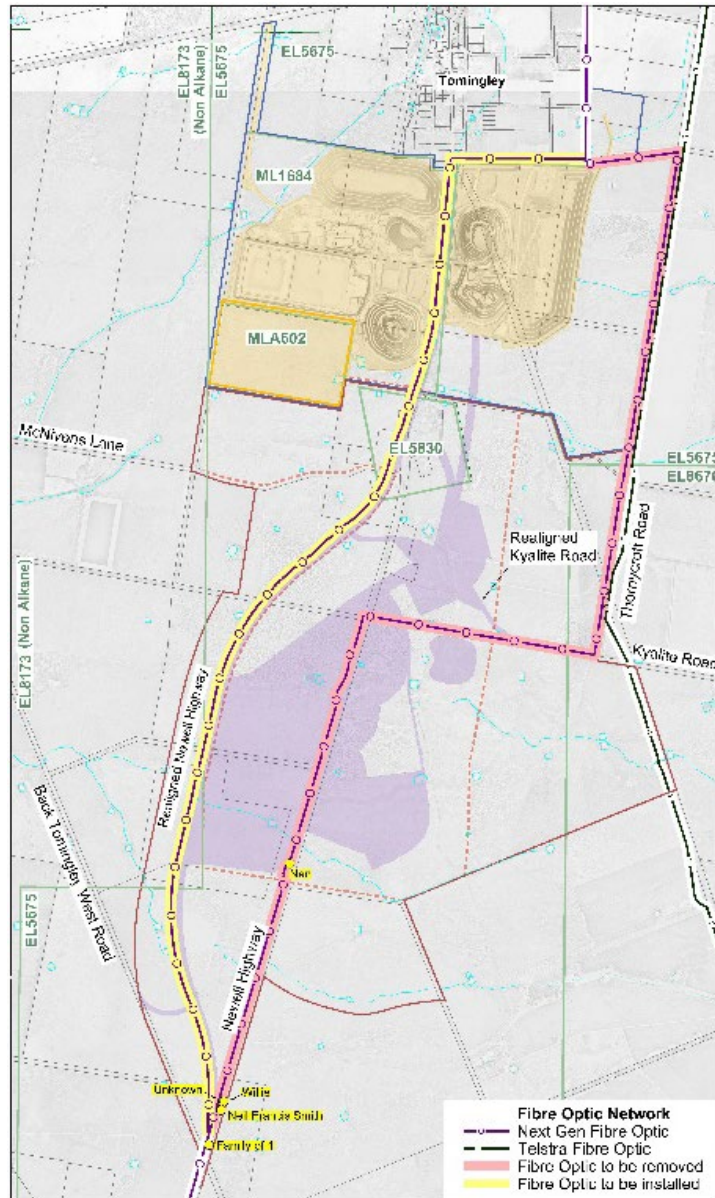
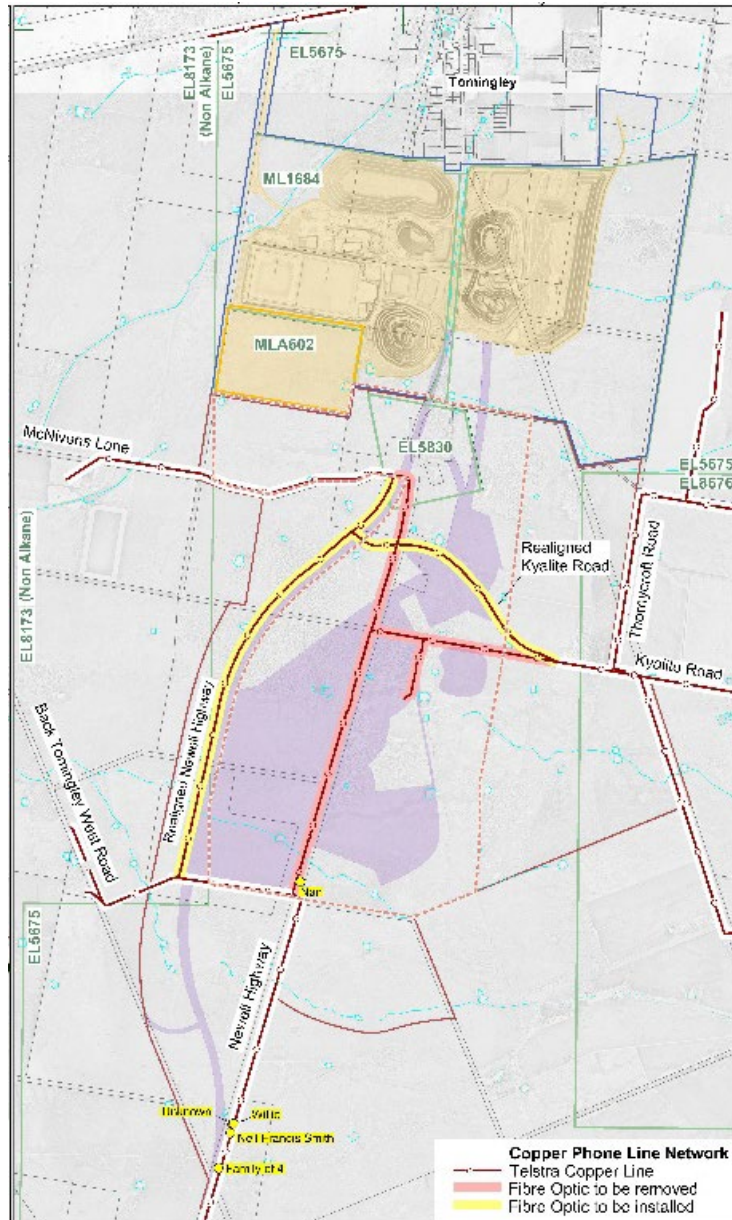


Figure 2 a) – Overhead Power



- | | |
|------------------------------|--|
| REFERENCE | |
| — SAR Mine Site Boundary | — Approved Limit of Disturbance |
| — TGO Mine Site Boundary | — Proposed Limit of Disturbance |
| --- Proposed MLA Area | — Cadastral Boundary |
| — Mineral Authority Boundary | — Watercourse/Drainage Line |
| — MLA 602 Boundary | — Dam |
| | ◆ Newell Highway Memorial & Identifier |

Figure 2 b) – Fibre Optic



- | | |
|---|--|
| <p>REFERENCE</p> <ul style="list-style-type: none"> — SAR Mine Site Boundary — TGO Mine Site Boundary — Proposed MLA Area — Mineral Authority Boundary — MLA 602 Boundary | <ul style="list-style-type: none"> — Approved Limit of Disturbance — Proposed Limit of Disturbance — Cadastral Boundary — Watercourse/Drainage Line — Dam ◆ Newell Highway Memorial & Identifier |
|---|--|

Figure 2 c) – Copper Phone Line

10 Drainage

As noted in Section 5.4, the 100% CD has used results from the hydrological study to locate and dimension the drainage culverts that traverse under the HW17 - Kyalite Deviation. The final report for the Hydrological Study is included in **APPENDIX 4**.

The drainage culverts included in the 100% CD are listed in **Table 8**. All culverts will have cast in-situ base slabs with precast crown units and link slabs, where appropriate.

11 Safety Barrier

Conceptual safety barrier design has been undertaken at this stage. Generally, safety barrier is only required over the culverts.

Definition of exact start and finish chainages, end treatments and safety barrier system will be included in the 50% DD submission.

12 Intersections

12.1 General

There are three intersections on the HW17 - Kyalite Deviation which connect NSC local roads. The configuration of each intersection and the design vehicle are shown in **Table 10**. Whilst not required due to traffic volumes, CHR/BAL configurations have been provided at the McNivens Lane and Back Tomingley West Road intersections in response to TfNSW comments on the 50% CD. Intersection Design Parameters and related calculations are included in **APPENDIX 5**.

Table 10 – Intersection Configurations

Intersecting Road	Intersection Configuration	Design Vehicle
Kyalite Road	CHR / AUL	B -Triple
Back Tomingley West Road	CHR / BAL	B -Triple
McNivens Lane	CHR / BAL	B -Triple

Horizontal swept paths for B-Triples have been used for the intersection designs and are included in **APPENDIX 3**. Designs have been prepared to avoid any encroachment into private property.

12.2 Kyalite Road

This intersection has been designed with CHR and AUL turn treatments. Details of the design are provided below.

12.2.1 CHR turn treatment

The turn treatment for this intersection has been based on a CHR turn treatment for a two lane rural road. In accordance with Austroads Guide to Road Design Part 4: Intersections and Crossings General, the general arrangement for the CHR is shown in **Figure 3**.

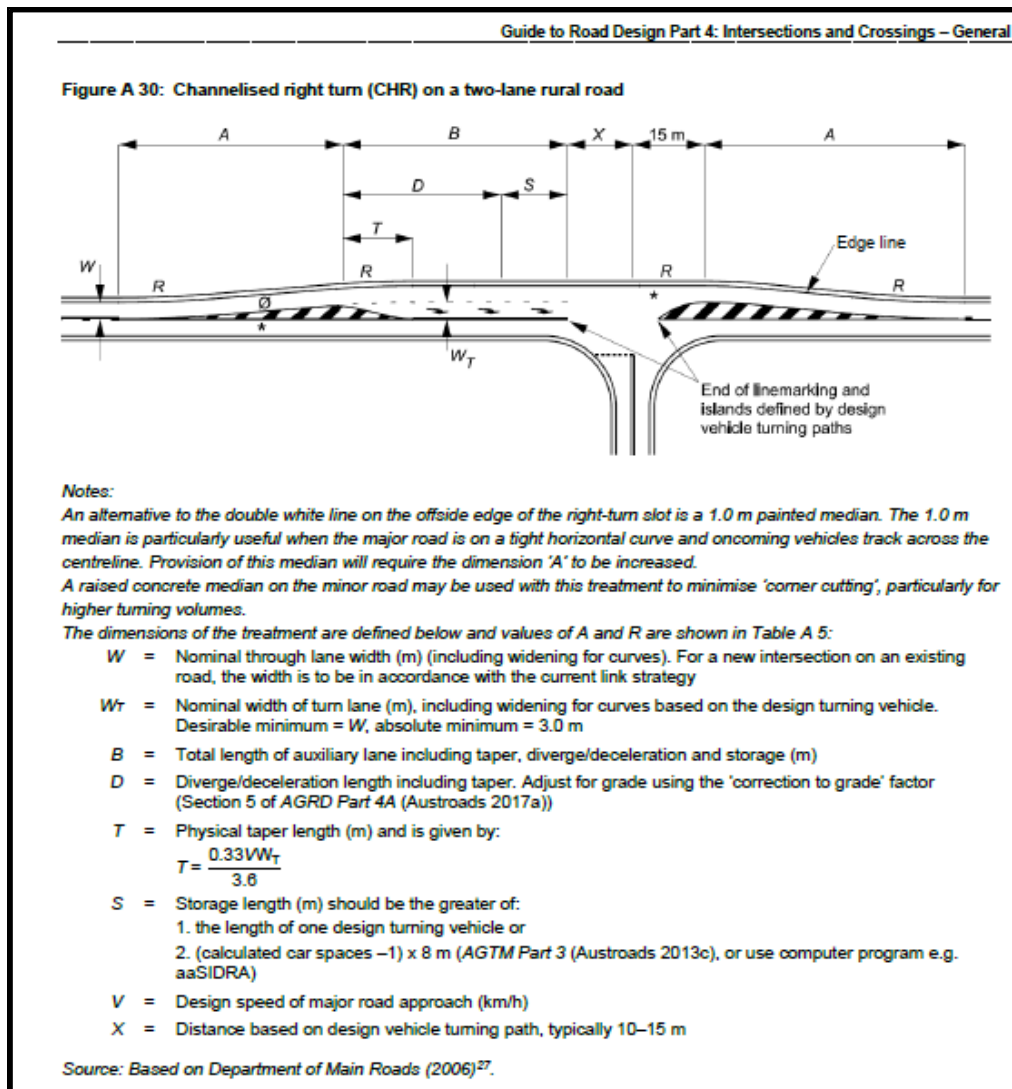


Figure 3 – CHR Turn Treatment

The dimensions of the CHR for this design have been based on the calculations as provided in **APPENDIX 5**.

12.2.2 AUL turn treatment

The AUL turn treatment for this intersection has been based on an AUL turn treatment for a two lane rural road. In accordance with Austroads Guide to Road Design Part 4: Intersections and Crossings General, the general arrangement for the AUL is shown in **Figure 4**.

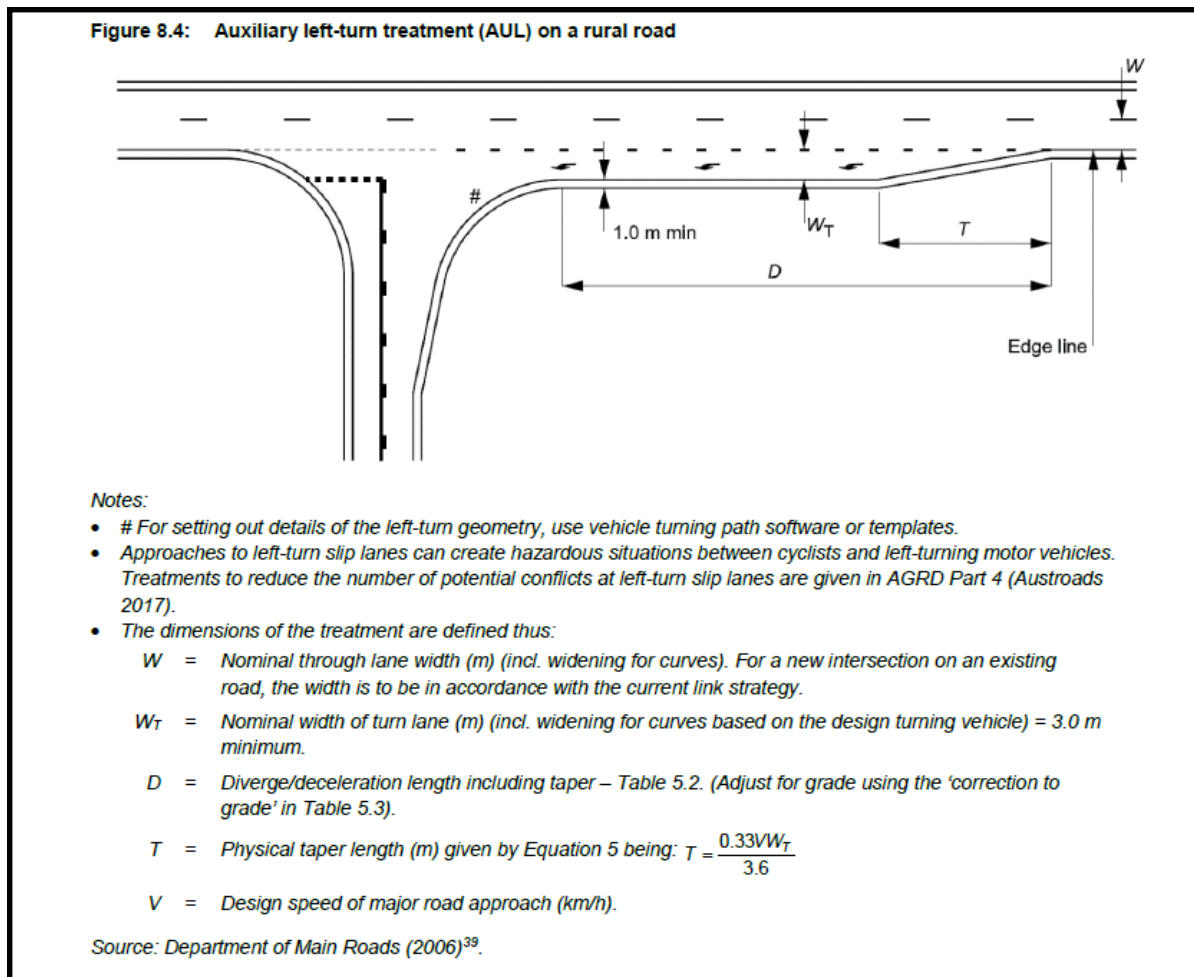


Figure 4 – Rural AUL Turn Treatment

The dimensions of the AUL for this design have been based on the calculations as provided in **APPENDIX 5**.

12.3 Back Tomingley West Road and Mc Nivens Lane

Both the Back Tomingley West Road and McNivens Lane intersections have been designed with CHR/BAL turn treatments. Details of the design are provided below.

12.3.1 BAL Turn Treatments

The design for these two intersections has been based on CHR/BAL turn treatments for a two lane rural road. In accordance with Austroads Guide to Road Design Part 4: Intersections and Crossings General, the general arrangement for the CHR and BAL are shown in **Figure 3** and **Figure 5** respectively.

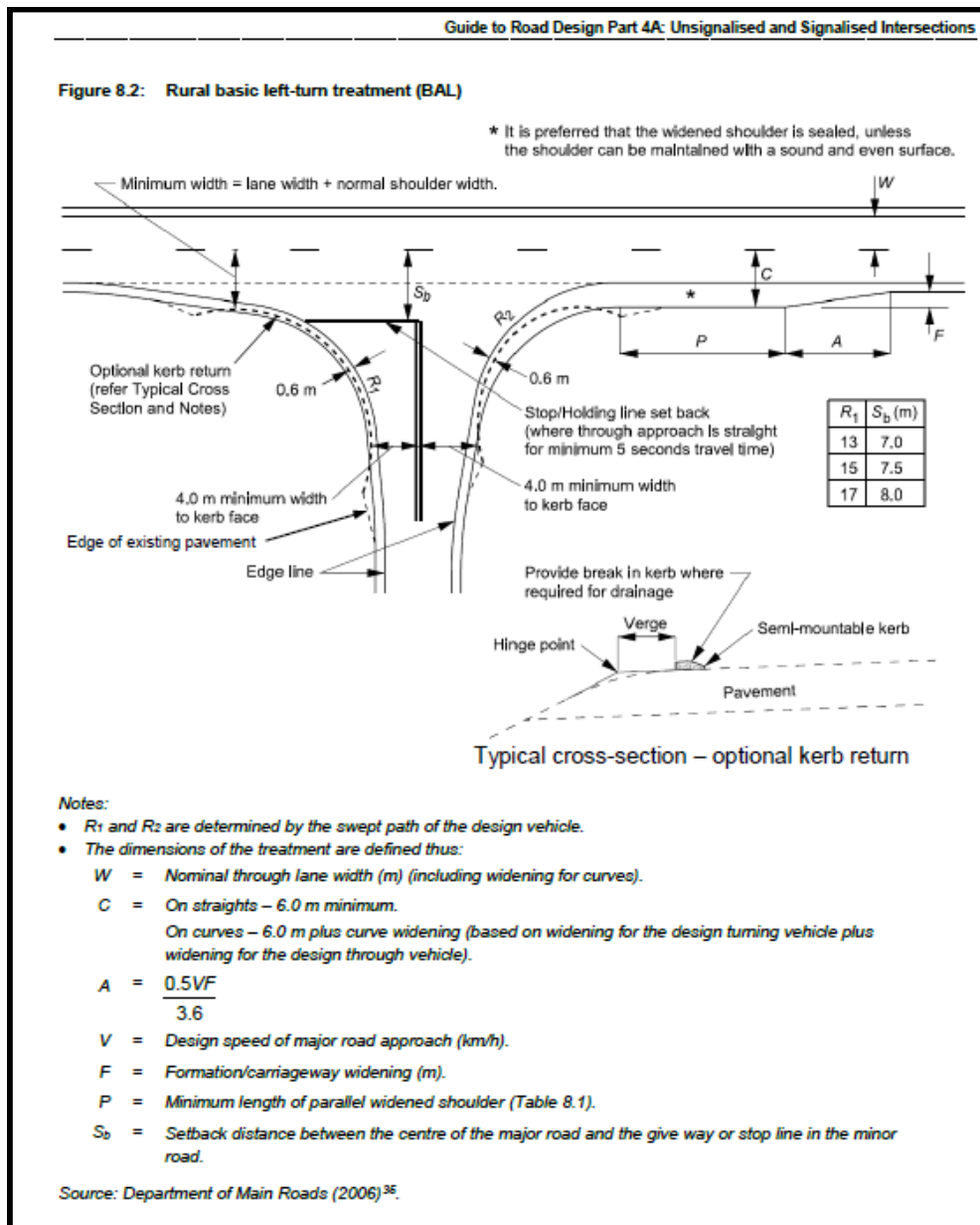


Figure 5 – BAL Turn Treatment

This design was based on the dimensions was based on the dimensions stated in Austroads Guide Part 4a. Refer to **APPENDIX 5** for BAL Turn Treatment Calculations.

13 Road Safety Audit

A Road Safety Audit (RSA) has been undertaken on the 100% CD and all issues closed out for the 100% CD submission. No Corrective Actions were raised by the RSA. The report is included in **APPENDIX 6**.

An additional RSA will be undertaken during the detailed design phase. The WAD required this to be undertaken as part of the 80% Detailed Design (80% DD) submission (refer WAD Attachment A cl 4).

14 Health Safety in Design (HSiD)

The principles of HSiD are being continually incorporated into the Concept Design. Given the issues relating to the construction and maintenance of the HW17 - Kyalite Deviation will be nearly identical to that of the existing HW17 alignment, a formal HSiD workshop will not be undertaken until the detailed design phase. The WAD required this to be undertaken following 80% DD (refer WAD Attachment A cl 23) however, it has been agreed⁷ that this be held prior to the 80% DD submission, as it will add greater value to the process.

A HSiD risk register has been established and will be updated continually during the design process. Examples of design changes initiated by HSiD considerations include formation widening at each major culvert to enable parking of maintenance vehicles clear of general traffic.

15 Constructability

As the Project is being funded and constructed by TGO, constructability consultation will be taken in house, in conjunction with the proposed mine construction schedule and related activities. It is noted a Constructability Workshop may be required following 80% DD (refer WAD Attachment A cl 23) however, it has been agreed⁸ that this be held prior to the 80% DD submission as it will add greater value to the process.

In general, with the majority of the Project being able to be constructed “off road” and well clear of the existing alignment and on flat, open natural surface, there should be minimal issues of constructability. It is anticipated that there will need to be a detailed examination of how to construct the section north of McNivens Lane whilst maintaining HW17 traffic flows, as the new and old alignments cross and are in close proximity. This will be considered in detail following detailed survey pick up of features and as part of the 50% DD and related construction staging plans.

16 Departures from the Standards

Departures from the standards have been included with this design due to numerous constraints. **10** provides details of the departure and the proposed mitigations.

Table 10 – Departure of the Standards and Proposed Mitigation Measures

Item	Departure Details	Justification/Mitigation
01	Nil	

17 Design Comments Register

Refer to **APPENDIX 7** for the Design Comments Register which includes all external design review comments and associated responses.

⁷ Response to RFI ALK001 Item 1.16

⁸ Response to RFI ALK001 Item 1.16

APPENDIX 1: Geotechnical Report

Constructive Solutions

Tomingley Gold – Newell Highway Realignment Project

Pavement Investigations and Bridge Foundation Assessment

Geotechnical Report

Report No. RGS32759.1 – AC Rev. 1

10 November 2021



RGS32759.1 – AC Rev. 1

10 November 2021

Constructive Solutions
7 Gipps Street
TAMWORTH NSW 2340

Attention: Steve O'Rourke

Dear Steve,

**RE: Tomingley Goldmine – Newell Highway Realignment Project
Geotechnical Report**

Regional Geotechnical Solutions Pty Ltd (RGS) are pleased to submit this geotechnical investigation report for the Tomingley Goldmine – Newell Highway Realignment Project.

The investigations were undertaken during a period of wet weather making site access difficult with some areas of the site only accessible via foot. This resulted in the need to vary the scope of works from that proposed with alternative means of investigation required, which include the use of hand-held equipment. This approach did not impact the outcomes of the assessment.

The assessment indicates a generally consistent profile across the site with some localised variances including areas with low subgrade CBR identified. The profile generally comprises alluvial clay soils over residual clay that grades into weathered rock at depths typically less than 3m.

Based on the results of the assessment sufficient investigations and laboratory analysis has been conducted to characterise the site. The investigations and assessment as presented herein are adequate to inform the planning and preliminary design phases of the project. Additional geotechnical input will be required throughout the various detailed design and construction phases of the project.

The report outlines the work undertaken, presents the results of the assessment and laboratory analysis and provide comments and recommendation on geotechnical aspects of the various components of the project.



If you have any questions regarding this report or require any further information, please do not hesitate to contact the undersigned.

For and on behalf of

Regional Geotechnical Solutions Pty Ltd

Prepared by

Louis Davidson

Geotechnical Engineer

Reviewed by

Adam Holzhauser

Associate Geotechnical Engineer



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- Figure 2 Culvert Test Location Plan
- Figure 3 Borrow Area Test Location Plan



Figure 4 Bridge Test Location Plan

Figure 5 Bridge Long Section

Appendices

Appendix A Results of Field Investigations

Appendix B Laboratory Test Result Sheets



1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) completed geotechnical investigations and assessment for the works associated with the proposed expansion of the Tomingley Gold Mine.

Tomingley Gold Mine is located south of Tomingley Village. The mine is seeking government approval to expand their mining operation to access two gold deposits south of the current mine. To expand the mine a section of the Newell Highway and sections of two local council roads will require rerouting. The works will also require several new culverts and a new single or possible two span bridge.

The investigations focused on the following areas of the proposed development:

- New alignment of Newell Highway.
- New alignments of council roads including
 - Kyalite Road; and
 - Back Tomingley West Road;
- Culvert locations.
- Proposed borrow area.
- Proposed bridge location.

The extent of the investigation is summarised in Table 1 below.

Table 1: Summary of Investigation

Location	Test Points	Method of Assessment	Depth (m)
Newell Highway	22	Combination of test pit, large and small diameter Borehole	1 - 1.5
Kyalite Road	2	Borehole	1.5
Back Tomingley West Road	3	Borehole	1 - 1.5
Culvert Locations	14	Combination of test pit, large and small diameter Borehole	1.2 - 3
Borrow Area	7	Borehole	1 - 3
Bridge	4	Borehole	8.65 – 11.6

This report presents the results of the geotechnical investigations and laboratory analysis that were undertaken for the project.

Diagram 1 and the Appended Figure 1 illustrate the location of the site.



Diagram 1: Google Earth Image Illustrating Site Location and Setting



The investigations were undertaken during an extended period of wet weather making site access difficult. Much of the site was only accessible via foot. Therefore, the scope of works was altered to suit conditions and enable the assessment to proceed. This included the use of hand-held equipment. This approach did not impact the outcomes of the assessment.

Given the generally consistent profile across the site sufficient investigations and laboratory analysis has been conducted to characterise the site. The investigations and assessment as presented herein are adequate to inform the planning and preliminary design phases of the project. Additional geotechnical input will be required throughout the various detailed design and construction phases of the project.



2 FIELD WORK

The investigations were undertaken during a period of prolonged wet weather. Most of the site was not accessible vehicles including four-wheel drive. Much of the site was also inaccessible for tracked plant without causing excess damage to the upper profile. The fieldwork program was rescheduled several times due to rain causing the timeframes to be significantly impacted. Alternative investigation methods including the use of hand tools was adopted to enable sitework to be completed.

Field work for the investigation included the following:

- Site walkover assessment which includes observation of the geological setting along the section of road being assessed, pavement drainage conditions, and pavement surface conditions along the alignment and more specifically in the vicinity of the borehole locations.
- Intrusive investigations including:
 - Drilling of thirty-one boreholes for pavement investigation (TP1 to TP31).
 - Four bridge investigation boreholes (BH1 to BH4).
 - Seven culvert investigation boreholes (C1, C2, C3, C8, C11, C14 and C15).
 - The borehole locations were marked out by RGS onsite using a handheld GPS based on the locations presented within the approved Geotechnical Investigation Plan. Figure 2 illustrates the borehole locations.
 - The pavement investigation boreholes were drilled to the depth of 1.5m, while the bridge investigation boreholes were drilled to depths of up to 11.6m. The culvert investigation boreholes were drilled to a depth of 3.0m with a Ute mounted drill rig with 100mm and 150mm diameter auger.
- Dynamic Cone Penetration (DCP) tests were undertaken within the subgrade soils alongside some of the boreholes. The results of the DCP tests are presented on the engineering logs presented in Appendix A.
- Collection of soil samples from prominent stratum encountered within the boreholes for subsequent laboratory analysis as detailed in Section 4. The samples were collected in heavy duty zip tie sealed plastic bags, with each sample allocated a unique sample reference number as indicated on the logs.

The borehole locations were marked out by RGS onsite using a handheld GPS based on the locations nominated by Constructive Solutions as outlined in Table 2. Figures 1 to 4 illustrates the borehole locations.

The pavement investigation boreholes were drilled to the depth of up to 1.5m, while the bridge investigation boreholes were drilled to depths of up to 11.6m. The culvert investigation boreholes were drilled to a depth of up to 3.0m using a combination of drilling and investigation methods.

The field work and logging were undertaken in general accordance with AS1726:2017 by a Geotechnical Engineer from RGS. Engineering logs of the boreholes are presented in Appendix A.

The test location plan provided by Constructive Solutions Drawing Number 2019116-002 was revised several times throughout the project including shortly after the completion of the first phase of the fieldwork, as such some locations on Revision H of the drawings do not match the numbering system used by RGS. The test numbers used by RGS and the corresponding labels in accordance with the Revision H drawing are summarised in Table 2 below.



Table 2: Test Locations

RGS Label	Constructive Solutions Label	Description
C1	C1	Culvert
C2	C3	Culvert
C3	C4	Culvert
C5	C6	Culvert
C6	C7	Culvert
C7	--	Culvert
C8	C9	Culvert
C10	C10	Culvert
C10A	C10 (Sth)	Culvert
C11	C11	Culvert
C12	C5	Culvert
C13	C13	Culvert
C14	C2	Culvert
C15	C8	Culvert
BH1	BH2	Bridge investigation
BH2	BH1	Bridge investigation
BH3	BH3	Bridge Investigation
BH4	BH4	Bridge Investigation
TP1	TP1	Borrow Area
TP2	TP2	Borrow Area
TP3	TP3	Borrow Area
TP4	TP4	Borrow Area
TP5	TP5	Borrow Area
TP6	TP6	Borrow Area
TP7	TP7	Newell Highway

RGS Label	Constructive Solutions Label	Description
TP8	TP8	Newell Highway
TP9	TP9	Newell Highway
TP10	TP10	Newell Highway
TP11	TP11	Newell Highway
TP12	TP12	Newell Highway
TP13	TP13	Newell Highway
TP14	TP14	Newell Highway
TP15	TP15	Newell Highway
TP16	TP16	Newell Highway
TP17	TP17	Newell Highway
TP18	TP18	Newell Highway
TP19	TP19	Newell Highway
TP20	TP20	Newell Highway
TP21	TP21	Newell Highway
TP22	TP22	Newell Highway
TP23	TP23	Newell Highway
TP24	TP24	Newell Highway
TP25	TP25	Newell Highway
TP26	TP26	Newell Highway
TP27	C10	Newell Highway
TP28	TP28	Newell Highway
TP29	TP29	Kyalite Road
TP30	TP30	Newell Highway
TP31	TP31	Newell Highway
TP32	TP32	Back Tomingley West Road



3 GEOMORPHOLOGY

3.1 Geology

The NSW Government 'MinView' Geological Survey of NSW indicates the Narromine 2nd Ed 1:250000 is the geological map relevant to the area. The map indicates the site is underlain by the following:

- (Cza) (White shading): Quaternary Alluvium, dominantly red silt with some pebble bands and quartz grit. includes relic meanders but currently is being eroded.
- (Cz) (Yellow shading): Tertiary Alluvium without any obvious meanders.
- Cotton Formation (θ -Sc) (Pink shading): Siltstone and Minor Chert

The majority of the alignment transitions between the quaternary and tertiary alluvium deposits. The southern section (TP7 to TP13) is located near the boundary of the Cotton Formation and the Quaternary Alluvium.

The extents of the geological units as illustrated on the 'MinView' website are presented in Diagram 2. The approximate extent of the section investigated is shown by the red box.

Diagram 2: Site Geology Conditions





Locally, the site is situated within a region characterised by flat to gently undulating alluvial topography. Most of the area is agricultural and the upper profile has been disturbed by tilling and cultivation.

Surface soils are primarily alluvial silty clays with some residual silty clays.

4 LABORATORY TESTING

4.1 Laboratory Testing Schedule

Samples collected during the field work were sent to the NATA accredited East West Enviroag testing laboratory in Tamworth, NSW. The laboratory scheduling was undertaken by RGS based on the scope of works outlined in RGS proposal (Ref: RGS32759.1 – AA) with some variation based on conditions encountered. The testing was undertaken in accordance with the relevant TfNSW test methods for the Newell Highway.

Tables 3 to 13 summarise the testing schedule undertaken. The test results are summarised in the following Sections. Laboratory test results sheets presented in Appendix B.



Table 3: Testing Schedule

Location	Test Type	Quantity
Newell Highway	CBR	14
	Atterberg Limit	15
	Moisture Content	14
	Grading	4
Kyalite Road	CBR	2
	Atterberg Limit	2
	Moisture Content	2
Back Tomingley West Road	CBR	1
	Atterberg Limit	1
	Moisture Content	1
Culvert Locations	Atterberg	5
	Aggressivity	6
	Sulphides and Oxidizing and Reducing Bacteria	3
	Soil Erodibility K Factor	5
	Emmerson Aggregate	5
Borrow Area	Atterberg Limit	4
	CBR	4
	Pre-treatment	0
	Moisture Content	4
Bridge	Acid Sulfate Rock	4
	Aggressivity	2
	Sulphides and Oxidizing and Reducing Bacteria	2
	Point Loads	14
	In-situ Permeability	2

The laboratory results for the relevant portion of the project are summarised below. Laboratory test result sheets are presented in the Appendices.

4.2 Pavement Testing

A summary of the laboratory 10 day soaked CBR (undertaken for Newell Highway), 4 day soak CBR (undertaken for council roads and other locations), and Atterberg Limits test results is presented in Tables 4 and 5.



Table 4: Summary of CBR & Atterberg Limits Test Results – Newell Highway Alignment

Sample Location	Sample Depth (m)	Material Type	Liquid Limit (%)	Plasticity Index (%)	Field MC (%)	OMC (%)	MDD (t/m ³)	CBR Swell (%)	CBR (%)
TP7	0.1 – 0.4	Pavement Gravel	18	5	--	--	--	--	--
TP7	0.6 – 1.1	CLAY	50	38	15.8	20.3	1.68	1.7	6
TP7	0.1 – 0.4	Pavement Gravel	17	3	--	--	--	--	--
TP8	0.5 – 1.0	Sandy CLAY	32	18	14.7	18.0	1.72	2.1	7
TP10	0.3 – 0.8	Silty CLAY	--	--	24.9	22.4	1.60	0.6	5
TP11	0.3 – 0.8	Sandy CLAY	--	--	17.1	9.4	2.00	0.2	9
TP16	0.3 – 0.8	Silty CLAY	--	--	13.5	11.3	1.93	-0.2	3
TP18	0.1 – 1.0	CLAY	53	41	12.4	16.5	1.73	4.3	2.5
TP19	0.2 – 1.0	Sandy CLAY	39	27	11.0	13.2	1.90	0.6	8
TP20	0.1 – 0.7	CLAY	44	32	16.9	19.1	1.69	1.2	5
TP21	0.1 – 0.7	CLAY	39	27	21.0	19.8	1.64	1.2	3
TP22	0.1 – 0.6	CLAY	39	27	17.2	19.2	1.71	1.3	7
TP23	0.4 – 1.0	Gravelly CLAY	45	34	15.8	17.4	1.78	0.6	7
TP24	0.1 – 0.5	CLAY	27	15	--	--	--	--	--
TP24	0.2 – 0.7	Sandy CLAY	--	--	14.3	13.0	1.91	-0.2	7
TP25	0.1 – 0.5	Pavement Gravel	25	3	--	--	--	--	--
TP25	0.8 – 1.3	Sandy CLAY	21	9	9.1	10.5	2.00	-0.2	11
TP27	0.1 – 0.45	Pavement Gravel	24	9	--	--	--	--	--
TP27	0.5 – 1.0	Silty CLAY	19	6	5.7	10.4	1.98	0.0	7

Note: Values in bold indicate results of note

CBR results along the Proposed Newell Highway alignment generally range from 5% to 11% with three outliers (TP16, TP18 and TP21) of 2.5% to 3%. The lower CBR results generally correlate with a high swell / reactive subgrade. Based on the results a design CBR of 5% is considered appropriate for the Newell Highway pavement design. Specific subgrade treatments will be required around TP16, TP18 and TP21 where lower CBR values were encountered. It is noted that other localised areas with lower CBRs could also be encountered along the alignment.

Table 5: Summary of CBR & Atterberg Limits Test Results – Kyalite Road

Sample Location	Sample Depth (m)	Material Type	Liquid Limit (%)	Plasticity Index (%)	Field MC (%)	OMC (%)	MDD (t/m ³)	CBR Swell (%)	CBR (%)
TP28	0.3 – 1.0	CLAY	59	48	21.2	23.8	1.56	5.2	2.5
TP29	0.1 – 0.4	Pavement	20	9	7.1	11.0	1.98	-0.5	6



CBR results along the Proposed Kyalite Road alignment were 2.5% to 6%. It is noted that TP28 was undertaken close to TP21 (Newell Highway) which had a CBR of 3% as illustrated below.

Based on the laboratory results a design CBR of 2.5% is considered appropriate for Kyalite Road.

Diagram 3: Location of Low CBR Values

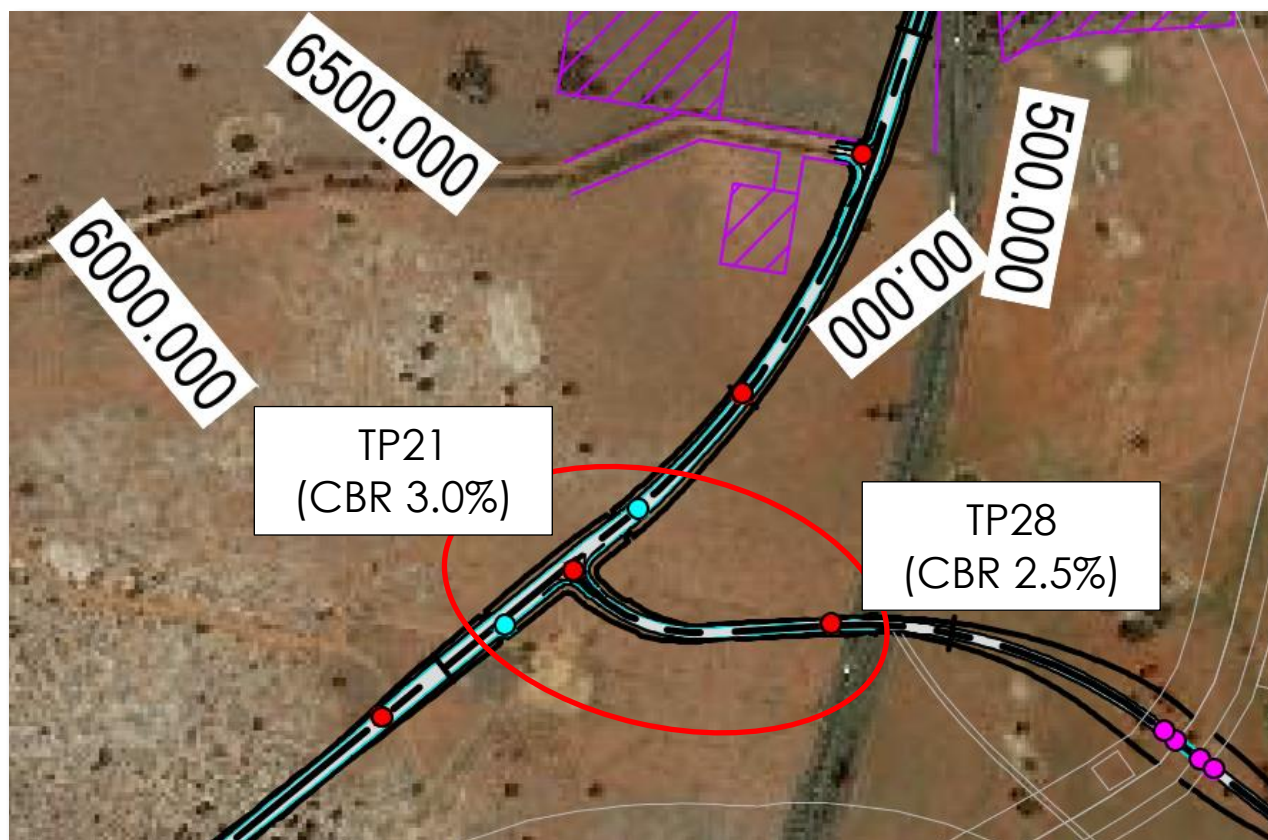


Table 6: Summary of CBR & Atterberg Limits Test Results – Back Tomingley West Road

Sample Location	Sample Depth (m)	Material Type	Liquid Limit (%)	Plasticity Index (%)	Field MC (%)	OMC (%)	MDD (t/m ³)	CBR Swell (%)	CBR (%)
TP32	0.1 – 0.6	Silty CLAY	24	12	8.0	12.2	1.91	0.4	5

Based on the laboratory results a design CBR of 5% is considered appropriate for Back Tomingley West Road.

Table 7: Summary of CBR & Atterberg Limits Test Results – Borrow Area

Sample Location	Sample Depth (m)	Material Type	Liquid Limit (%)	Plasticity Index (%)	Field MC (%)	OMC (%)	MDD (t/m ³)	CBR Swell (%)	CBR (%)
TP1	0.3 – 0.8	Silty CLAY	37	24	19.3	15.9	1.81	0.1	3.5
TP4	0.2 – 0.5	Sandy CLAY	21	8	13.2	10.8	1.97	0.3	6
TP5	0.4 – 1.0	CLAY	51	39	18.6	18.6	1.73	1.4	7
TP6	0.2 – 0.7	Sandy CLAY	29	17	15.6	15.2	1.81	1.0	7



The material within the proposed borrow (future mine pit) could be reused as general fill but should not be used in the upper zone of any pavements. A design CBR of 5% is considered appropriate. Some conditioning may be required for material in the southern portion of the site excavated from around TP1.

It is noted that where swell is greater than 2.5% a capping layer will need to be incorporated in the overall pavement thickness design to meet TfNSW requirements.

Generally, the materials are consistent along the proposed alignment with some localised exceptions. These sections can be managed locally with specific subgrade treatments incorporated into the pavement design.

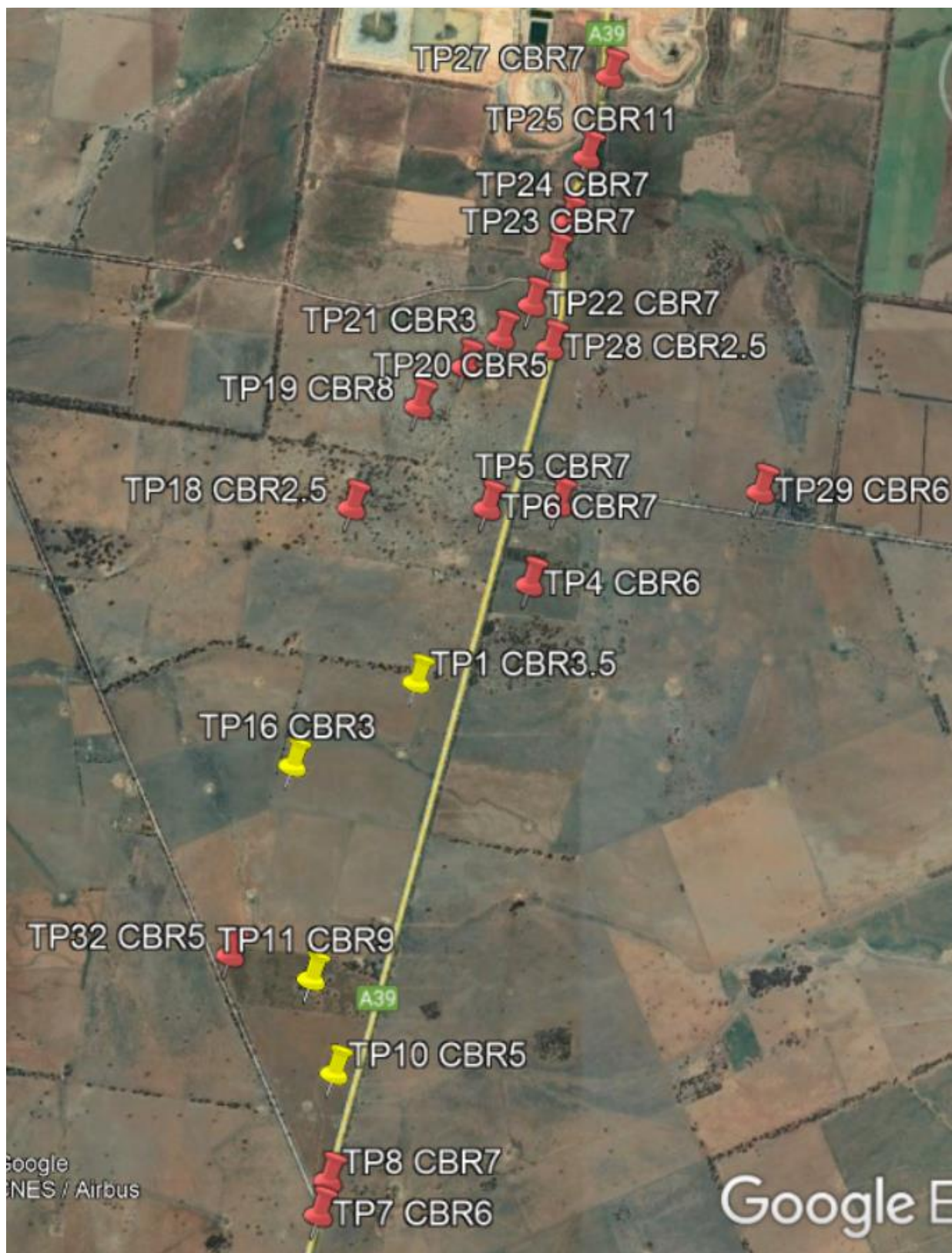
The fieldwork was undertaken in a period of prolonged and ongoing rainfall. The upper profile was 'saturated' with optimum moisture content well above optimum. The site was not trafficable as a result. During 'dry' weather site trafficability is not likely to be an issue. The upper 300mm or so of the profile is heavily disturbed due to tillage and cultivation. This has resulted in an increase in the permeability of the upper profile rendering it more susceptible to moisture increase and subsequent softening. Long term cultivation has resulted in the formation of a hard pan at approximately 300mm depth over most of the site. The hard pan compounds the issues associated with moisture ingress and softening as it forms a less permeable layer upon which water penetration is reduced causing water to effectively pond within the upper 300mm.

If construction is undertaken during a period of wet weather such as that experienced during the investigations extensive subgrade replacement is expected to be required.

The locations tested and the CBR results are illustrated in Diagram 4.



Diagram 4: Summary of CBR Results





4.3 Bridge and Culvert Testing

The laboratory test results for the proposed bridge and culvert areas are presented in the following tables.

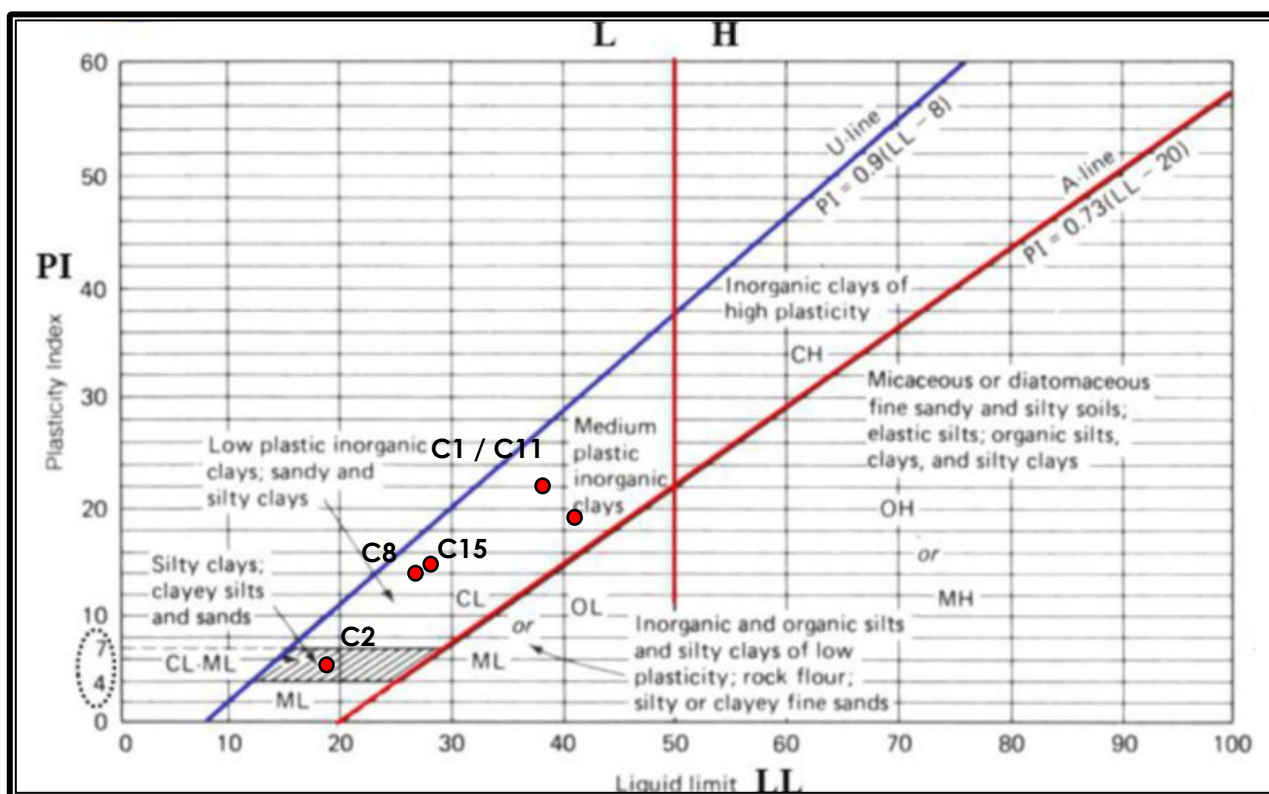
A summary of the Atterberg Limits test results for the culverts is presented in Table 8.

Table 8: Summary of Atterberg Limits Test Results – Culvert

Sample Location	Sample Depth (m)	Material Type	Liquid Limit (%)	Plasticity Index (%)
C1	0.4 – 0.65	Silty CLAY	37	22
C2	0.5 – 0.6	Silty CLAY	18	6
C8	0.3 – 0.6	Silty CLAY	26	14
C11	0.5 – 0.8	Silty CLAY	37	22
C15	0.5 – 0.8	Sandy CLAY	28	15

The results of the testing have been plotted on the Soil Plasticity Chart presented in Figure 1

Chart 1: Plasticity Chart



The Atterberg Limit testing indicates the soil at the culvert locations are clays of low to medium plasticity. Tactile field assessment indicates the soils are generally medium to high plasticity.

The results of aggressivity testing for the bridge and culvert locations are summarised in Table 9 and Table 10 below. The results have been compared against the exposure classification criteria set out in AS2159-2009, Piling – Design and Installation.



Table 9: Results of Soil Aggressivity Testing - Culverts

Location	Sample Depth (m)	Texture	pH	Soluble Sulfate (mg/kg)	Chloride (mg/kg)	Resistivity (ohm.cm)	Concrete	Steel
C1	0.4 – 0.65	Fine (B)	5.66	7.46	32.5	11,111	Non-aggressive	Non-aggressive
C2	0.5 – 0.6	Fine (B)	5.26	9.65	22.2	25,000	Mild	Non-aggressive
C6	1.8 – 2.0	Fine (B)	7.13	2,517	1216	534	Non-aggressive	Moderate
C8	0.3 – 0.6	Fine (B)	5.36	7.86	18.3	25,000	Mild	Non-aggressive
C11	0.5 – 0.8	Fine (B)	6.76	10.8	7.05	14,285	Non-aggressive	Non-aggressive
C15	0.5 – 0.8	Fine (B)	6.08	5.21	7.42	33,333	Non-aggressive	Non-aggressive

Table 10: Results of Soil Aggressivity Testing – Bridge

Location	Sample Depth (m)	Texture	pH	Soluble Sulfate (mg/kg)	Chloride (mg/kg)	Resistivity (ohm.cm)	Concrete	Steel
BH2	2.5 – 2.6	Coarse (A)	8.23	236	71.5	13,432	Mild	Non-aggressive
BH3	0.5 – 0.6	Medium (A)	8.75	142	44	16,502	Mild	Non-aggressive

Results of Emerson Aggregate and Soil Erodibility testing are summarised in Table 11.



Table 11: Results of Emmerson Aggregate and Soil Erodibility Factor (K) Testing

Location	Emmerson Class No.	Dispersion Potential	Soil Erodibility Factor (K)
C1	1	High	0.03
C2	3b	Moderate	0.05
C8	3b	Moderate	0.04
C11	3b	Moderate	0.02
C15	3b	Moderate	0.03

The results of the Sulphides and Oxidizing and reducing bacteria analysis is presented in Table 12.

Table 12: Results of Sulphides and Oxidizing and Reducing Bacteria Analysis

Location	Sulphate Reducers No./g	Sulphur Oxidizers No./g
C5	+ (<10)	+ (1<X<100)
C7	+ (<10)	<1
C12	+ (<10)	<1
BH2	<1	<1
BH3	<1	+ (1<X<100)

The results of the analysis indicate an absence of or very low numbers of sulphate reducers and sulfate oxidizers.

The results of acid sulfate rock analysis are presented in Table 13.



Table 13: Results of Acid Sulfate Road Testing

Location	Depth (m)	Potential Sulfidic Acidity – CRS (mol H ⁺ /t)	Acid Neutralising Capacity (mol H ⁺ /t)	NAG pH	NAG Net Acidity to pH7	Classification (based on NAG pH and NAPP)	Classification (based on NAPP)
BH1	5.55-5.60	0	213	7.54	0	NAF	ACM
BH2	8.26-8.30	0	255	7.95	0	NAF	ACM
BH3	2.85-2.90	0	999	8.62	0	NAF	ACM
BH4	6.22-6.34	0	158	6.84	0.3	NAF	ACM

The results of the analysis indicate the following:

- NAF – The rock tested is non-acid forming.
- ACM – The rock tested has acid consuming potential.

4.4 Permeability Testing

One in-situ falling head permeability test was undertaken at the proposed bridge location. Additional testing had been proposed but was not feasible due to seepage flows through the upper profile from recent and ongoing rainfall at the time of the investigations. Diagram 4 illustrates the approximately location of the testing.

Diagram 4: Permeability Test Location





One uncased falling head permeability test was undertaken adjacent to BH3. The borehole was drilled using an 100mm auger and extended to a depth of 1.0m.

The borehole encountered alluvial and residual clays grading to weathered brecciated sandstone.

The testing indicates an average hydraulic conductivity (k) of 1.65×10^{-6} m/s. This value is consistent with what would be expected for the materials encountered.

5 ROAD ALIGNMENTS

The majority of the boreholes excavated for the proposed pavements were drilled within agricultural areas along the proposed new alignment. Boreholes were drilled within the existing Newell Highway pavements at four locations including:

- The Northern and southern tie-ins to the Newell Highway.
- Kyalite Road.
- Back Tomingley West Road.

A summary of the existing pavement and subgrade conditions within each section is provided below.

5.1 Existing Newell Highway (South Side)

The existing pavement has generally been constructed at or near grade, or on low fill embankments in lower lying areas. The pavement is in reasonable condition and appears to have been upgraded in the past 5 or so years.

The pavement profile generally comprised:

Wearing Surface: Spray Seal generally 15mm to 30mm thick.

Base: Sandy GRAVEL, fine to coarse grained, angular gravel very dense, to up to 0.25m

Subbase: Gravelly SAND, fine to coarse grained fine to coarse grained angular gravel, up to 0.45m

Subgrade: Alluvial Silty CLAY, medium to high plasticity, with some fine-grained sand, and fine grained gravel, hard, to at least 1.5m.

Further details of the conditions encountered are provided in the Engineering Logs (TP7 to TP8) presented in Appendix A.

The pavement condition and pavement/subgrade materials are illustrated in the photographs below.



1. Newell Highway near TP7 looking north



2. Newell Highway near TP7 looking south



3. TP7 exposure

5.2 Existing Highway (North Side)

The pavement is in reasonable condition and appears to have been upgraded in the past 5 or so years. The pavement profile generally comprised:



Wearing Surface: Spray seal generally 30mm thick.

Base/Subbase: Sandy Silty GRAVEL, fine to coarse grained, angular, fine to medium grained sand, to up to 0.6m.

General Fill: Silty CLAY, medium plasticity, very stiff to hard, to up to 0.8m.
Clayey GRAVEL, fine to coarse grained, red-brown.

Subgrade: Alluvial Silty CLAY/Clayey SILT, medium plasticity, hard, to at least 1.5m.

Further details of the conditions encountered are provided in the Engineering Logs (TP25 & TP27) presented in Appendix A.

The pavement condition and pavement/subgrade materials are illustrated in the photographs below.



1. Newell Highway near TP27 looking south



2. TP27 exposure



5.3 Proposed Highway Alignment

The proposed new alignment is located within generally flat to gently undulating alluvial terrain with some minor landform modifications. Review of the geology maps the local geomorphology and the site walkover indicate consistency along the proposed alignment. The intrusive investigations support this with the subsurface profile being consistent along the alignment, comprising an upper profile of alluvial soils overlying residual clay from about 1.0m that grades into weathered rock. The upper 300mm or so of the profile has been disturbed through tilling and cultivation from past and current agricultural activities. This tillage has resulted in a hardpan at 300mm depth.

Across the 22 boreholes drilled along the proposed new alignment medium plasticity clay was typically encountered. There was some localised variability in the material encountered.

In consideration of the site geomorphology and consistency between the boreholes the extent of the investigation is considered appropriate to inform pavement design and construction.

The general profile encountered within the borehole drilled along the proposed highway alignment is summarised below.

Alluvial Soils: Silty CLAY, medium to high plasticity, firm to up to 0.4m. Disturbed due to tillage.

Silty CLAY, medium to high plasticity with some fine to medium grained gravel stiff to hard, to at least 1.5m.

Further details of the conditions encountered are provided in the Engineering Logs (TP9 to TP24) presented in Appendix A.

The photograph below illustrates the typical profile encountered along the alignment.



1. Typical soil profile along proposed alignment (TP17 shown)



As discussed in Section 4.2 specific subgrade treatments will be required around TP16, TP18 and TP21 where lower CBR values were encountered. Other localised areas may also require specific treatments once the subgrade is exposed and can be assessed. The extend of required subgrade treatment works will be significant influence by the prevailing weather conditions at the time of construction.

5.4 Kyalite Road

Kyalite is an unsealed council road. The pavement was in poor condition with only a very thin pavement profile.

Pavement Gravel: Less than 50mm of gravel over subgrade.

Subgrade: Alluvial Silty CLAY, high plasticity, hard.

The proposed new alignment comprised a similar profile with a firm layer in the upper 0.25m due to the high moisture content.

Further details of the conditions encountered are provided in the Engineering Logs (TP28 to TP29) presented in Appendix A.

5.5 Back Tomingley West Road

Back Tomingley West Road is an unsealed council road in poor condition.

The pavement profile generally comprised:

Pavement: Silty Sandy GRAVEL, fine to coarse grained, dense to 0.08m.

Subgrade: Alluvial Silty CLAY, medium to high plasticity, with fine to medium grained sand, hard

The subsurface profile of the proposed new alignment is summarised below.

Alluvial Soils: Silty CLAY, medium to high plasticity, with some fine to medium grained gravel and sand, firm to up to 0.3m.

Silty CLAY, medium to high plasticity, medium grained gravel, and sand, stiff, to at least 1.2m.

Further details of the conditions encountered are provided in the Engineering Logs (TP30 to TP32) presented in Appendix A.



6 CULVERT SITES

There are fifteen proposed culvert locations along the proposed new highway alignment, the Kyalite Road realignment, and proposed mine haul road.

6.1 Surface Conditions

The culvert locations are within generally flat to gently undulating alluvial terrain with some minor landform modifications.

The satellite images below illustrate the site location and site setting.

Diagram 5: Culvert Investigation Boreholes in Relation to Existing Mine



6.2 Subsurface Conditions

The subsurface conditions encountered at the culvert location are similar to those encountered elsewhere on the site. The profile generally comprises an upper profile of alluvial soils overlying residual clay from about 1.0m that grades into weathered rock. The upper 300mm or so of the profile has been disturbed through tilling and cultivation from past and current agricultural activities. This tillage has resulted in a hardpan at 300mm depth.



Table 14: Summary of Subsurface Conditions Encountered in Boreholes

Material Name	Material Description	C1	C2	C3	C5	C6	C7	C8	C10	C10A	C11	C12	C13	C14	C15
		Depth to Base of Layer (m)													
FILL (Pavement)	Gravelly SAND/ Gravelly SILT, fine to coarse grained, gravel is fine to coarse grained subangular to angular, low plasticity fines	--	--	--	--	--	--	--	0.5	0.8	--	--	--	--	1.3
TOPSOIL	Clayey SILT, low plasticity, trace of fine grained sand and gravel, firm	--	--	--	--	--	--	0.2	--	--	--	0.25	0.2	--	--
	Sandy CLAY, medium plasticity	--	--	--	--	--	0.2	--	--	--	--	--	--	--	--
ALLUVIAL SOIL	Silty CLAY, medium to high plasticity, trace to some fine to medium grained gravel and sand, firm in upper 0.2 – 0.4m, then stiff to hard	1.5	1.0	1.2	0.9	1.0	0.8	1.1	1.5	≥1.95	1.2	0.5	1.2	1.2	≥3.0
RESIDUAL SOIL	Silty CLAY, high plasticity, fine to medium grained gravel, stiff to hard	≥1.8*	≥1.5*	≥1.6*	≥3.0	≥3.0	≥3.0	≥1.2*	≥2.6	--	≥1.6*	≥3.0	≥3.0	≥1.5*	--

Notes: ≥ indicates that the base of the material layer was not encountered
 -- indicates that the material was not encountered within the borehole
 * indicates practical refusal was encountered



Seepage through the upper profile due to recent and ongoing rainfall rendered meaningful observations of groundwater useless. Based on site geology and topography groundwater levels are likely to be in excess of 5m.

As summarised above the profile for all culvert locations is generally consistent with those encountered across the entire site. Due to the consistency of the profile excessive laboratory testing (i.e. one at every culvert location) was not considered necessary. Instead in situ testing including Dynamic Cone Penetrometer testing, Standard Penetration Testing, and Pocket Penetrometer testing was undertaken at each location. The in-situ testing undertaken is considered more relevant to providing appropriate data necessary to the design of the culvert foundations.

6.3 Culvert Foundation Options & Design Parameters

Shallow footings would be appropriate for the culverts. Footings founded within the alluvial or residual clay of at least stiff strength could be design based on an allowable base bearing capacity of **100ka**.

6.4 Chemical Aggressivity

The results soil aggressivity testing at the culvert locations (Refer to Table 9) indicate the soils have:

- A pH of greater than 5.
- A soluble sulfate concentration of < 5,000ppm.
- A chloride concentration of < 5,000ppm.
- A resistivity of > 5,000 ohm.cm.

It is therefore recommended that in accordance with AS2159-2009 '*Piling – Design and installation*' that an exposure classification of mild for concrete elements and non-aggressive steel elements be adopted.

7 BRIDGE INVESTIGATION

Boreholes were undertaken for the proposed bridge that will span a mining haul road used to service the mine.

7.1 Surface Conditions

The proposed bridge is located in an area of flat terrain that is currently used for cropping. There is a manmade elevated embankment approximately 1m high running generally north south through the bridge alignment. At the time of the field work the vegetation was minimal with a crop having recently been harvested. There are several scattered trees in the area. The upper profile has been filled and is exposed leaving the area trafficable due to the recent rainfall.

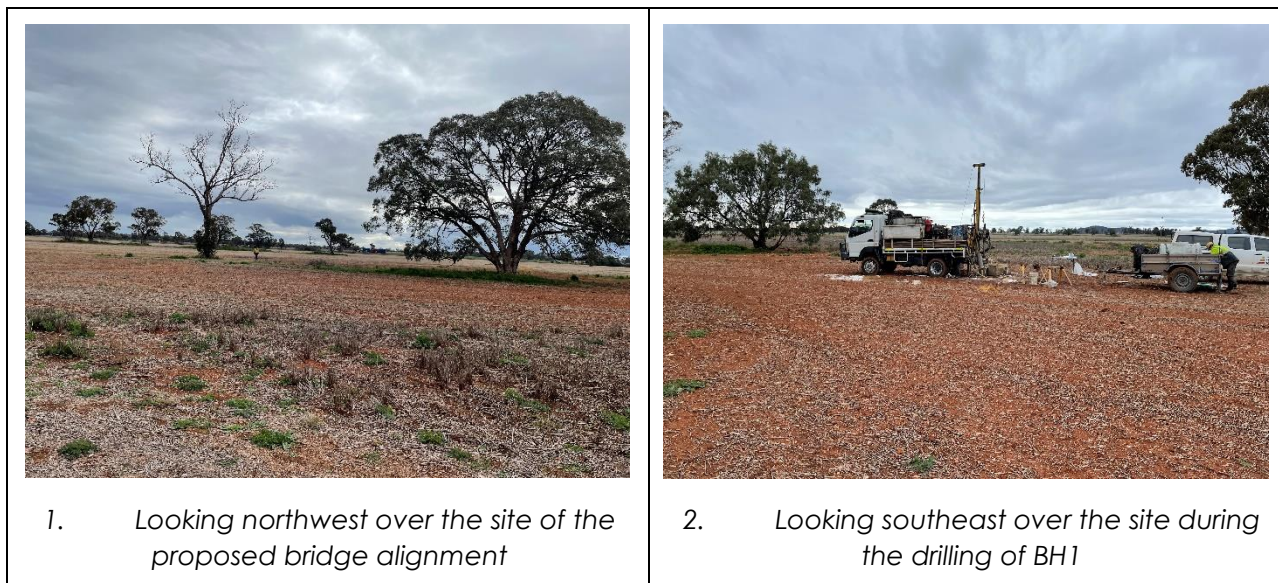
The Google Earth image below illustrate the site location and site setting.



Diagram 6: Haul Road Bridge Location



Site photographs are presented below



7.2 Subsurface Conditions

The subsurface conditions have been characterised into geotechnical units based on the results of the subsurface investigations. The profiles encountered in the boreholes are summarised in Table 13. Further details are presented on the Engineering Logs. An interpretive geotechnical section is presented on Figure 5.



Table 15: Summary of Subsurface Conditions Encountered in Boreholes

Material Name	Material Description	BH1	BH2	BH3	BH4
		Depth to Base of Layer (m)			
Alluvial CLAY	Silty CLAY, Medium to high plasticity, red-brown, with fine to medium grained angular gravel	1.8	0.3	--	0.6
Residual CLAY	Silty CLAY, medium plasticity, pale orange-brown	2.2	--	1.5	1.6
XW TO HW BRECCIATED SANDSTONE	Silty CLAY, medium plasticity, red-brown, with some quartz gravel, fine to medium grained, angular	5.5	3.2	3.2	5.6
MW – SW BRECCIATED SANDSTONE	BRECCIATED SANDSTONE, fine to coarse grained, indistinctly bedded, low strength to high strength.	≥ 10.1	≥ 9.1	≥ 8,65	≥ 11.6

Notes: ≥ indicates that the base of the material layer was not encountered
 -- indicates that the material was not encountered within the borehole

Point load testing undertaken on the recovered core indicated the weathered brecciated sandstone varies from very low to high strength with axial point load index ranging from 0.05 to x 1.5 MPa.

The use of drilling fluids rendered observations of groundwater conditions meaningless. Groundwater was not encountered in any of the bore holes. Groundwater levels do fluctuate due to inclement weather, seasonal variations, or due to reasons that may not have been apparent at the time of the site investigation.

7.3 Foundation Options & Design Parameters

The new bridge can be supported on piles founded within the weathered rock. Bored piles that extend through the upper soil profile to found within moderately to slightly weathered brecciated sandstone would be feasible. If bored piles are adopted, temporary or permanent liners may be required to support the upper clay profile and fractured rock that may collapse during pile drilling, particularly if groundwater inflows are encountered.

The design parameters presented in Table 16 can be adopted for pile design.

Table 16: Pile Design Parameters for Bored Piles

Material Name	Ultimate End Bearing Pressure, fb	Ultimate Skin Friction (Compression), fm,s	Effective Vertical Young's Modulus, E'v	Effective Horizontal Young's Modulus, E'h	Limiting Lateral Yield Pressure, py
MW – SW Brecciated Sandstone	10 MPa	350 kPa	250 MPa	150 MPa	2.5 MPa (upper 1m of rock socket) 5 MPa (below 1m)

In accordance with AS2159-2009, when assessing the geotechnical reduction factor (Φ_g) an assignment of an Average Risk Rating (ARR) is required which considers the redundancy of the pile system and the quantity and type of pile testing. This process necessarily requires the consideration



of several factors which are beyond the direct control of a geotechnical consultant during the site investigation stage. For a recommendation to be provided the assumptions listed below have been made. If these assumptions change, the geotechnical reduction factor would need to be modified in accordance with the requirements of AS2159-2009 Clause 4.3.

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report.
- Neither static, rapid or dynamic load testing is undertaken on any of the piles.
- Limited degree of professional geotechnical involvement in the supervision of the installation of the piles.
- No performance monitoring of the supported structure during or after construction.

Based on the above and in accordance with AS2159-2009 a risk rating of 2.72 is estimated. Therefore, assuming the pile configuration will have low redundancy a Geotechnical Strength Reduction Factor of $\Phi_g=0.52$ would be appropriate.

At least the initial stages of pile installation should be observed by a suitably experienced geotechnical engineer to assess that the recommended founding material has been reached and to check initial assumptions about foundation conditions and possible variations between borehole locations.

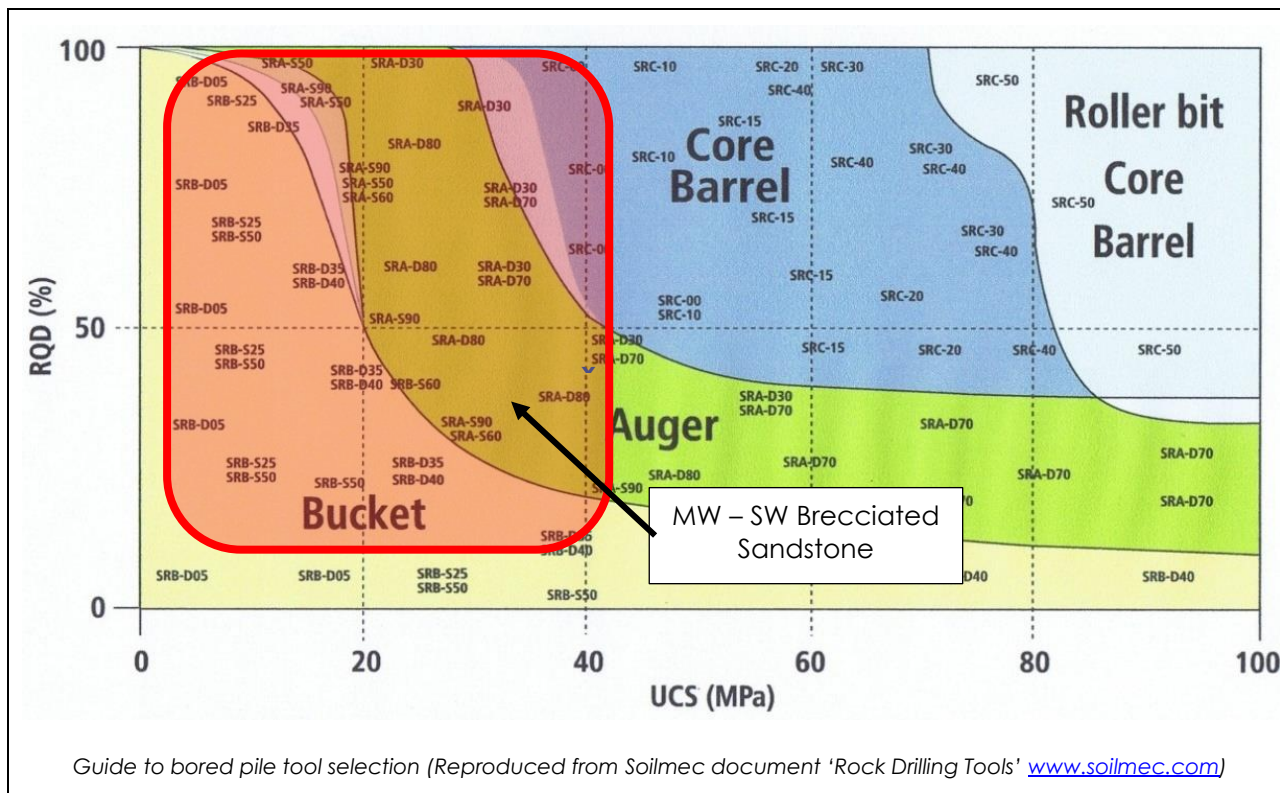
Where piles are proposed a temporary granular working platform should be constructed to support the piling rig. The platform should be designed by a suitably experienced engineer in accordance with the BRE design guide '*Working platforms for tracked plant: good practice design guide to the installation, maintenance and repair of ground-supported working platforms*' (2004) and should also be designed to account for slope instability. To design the platform the piling contractor will be required to provide Case 1 and Case 2 loading conditions (as defined within the BRE guide) as well as effective track lengths and widths for each case. The loading cases are generally unique for each different piling rig/setup.

7.4 Pile Drilling.

The excavation of open bored piles is not recommended due to the likely collapse of the upper profile particularly if groundwater inflows are encountered. Temporary or permanent casing that extends to socket within the upper weathered rock profile will be required.

Point load strength index testing was undertaken on the rock. The point load results have been converted to a Uniaxial Compressive Strength (UCS) based on a conversion factor of 25.

Soilmec provides a guideline for bored pile tool selection based on typical RQD and UCS, as shown below. The indicative UCS and RQD values indicate that pile excavation could be undertaken with an auger, however, where higher strength or less fractured material is encountered a core barrel may be required and should be allowed for.



7.5 Chemical Aggressivity

The results soil aggressivity testing at the bridge location (Refer to Table 10) indicate the soils have:

- A pH of greater than 5.
- A soluble sulfate concentration of < 5,000ppm.
- A chloride concentration of < 5,000ppm.
- A resistivity of > 5,000 ohm.cm.

It is therefore recommended that in accordance with AS2159-2009 'Piling – Design and installation' that an exposure classification of mild for concrete elements and non-aggressive steel elements be adopted.

8 ADDITIONAL WORKS

Additional geotechnical assessment, advice and design guidance is likely to be required throughout the planning, design, and construction phase of the project. Once preliminary designs are completed, we recommend consulting with RGS to assess the requirements for these additional works based on the design details. Additional geotechnical input is anticipated to be required for the following:

- Subgrade treatment and preparation.
- Pavement design.
- Culvert foundation treatment and bearing capacity assessment.
- Bridge foundation assessment.
- Fill placement and compaction control.



- Material testing

RGS would be pleased to assist with these and any other geotechnical aspects of eth project that may arise.

9 LIMITATIONS

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Regional Geotechnical Solutions Pty Ltd.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in this report and used as the basis for the recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Regional Geotechnical Solutions for the purposes of preparing this report it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Regional Geotechnical Solutions for inaccuracies within any data supplied by others.

If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.



For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by

Reviewed by

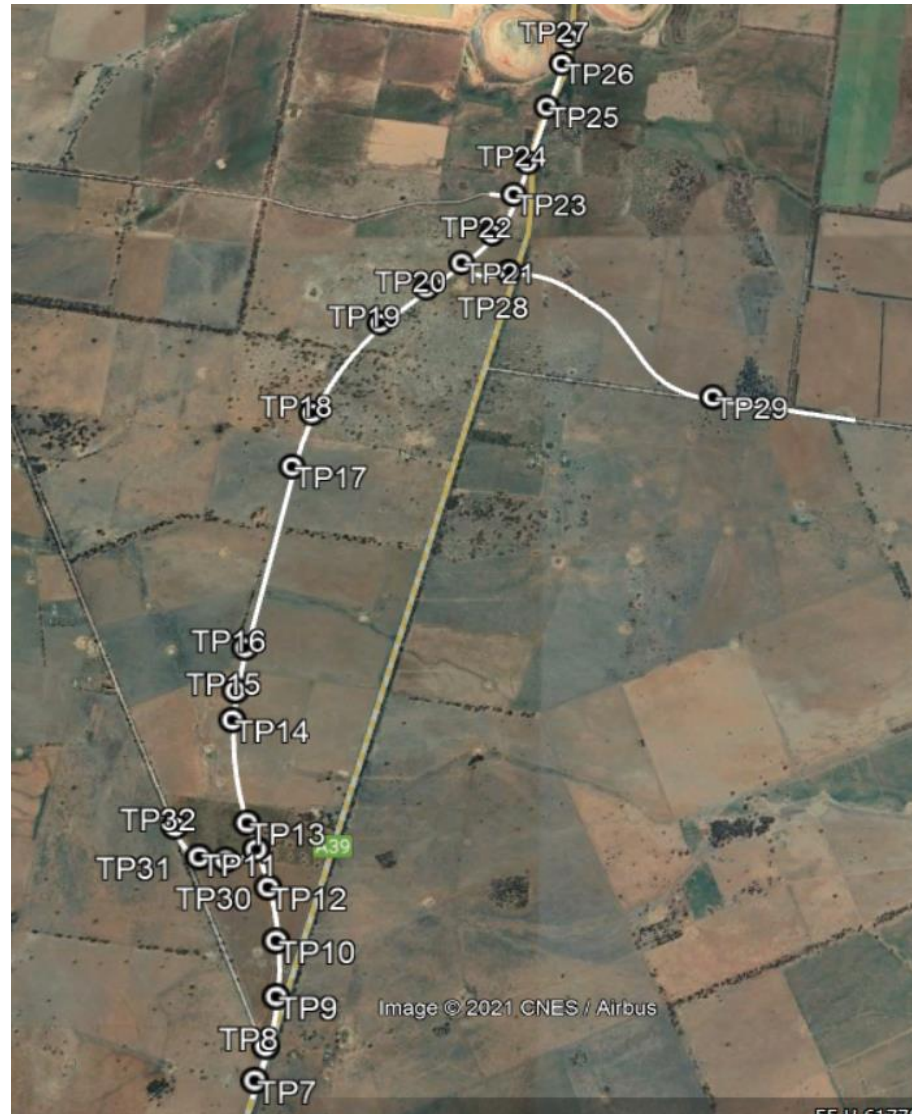
Louis Davidson

Adam Holzhauser

Geotechnical Engineer

Associate Geotechnical Engineer

Figures



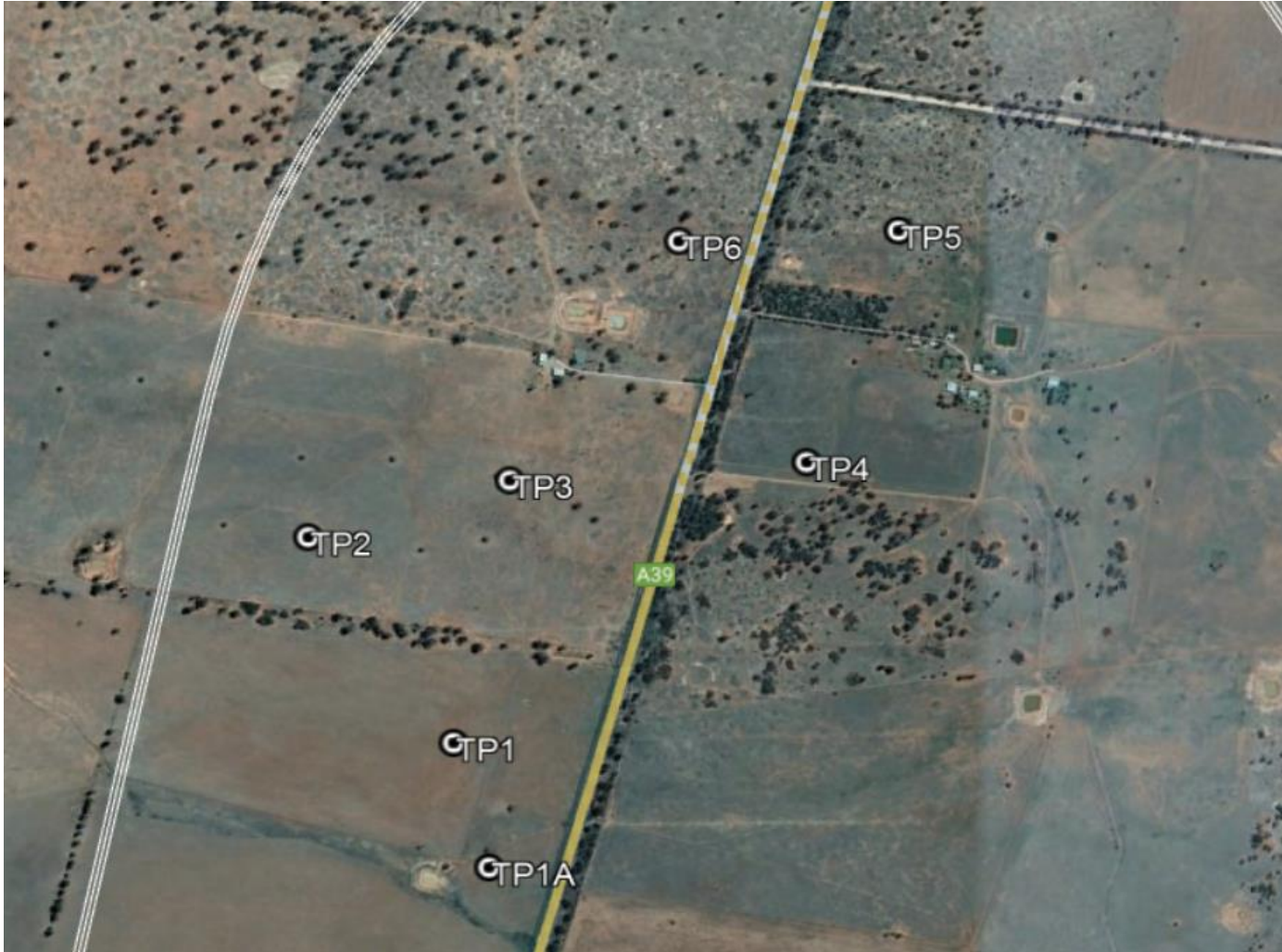
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	Project:	Tomingley Gold – Newell Highway Realignment Project	Drawn By:	LD
		Newell Highway, Tomingley NSW	Date:	27-Oct-21
	Title:	Road Realignment Test Location Plan	Drawing No.	FIGURE 1



Image © 2021 CNES / Airbus



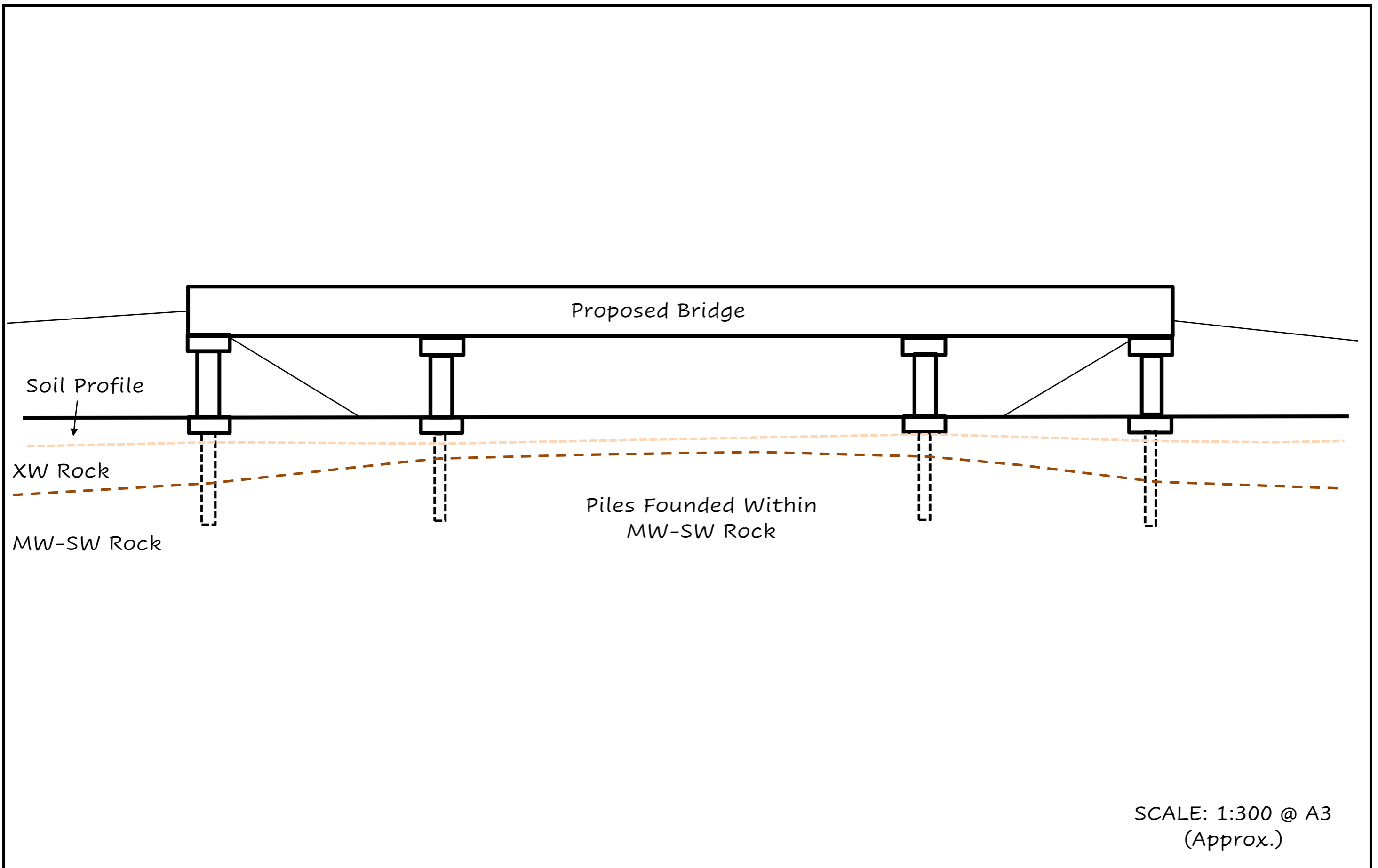
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	Project:	Tomingley Gold – Newell Highway Realignment Project	Drawn By:	LD
		Newell Highway, Tomingley NSW	Date:	27-Oct-21
	Title:	Culvert Test Location Plan	Drawing No.	FIGURE 2



REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Constructive Solutions	Job No.	RGS32576.1
	Project:	Tomingley Gold – Newell Highway Realignment Project	Drawn By:	LD
		Newell Highway, Tomingley NSW	Date:	27-Oct-21
	Title:	Borrow Area Test Location Plan	Drawing No.	FIGURE 3



Client:	Constructive Solutions	Job No.	RGS32576.1
Project:	Tomingley Gold – Newell Highway Realignment Project Newell Highway, Tomingley NSW	Drawn By:	LD
Title:	Bridge Test Location Plan	Date:	27-Oct-21
		Drawing No.	FIGURE 4



 REGIONAL GEOTECHNICAL SOLUTIONS	Client:	Constructive Solutions	Job No.	RGS32576.1
	Project:	Tomingley Gold – Newell Highway Realignment Project Newell Highway, Tomingley NSW	Drawn By:	AH
	Title:	Bridge Long Section	Date:	27-Oct-21
			Drawing No.	FIGURE 5

Appendix A

Results of Field Investigations



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHTP1**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, dark red/brown, with some gravel, fine grained and sand	M > Wp	F	HP	60	ALLUVIAL GRASS
				0.5		CH	Silty CLAY: Medium to high plasticity, red/brown, with some gravel, fine grained and sand		St	HP	120	Upper 300mm disturbed via tilling Surface water nearby
				1.0			Hole Terminated at 1.00 m					

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 TP1-31 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

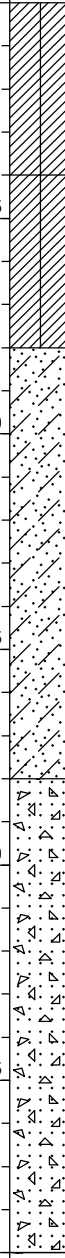
ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHTP1A**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
AD/TC	Not Encountered					CH	Silty CLAY: Medium to high plasticity, dark red/brown, with gravel, fine grained and sand	M > Wp	F	HP	75	ALLUVIAL GRASS	
				0.40m		CH	Silty CLAY: Medium to high plasticity, red/brown, with gravel, fine grained and sand		St	HP	80		
				0.80m		SC	Clayey SAND: Fine grained, pale orange/brown, with a trace of fine grained gravel	D	VD	HP	100		RESIDUAL/EXTREMELY WEATHERED BRECCIA
				1.80m			BRECCIA: Fine grained, pale orange/brown			HP	600		
				2.90m		Hole Terminated at 2.90 m						EXTREMELY TO HIGHLY WEATHERED BRECCIA Very low strength with some low strength bands	

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 50mm Diameter tube sample
- CBR Bulk sample for CBR testing
- E Environmental sample
- ASS Acid Sulfate Soil Sample
- B Bulk Sample

Field Tests

- PID Photoionisation detector reading (ppm)
- DCP(x-y) Dynamic penetrometer test (test depth interval shown)
- HP Hand Penetrometer test (UCS kPa)

Consistency	UCS (kPa)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
H Hard	>400	
Fb Friable		

Density	Density Index
V Very Loose	<15%
L Loose	15 - 35%
MD Medium Dense	35 - 65%
D Dense	65 - 85%
VD Very Dense	85 - 100%



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP2

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > Wp	F	HP	80	ALLUVIAL GRASS Upper 300mm profile disturbed via tilling
						0.30m				HP	120	
				1.0		CH	Silty CLAY: Medium plasticity, red/brown mottled brown, with fine to medium grained gravel and sand		St	HP	180	
						1.00m				HP	250	
Hole Terminated at 1.00 m												

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_TP1-31_LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP3

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > Wp	F	HP	80	ALLUVIAL GRASS Upper 300mm profile disturbed via tilling
				0.30m		CH	Silty CLAY: Medium plasticity, red/brown mottled brown, with fine to medium grained gravel and sand		St	HP	120	
				0.5						HP	180	
				1.0						HP	250	
							Hole Terminated at 1.00 m					

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 TP1-31 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP7A**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: BOREHOLE DIAMETER: 100 mm INCLINATION: 90° EASTING: SURFACE RL: NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
EX	Not Encountered	0.05m			[Cross-hatched pattern]	GP	FILL: Sandy GRAVEL, fine to coarse grained gravel, angular, pale red/brown	D	VD	DCP (0.3-1.1m)		FILL-PAVEMENT GRAVEL 300mm thick Spray Seal	
		DB 0.25m				CH	FILL: Gravelly SAND, fine to coarse grained, red/brown, gravel is fine to coarse grained, angular				6		
				0.5	[Diagonal hatched pattern]	CH	Silty CLAY: Medium to high plasticity, red/brown, with fine grained gravel	M > Wp	H		7	ALLUVIAL	
				1.0						6	4	HP=450kPa	
				1.20			Hole Terminated at 1.20 m				5	5	HP=500kPa
				1.5									
				2.0									
				2.5									

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 TP1-31 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP9

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
PA	Not Encountered			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand, rootlets to 50mm	M > Wp	F	HP	60	ALLUVIAL: GRASS Upper 300mm disturbed via tilling Surface water nearby	
						CH	Silty CLAY: Medium to high plasticity, red/brown, with trace to some fine grained gravel and sand			St	HP		120
										HP	150		
				1.0			Hole Terminated at 1.20 m						
				1.5									
				2.0									
				2.5									

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_TP1-31_LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP10**

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
PA	Not Encountered			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand, rootlets to 50mm	M > Wp	F	HP	60	ALLUVIAL: GRASS Seepage through upper profile into borehole
						CH	Silty CLAY: Medium to high plasticity, red/brown, with trace to some fine grained gravel and sand		St	HP	120	
								1.0				
				1.20m	Hole Terminated at 1.20 m							
				1.5								
				2.0								
				2.5								

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT: RGS32759.1 TP131 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit	
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%		



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP11**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand, rootlets to 50mm	M > Wp	F	HP	60	ALLUVIAL: GRASS	
				0.30m		CH	Silty CLAY: Medium to high plasticity, red/brown, with trace to some gravel, fine grained and sand		St		HP	120	
				1.0							HP	150	Seepage through upper profile into borehole
				1.20m	Hole Terminated at 1.20 m								
				1.5									
				2.0									
				2.5									

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 TP11 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP12**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand, rootlets to 50mm	M > Wp	F	HP	60	ALLUVIAL GRASS
				0.35m		CH	Silty CLAY: Medium to high plasticity, red/brown, with trace to some fine grained gravel and sand		St	HP	120	Seepage through upper profile into borehole
				1.0m						HP	150	
				1.20m	Hole Terminated at 1.20 m							
				1.5m								
				2.0m								
				2.5m								

RG.LIB.1.05.0.GLB.Log.RG.NON-CORED.BOREHOLE.-.TEST.PIT.RGS32759.1.TP131.LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP13**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand, rootlets to 50mm	M > Wp	F	HP	60	ALLUVIAL: GRASS	
				0.30m		CH	Silty CLAY: Medium to high plasticity, red/brown, with some gravel, fine grained and sand		St		HP	120	Seepage through upper profile into borehole
				1.0							HP	150	
							Hole Terminated at 1.20 m						
				1.5									
				2.0									
				2.5									

RG.LIB.1.05.0.GLB.Log.RG.NON-CORED.BOREHOLE - TEST.PIT.RGS32759.1.TP13.1.LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP14

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with fine to medium grained gravel and sand	M > Wp	F	HP	60	ALLUVIAL GRASS
						CH	Silty CLAY: Medium to high plasticity, red/brown, with a trace to some fine to medium grained gravel			St		Upper 200mm disturbed via tilling
				1.0			Hole Terminated at 1.00 m					

RG.LIB.1.05.0.GLB.Log.RG.NON-CORED.BOREHOLE - TEST.PIT.RGS32759.1.TP14.1.LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP15**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with fine to medium grained gravel and sand	M > Wp	F	HP	60	ALLUVIAL GRASS
						CH	Silty CLAY: Medium to high plasticity, red/brown, with a trace to some fine to medium grained gravel			St		Upper 200mm disturbed via tilling
				1.0			Hole Terminated at 1.00 m					

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_TP15_1 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP16**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with some gravel, fine to medium grained and sand	M > Wp	F - St	HP	60	ALLUVIAL GRASS
				0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with some gravel, fine to medium grained and sand		St	HP	120	Upper 300mm disturbed via tilling
				1.0			Hole Terminated at 1.00 m					

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 TP16_1 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP17

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > Wp	F - St	HP	60	ALLUVIAL GRASS Upper 300mm disturbed via tilling
				0.30m		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with fine to medium grained gravel and sand		St - VSt	HP	120	
				0.5						HP	180	
				1.0						HP	250	
							Hole Terminated at 1.00 m					

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_TP131_LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **TP26**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 24/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered	0.25m		0.25m		CL	Silty CLAY: Low plasticity, brown, with a trace of fine grained gravel and sand	M > Wp	F			ALLUVIAL GRASS Disturbed profile due to cultivation
		DB		0.5m		CH	Silty CLAY: Medium to high plasticity, orange/brown, with a trace to some gravel, fine grained and sand						VSt
		0.80m		1.00m			Hole Terminated at 1.00 m					

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 TP131 LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigal Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP30

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	▶			0.5		CH	Silty CLAY: Medium to high plasticity, dark red/brown mottled brown, with fine to medium grained gravel and sand, rootlets in upper 100mm	M > Wp	F	HP	60	ALLUVIAL GRASS Upper 300mm disturbed via tilling
						CH	Silty CLAY: Medium to high plasticity, brown, with trace to some fine to medium grained gravel and fine grained sand			St		
										HP	120	
				1.0			Hole Terminated at 1.00 m			HP	150	

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_TPI131_LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: TP31

CLIENT: Constructive Solutions
PROJECT NAME: Tomingley Mine Expansion
SITE LOCATION: Tomingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
JOB NO: RGS32759.1
LOGGED BY: AH
DATE: 24/7/21

DRILL TYPE: Power Auger **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	▶			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with fine to medium grained gravel and sand, rootlets in upper 100mm	M > Wp	F	HP	60	ALLUVIAL GRASS Upper 300mm disturbed via tilling
						CH	Silty CLAY: Medium to high plasticity, brown, with trace to some fine to medium grained gravel and fine grained sand			St		
										HP	120	
				1.0			Hole Terminated at 1.00 m			HP	150	

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_TP131_LOGS.GPJ <<DrawingFile>> 22/10/2021 13:42 10.03.00.09 Daigel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC1**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
PA	▶					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and trace of fine grained sand, rootlets to 50mm	M > Wp	F	HP	60	ALLUVIAL GRASS Upper 200mm of profile disturbed via tilling Seepage through upper profile	
		0.30m	CH	Silty CLAY: Medium to high plasticity, red/brown, with trace to some fine to medium grained gravel		St	HP			150			
		0.5									HP		200
		1.0											
				1.5		1.50m	CL	Sandy CLAY: Low to medium plasticity, pale orange-brown, with trace fine grained gravel	VSt - H	HP	450	RESIDUAL	
				1.80m				HP		600			
				2.0			Hole Terminated at 1.80 m Practical PA Refusal						
				2.5									

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_BHC1-15.LOGS.GPJ <-DrawingFiles> 25/10/2021 10:35 10.03.00.09 Dargel Lab and In Situ Tool



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC2**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > Wp	F - St	HP	60	ALLUVIAL: GRASS
				0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with some fine to medium grained gravel and sand		St	HP	150	
				1.0		CI	Sandy CLAY: Medium plasticity, orange-brown, with a trace to some fine grained gravel		VSt - H	HP	450	RESIDUAL
				1.5			Hole Terminated at 1.50 m Practical PA Refusal					
				2.0								
				2.5								

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1_BHC1-15.LOGS.GPJ <-DrawingFiles> 25/10/2021 10:35 10.03.00.09 Dargel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC3**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > WP	St	HP	120	ALLUVIAL GRASS
				0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with some fine to medium grained gravel and sand		VSt		HP		250
				1.0			CL	Sandy CLAY: Low to medium plasticity, orange-brown, with a trace to some fine grained gravel				
				1.5								
				2.0			Hole Terminated at 1.60 m Practical PA Refusal					
				2.5								

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_BHC1-15_LOGS.GPJ <-DrawingFiles> 25/10/2021 10:35 10.03.00.09 Dargel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC8**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
PA	 0.30m DB 0.70m			0.00		ML	TOPSOIL: Clayey SILT, low plasticity, brown, with rootlets and a trace of fine grained sand and gravel	M > Wp	F			GRASS	
				0.20		CH	Silty CLAY: Medium to high plasticity, brown					F - St	ALLUVIAL
				0.70		CI	Gravelly CLAY: Medium plasticity, brown, gravel is fine to medium grained, rounded					F	
				1.10		CH	Silty CLAY: Medium to high plasticity, orange-brown					H	RESIDUAL
				1.20			Hole Terminated at 1.20 m Practical PA Refusal						

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_BHC1-15_LOGS.GPJ <-DrawingFiles> 25/10/2021 10:35 10.03.00.09 Dargel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC10**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Truck Mounted EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 450 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations			
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result		
AD/TC	Not Encountered	0.05m				SP	FILL: Gravelly SAND, fine to coarse grained, pale red, brown, gravel is fine to coarse grained, subangular to angular	D	VD			FILL-25mm THICK SPRAY SEAL PAVEMENT GRAVEL SUBGRADE		
		DB				0.30m	ML	FILL: Gravelly SILT, low plasticity, pale brown, gravel is fine to medium grained, angular	M < wp	H / Fb	11		25	
		0.30m				0.50m	CH	Silty CLAY: Medium to high plasticity, red-brown, with fine grained gravel		H	DCP (0.3-1m)	13	ALLUVIAL HP=>600kPa	
		0.50m				1.0				14				
		DB				1.5						12		
						1.80m		CL	Sandy CLAY: Low to medium plasticity, pale orange-brown, with trace fine grained gravel					15
						2.0			With fine to coarse grained, angular quartz gravel from 1.8m					14
		1.00m				2.5							HP=>600kPa	HP=>600kPa Grading to Extremely Weathered Rock from 1.5m
						2.60m								
										Hole Terminated at 2.60 m				

RG.LIB.1.05.0.G.L.B. Log_RG_NON-CORED_BOREHOLE - TEST PIT_RGS32759.1_BHC1-15_LOGS.GPJ <-DrawingFiles> 25/10/2021 10:35 10.03.00.09 Dargel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit	
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%		



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC10A**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Truck Mounted EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 450 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information						Field Test		Structure and additional observations				
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result					
AD/TC	Not Encountered			1.50m SPT 30/150mm N=R		GP	FILL: Sandy GRAVEL, fine to coarse grained, angular, pale red-brown	D	VD			FILL-30mm THICK SPRAY SEAL PAVEMENT GRAVEL				
						ML	FILL: Gravelly SILT, low plasticity, pale red-brown, gravel is fine to medium grained	M < w _p	H / Fb	DCP (0.4-1.3m)	10	SUBGRADE: FILL				
									12							
									15							
									14							
									1.0	CH	Silty CLAY: Medium to high plasticity, red-brown, with fine grained gravel		H		10	ALLUVIAL
														11		
														11		
														12		
														12		
			2.0				Hole Terminated at 1.95 m									

RG.LIB.1.05.0.GLB. Log_RG_NON-CORED BOREHOLE - TEST PIT_RGS32759.1 BHC115 LOGS.GPJ <-DrawingFiles> 25/10/2021 10:35 10.03.00.09 Dargel Lab and In Situ Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC11**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
PA	Not Encountered					CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > Wp	St	HP	120	ALLUVIAL: GRASS	
				0.5		CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with some fine to medium grained gravel and sand		VSt		HP	250	
				1.0		CL	Sandy CLAY: Low to medium plasticity, orange-brown, with a trace to some fine grained gravel						RESIDUAL
				1.5									
				2.0			Hole Terminated at 1.60 m Practical PA Refusal						
				2.5									

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LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC14**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Power Auger EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
PA	Not Encountered			0.5		CH	Silty CLAY: Medium to high plasticity, red/brown, with fine to medium grained gravel and sand	M > Wp	F	HP	60	ALLUVIAL: GRASS
						CH	Silty CLAY: Medium to high plasticity, red/brown mottled brown, with some fine to medium grained gravel and sand		St			
						CL	Sandy CLAY: Low to medium plasticity, orange-brown, with some fine grained gravel		VSt - H			
				1.5			Hole Terminated at 1.50 m Practical PA Refusal					

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LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BHC15**

CLIENT: Constructive Solutions
 PROJECT NAME: Tomingley Mine Expansion
 SITE LOCATION: Tomingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 1
 JOB NO: RGS32759.1
 LOGGED BY: AH
 DATE: 23/7/21

DRILL TYPE: Truck Mounted EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 450 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
AD/TC	Not Encountered	0.05m				SP	FILL: Gravelly SAND, fine to coarse grained, red-brown, gravel is fine to coarse grained, angular	D - M	VD	DCP (0.5-1.2m)		FILL: 30mm THICK SPRAY SEAL PAVMENT GRAVEL SUBGRADE	
		DB				GP	FILL: Sandy GRAVEL, medium to coarse grained, angular, red-brown						
		0.30m				SP	FILL: Gravelly SAND, fine to coarse grained, red-brown, gravel is fine to coarse grained, angular, with silt				12		
							ML	FILL: Sandy SILT, low plasticity, pale grey/brown, sand is fine grained	M < w _p		Fb		18
		0.80m					GP	FILL: Sandy GRAVEL, fine to coarse grained gravel, angular, brown	D		VD		12
		DB					CH	Silty CLAY: Medium to high plasticity, red-brown, with fine grained gravel	M < w _p		H		10
		1.10m											10
									9				
												ALLUVIAL	

3.00m Hole Terminated at 3.00 m

LEGEND:	Notes, Samples and Tests	Consistency	UCS (kPa)	Moisture Condition
Water	U ₅₀ 50mm Diameter tube sample	VS Very Soft <25		D Dry
Water Level (Date and time shown)	CBR Bulk sample for CBR testing	S Soft 25 - 50		M Moist
Water Inflow	E Environmental sample	F Firm 50 - 100		W Wet
Water Outflow	ASS Acid Sulfate Soil Sample	St Stiff 100 - 200		w _p Plastic Limit
Strata Changes	B Bulk Sample	VSt Very Stiff 200 - 400		w _L Liquid Limit
Gradational or transitional strata	Field Tests	H Hard >400		
Definitive or distinct strata change	PID Photoionisation detector reading (ppm)	Fb Friable		
	DCP(x-y) Dynamic penetrometer test (test depth interval shown)	Density	V Very Loose	Density Index <15%
	HP Hand Penetrometer test (UCS kPa)	L Loose	L Loose	Density Index 15 - 35%
		MD Medium Dense	MD Medium Dense	Density Index 35 - 65%
		D Dense	D Dense	Density Index 65 - 85%
		VD Very Dense	VD Very Dense	Density Index 85 - 100%

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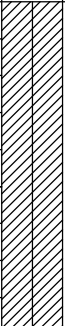


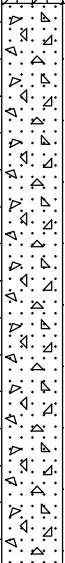
ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1

CLIENT: Constructive Solutions
PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
SITE LOCATION: Tommingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 3
JOB NO: RGS32759.1
LOGGED BY: LD
DATE: 23/7/21

DRILL TYPE: MD200 **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/TC	Not Encountered	SPT 1.0m 4,5,7 N=12		1.0		CH	Silty CLAY: Medium to high plasticity, red-brown, with fine to medium grained angular gravel	M > Wp	St			ALLUVIAL
		SPT 2.5m 8,13,10 N=23		2.0		CH	Silty CLAY: Medium plasticity, pale orange-brown		VSt			RESIDUAL
				2.20m		ML	Clayey SILT: Low plasticity, pale orange-brown		H / Fb			EXTREMELY WEATHERED BRECCIA
				2.50m			BRECCIA: Fine to coarse grained, pale orange and orange	M < Wp				EXTREMELY TO HIGHLY WEATHERED BRECCIA
				5.54m			Continued as Cored Drill Hole					
				6.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distinct strata change

Notes, Samples and Tests

- U₅₀ 50mm Diameter tube sample
- CBR Bulk sample for CBR testing
- E Environmental sample
- ASS Acid Sulfate Soil Sample
- B Bulk Sample

Field Tests

- PID Photoionisation detector reading (ppm)
- DCP(x-y) Dynamic penetrometer test (test depth interval shown)
- HP Hand Penetrometer test (UCS kPa)

Consistency	UCS (kPa)	Moisture Condition
VS Very Soft	<25	D Dry
S Soft	25 - 50	M Moist
F Firm	50 - 100	W Wet
St Stiff	100 - 200	W _p Plastic Limit
VSt Very Stiff	200 - 400	W _L Liquid Limit
H Hard	>400	
Fb Friable		

Density		Density Index
V Very Loose		<15%
L Loose		15 - 35%
MD Medium Dense		35 - 65%
D Dense		65 - 85%
VD Very Dense		85 - 100%



ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: Page 2 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing		Rock Mass Defects	
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
			1.0								
			2.0								
			3.0								
			4.0								
			5.0								
					START CORING AT 5.54m						
NMLC			6.0		BRECCIA: Indistinctly bedded SANDSTONE, fine grained, orange-brown	MW - SW	L - M		100	300	JT 20° PL RO CN JT 30° UN RO IS JT 30° PL RO IS JT 30° PL RO IS SM Clay 50mm thick JT 15° UN RO IS JT 45° PL RO IS JT 20° UN RO CN JT 70° UN RO CN
LEGEND:				Bedding		Weathering		Strength		Defect Type	
Method				Laminated <20mm		EW Extremely Weathered		VL Very Low <0.1		JT Joint	
WB Wash Bore				Thinly Bedded 20-200mm		HW Highly Weathered		L Low 0.1 - 0.3		PT Parting	
RR Rock Roller				Medium Bedded 200-600mm		MW Moderately Weathered		M Medium 0.3 - 1		SM Seam	
CB Claw or Blad Bit				Thickly Bedded 600-2000mm		SW Slightly Weathered		H High 1 - 3		SZ Shear Zone	
NMLC NMLC Core				Very Thickly Bedded 2000mm		FR Fresh		VH Very High 3 - 10		CS Crushed Seam	
NQ,HQ,PQ Wireline Coring				Massive No Visible Bedding				EH Extremely High >10			
				Degree of Fracturing				Roughness		Coating	
				Fragmented <20mm				VR Very Rough		CN Clean	
				Highly Fractured 20mm to 40mm				RO Rough		SN Stained	
				Fractured 40mm to 200mm				SO Smooth		VN Veneer(<1mm)	
				Slightly Fractured 200mm to 1000mm				SL Slickensided		CO Coating(1-5mm)	
										PL Planar	
										CU Curved	
										ST Stepped	
										IR Irregular	

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ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH1**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: Page 3 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects			
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness	
NMLC			8.0		BRECCIA: SANDSTONE, fine grained, pale grey BRECCIA: SANDSTONE, fine to medium grained, pale orange-brown, with seams of fine grained, pale grey rock, indistinctly bedded	MW - SW	H		70	200	100mm thick seam at 75°	
			9.0							100	JT 20° PL RO CN SM 60° 3mm thick clay infil JT 15° IR RO CN PT IR RO CN JT 60° IR RO CN JT 0-20° IR RO CN JT 60-70° UN RO CN	
			10.0		QUARTZ: White, fractured to fragmented	FR	VH			200	JT 0-50° IR RO CN	
			10.0		BRECCIA: SANDSTONE, fine grained, pale orange-brown, with fine, dark grey seams, indistinctly bedded	MW - SW	H			100	JT 20° IR RO CN	
			11.0		Hole Terminated at 10.10 m							
			12.0									
			13.0									

LEGEND: Method WB Wash Bore RR Rock Roller CB Claw or Blad Bit NMLC NMLC Core NQ,HQ,PQ Wireline Coring	Bedding Laminated <20mm Thinly Bedded 20-200mm Medium Bedded 200-600mm Thickly Bedded 600-2000mm Very Thickly Bedded 2000mm Massive No Visible Bedding	Weathering EW Extremely Weathered HW Highly Weathered MW Moderately Weathered SW Slightly Weathered FR Fresh	Strength VL Very Low <0.1 L Low 0.1 - 0.3 M Medium 0.3 - 1 H High 1 - 3 VH Very High 3 - 10 EH Extremely High >10	Defect Type JT Joint PT Parting SM Seam SZ Shear Zone CS Crushed Seam
	Degree of Fracturing Fragmented <20mm Highly Fractured 20mm to 40mm Fractured 40mm to 200mm Slightly Fractured 200mm to 1000mm	Roughness VR Very Rough RO Rough SO Smooth SL Slickensided	Coating CN Clean SN Stained VN Veneer(<1mm) CO Coating(1-5mm)	Planarity PL Planar CU Curved ST Stepped IR Irregular



	Client	Constructive Solutions	Job No.	RGS32759.1
	Project:	Newell Highway Realignment Project Newell Highway, Tomingley	Drawn By:	LD
			Date:	30-Nov-21
	Title:	Core Photograph - BH1	Drawing No	Core Photo 1



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result	
AD/TC	Not Encountered	SPT 1.0m 18,26/130 N=R		1.0		CL	Silty CLAY: Medium plasticity, red-brown, with some sand, fine grained	M < Wp	St - VSt			RESIDUAL	
						CL	Silty CLAY: Medium plasticity, red-brown, with some quartz gravel, fine to medium grained, angular					H / Fb	EXTREMELY TO HIGHLY WEATHERED SANDSTONE
						CL	Sandy CLAY: Medium plasticity, pale brown						
		SPT 2.5m 20,25/80 N=R		2.0									
				3.0									
				3.20m			Continued as Cored Drill Hole						
				4.0									
				5.0									
				6.0									

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	

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ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: Page 2 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing		Rock Mass Defects	
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC			1.0								
			2.0								
			3.0								
					START CORING AT 3.20m						
			4.0		BRECCIA: SANDSTONE , fine to coarse grained, grey, brown, indistinctly bedded	MW - SW	M		100	20	JT RO PL SN CS 50mm
			5.0			MW			65	125	JT RO PL SN JT RO PL SN JT RO PL SN JT RO PL SN JT RO PL VN JT RO PL SN PT RO PL SN
			6.0		NO CORE	EW	VL		20	100	Various clay seams 2-5mm thick spaced at 10-50mm SM Clayey GRAVEL, fine to medium grained quartz gravel, 80mm SM Clay 10mm 40° SM Quartz Various rehealed joints SM Clay 5mm 50° JT 30° RO PL SN Fragmented core
					BRECCIA: SANDSTONE , fine to medium grained, pale brown, pale grey, indistinctly bedded	MW	L		0	20	Fragmented core
									0	20	Highly fractured rehealed joints SM Clay 10mm SM Clay 10mm

RG.LIB.1.05.0.G.L.B. Log_RG_CORED_BOREHOLE_RGS32759.1.LOGS.GPJ <<DrawingFile>> 06/10/2021 15:40 10.03.00.09 Datagel Lab and In Situ Tool

LEGEND:		Bedding		Weathering		Strength		Defect Type			
Method		Laminated	<20mm	EW	Extremely Weathered	VL	Very Low	$I_{s(50)}$	<0.1	JT	Joint
WB	Wash Bore	Thinly Bedded	20-200mm	HW	Highly Weathered	L	Low		0.1 - 0.3	PT	Parting
RR	Rock Roller	Medium Bedded	200-600mm	MW	Moderately Weathered	M	Medium		0.3 - 1	SM	Seam
CB	Claw or Blad Bit	Thickly Bedded	600-2000mm	SW	Slightly Weathered	H	High		1 - 3	SZ	Shear Zone
NMLC	NMLC Core	Very Thickly Bedded	2000mm	FR	Fresh	VH	Very High		3 - 10	CS	Crushed Seam
NQ,HQ,PQ	Wireline Coring	Massive	No Visible Bedding			EH	Extremely High		>10		
		Degree of Fracturing				Roughness		Coating		Planarity	
		Fragmented	<20mm			VR	Very Rough	CN	Clean	PL	Planar
		Highly Fractured	20mm to 40mm			RO	Rough	SN	Stained	CU	Curved
		Fractured	40mm to 200mm			SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
		Slightly Fractured	200mm to 1000mm			SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular



ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH2**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: Page 3 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information			Testing	Rock Mass Defects			
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC			8.0		BRECCIA: SANDSTONE, fine to medium grained, pale brown, pale grey, indistinctly bedded (continued)	SW	M		0	20	SM Clay 10mm
		50	JT 10° RO PL VN								
			JT 20° RO PL CN								
			JT 50° RO PL CN								
			JT 40° RO PL CN								
		100	Various rehealed joints								
			JT 15° RO PL CN								
			JT 20° RO PL CN								
		50	JT 20° RO PL CN								
			JT 20° RO PL ST CN								
	100	Highly fractured									
		JT 15° RO CU CN									
		JT 50° RO PL CN									
	50	JT 5° RO PL CN									
		Highly fractured									
		JT 10° RO PL CN									
		JT 20° RO PL CN									
	70	JT 30° RO PL CN									
	42										
	150										
		9.0		Hole Terminated at 9.10 m							
			10.0								
			11.0								
			12.0								
			13.0								

LEGEND:		Bedding		Weathering		Strength		Defect Type			
Method											
WB	Wash Bore	Laminated	<20mm	EW	Extremely Weathered	VL	Very Low	$I_{s(50)}$	<0.1	JT	Joint
RR	Rock Roller	Thinly Bedded	20-200mm	HW	Highly Weathered	L	Low		0.1 - 0.3	PT	Parting
CB	Claw or Blad Bit	Medium Bedded	200-600mm	MW	Moderately Weathered	M	Medium		0.3 - 1	SM	Seam
NMLC	NMLC Core	Thickly Bedded	600-2000mm	SW	Slightly Weathered	H	High		1 - 3	SZ	Shear Zone
NQ,HQ,PQ	Wireline Coring	Very Thickly Bedded	2000mm	FR	Fresh	VH	Very High		3 - 10	CS	Crushed Seam
		Massive	No Visible Bedding			EH	Extremely High		>10		
		Degree of Fracturing				Roughness		Coating		Planarity	
		Fragmented	<20mm			VR	Very Rough	CN	Clean	PL	Planar
		Highly Fractured	20mm to 40mm			RO	Rough	SN	Stained	CU	Curved
		Fractured	40mm to 200mm			SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
		Slightly Fractured	200mm to 1000mm			SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular



	Client	Constructive Solutions	Job No.	RGS32759.1
	Project:	Newell Highway Realignment Project Newell Highway, Tomingley	Drawn By:	LD
			Date:	30-Nov-21
	Title:	Core Photograph - BH2	Drawing No	Core Photo 2



ENGINEERING LOG - BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: 1 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/TC	Not Encountered	SPT 1.0m 4,5,7 N=12		1.0		CL	Silty CLAY: Medium plasticity, red-brown, with some sand, fine grained	M < WP	St			RESIDUAL
		SPT 2.5m 8,13,10 N=23		2.0		CL	Sandy CLAY: Medium plasticity, pale brown		VSt			EXTREMELY WEATHERED BRECCIA
				3.0			Continued as Cored Drill Hole					
				4.0								
				5.0								
				6.0								

RG.LIB.1.05.0.GLB.Log.RG.NON-CORED.BOREHOLE.-.TEST.PIT.RGS32759.1.LOGS.GPJ <<DrawingFile>>.06/10/2021.15:32.10.03.00.09.Datgel.Lab.and.In.Situ.Tool

LEGEND: Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes Gradational or transitional strata Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH3

CLIENT: Constructive Solutions
PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
SITE LOCATION: Tommingley
TEST LOCATION: Refer to Figure 1

PAGE: Page 2 of 3
JOB NO: RGS32759.1
LOGGED BY: LD
DATE: 23/7/21

DRILL TYPE: MD200 **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing		Rock Mass Defects								
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness							
NMLC			1.0															
			2.0															
			2.65		START CORING AT 2.65m													
			3.0		NO CORE													
			3.0		BRECCIATED SANDSTONE: Fine to coarse grained, with trace of fine to medium grained quartz gravel, indistinctly bedded	EW - HW	VL	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness							
			3.0									20	0	50	Fragmented core Various resealed joints across whole core Highly fractured core			
			3.0									50						
			4.0				MW					VL - L	0	70	PT RO PL SN PT RO PL SN CS 15mm JT 70° RO PL SN JT 20° RO PL SN JT 50° RO PL SN JT 10° RO ST SN JT 80° RO ST SN JT 10° RO PL SN Highly fractured			
			4.0									L				35	380	JT 70° RO PL SN JT 85° RO PL SN
			4.0																100	50	JT 10° RO PL SN CS 10mm JT 40° RO PL SN JT 20° RO ST SN JT 50° RO ST SN JT RO PL JT 40° RO PL SN
		5.0					45					200	Highly fractured					
		5.0				150								50	Highly fractured			
		5.0				50										100	JT 60° RO PL SN JT 65° RO ST SN	
		6.0																

RG_LIB_1.05.0.G.LB_Log_RG_CORED_BOREHOLE_RGS32759.1.LOGS.GPJ <<DrawingFile>> 06/10/2021 15:40 10.03.00.09 Datagel Lab and In Situ Tool

LEGEND:		Bedding		Weathering		Strength		Defect Type			
Method											
WB	Wash Bore	Laminated	<20mm	EW	Extremely Weathered	VL	Very Low	<0.1	JT	Joint	
RR	Rock Roller	Thinly Bedded	20-200mm	HW	Highly Weathered	L	Low	0.1 - 0.3	PT	Parting	
CB	Claw or Blad Bit	Medium Bedded	200-600mm	MW	Moderately Weathered	M	Medium	0.3 - 1	SM	Seam	
NMLC	NMLC Core	Thickly Bedded	600-2000mm	SW	Slightly Weathered	H	High	1 - 3	SZ	Shear Zone	
NQ,HQ,PQ	Wireline Coring	Very Thickly Bedded	2000mm	FR	Fresh	VH	Very High	3 - 10	CS	Crushed Seam	
		Massive	No Visible Bedding			EH	Extremely High	>10			
		Degree of Fracturing				Roughness		Coating		Planarity	
		Fragmented <20mm				VR		CN		PL	
		Highly Fractured 20mm to 40mm				RO		SN		CU	
		Fractured 40mm to 200mm				SO		VN		ST	
		Slightly Fractured 200mm to 1000mm				SL		CO		IR	



ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH3**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: Page 3 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC			8.0		BRECCIATED SANDSTONE: Fine to coarse grained, with trace of fine to medium grained quartz gravel, indistinctly bedded (<i>continued</i>)	MW	L		45	100	JT 80° RO PL SN
				50						Highly fractured	
				250							
				50							
				200							
				50						Highly fractured	
				200						JT 20° RO PL SN	
			50	Highly fractured							
			9.0		Hole Terminated at 8.65 m						
			10.0								
			11.0								
			12.0								
			13.0								

LEGEND: Method WB Wash Bore RR Rock Roller CB Claw or Blad Bit NMLC NMLC Core NQ,HQ,PQ Wireline Coring	Bedding Laminated <20mm Thinly Bedded 20-200mm Medium Bedded 200-600mm Thickly Bedded 600-2000mm Very Thickly Bedded 2000mm Massive No Visible Bedding	Weathering EW Extremely Weathered HW Highly Weathered MW Moderately Weathered SW Slightly Weathered FR Fresh	Strength VL Very Low <0.1 L Low 0.1 - 0.3 M Medium 0.3 - 1 H High 1 - 3 VH Very High 3 - 10 EH Extremely High >10	$I_{s(50)}$ <0.1 0.1 - 0.3 0.3 - 1 1 - 3 3 - 10 >10	Defect Type JT Joint PT Parting SM Seam SZ Shear Zone CS Crushed Seam	
	Degree of Fracturing Fragmented <20mm Highly Fractured 20mm to 40mm Fractured 40mm to 200mm Slightly Fractured 200mm to 1000mm			Roughness VR Very Rough RO Rough SO Smooth SL Slickensided	Coating CN Clean SN Stained VN Veneer(<1mm) CO Coating(1-5mm)	Planarity PL Planar CU Curved ST Stepped IR Irregular



	Client	Constructive Solutions	Job No.	RGS32759.1
	Project:	Newell Highway Realignment Project	Drawn By:	LD
		Newell Highway, Tomingley	Date:	30-Nov-21
	Title:	Core Photograph - BH3	Drawing No	Core Photo 3

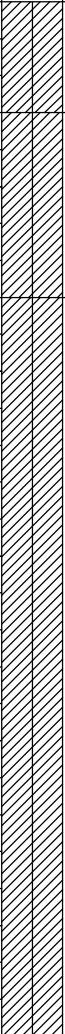
ENGINEERING LOG - BOREHOLE






BOREHOLE NO: BH4

CLIENT: Constructive Solutions
PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
SITE LOCATION: Tommingley
TEST LOCATION: Refer to Figure 1

PAGE: 1 of 3
JOB NO: RGS32759.1
LOGGED BY: LD
DATE: 23/7/21

DRILL TYPE: MD200 **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information					Field Test		Structure and additional observations	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics, colour, minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type		Result
AD/TC	Not Encountered					CL	Silty CLAY: Medium plasticity, red-brown, with a trace of gravel, fine grained, angular, quartz	M < WP	St			ALLUVIAL
		SPT 1.0m 13,16,24 N=40		1.0		CL	Silty CLAY: Medium plasticity, red-brown, with some sand medium to coarse grained		H			
		SPT 2.5m 25/100 N=R		2.0		CL	Silty CLAY: Medium plasticity, pale brown, red-brown		H / Fb	HP HP	600 600	EXTREMELY WEATHERED BRECCIA
		SPT 4.0m 25/150 N=R		4.0								
		SPT 5.5m 25/100 N=R		5.0								
				5.60			Continued as Cored Drill Hole					
				6.0								

LEGEND: Water  Water Level (Date and time shown)  Water Inflow  Water Outflow Strata Changes  Gradational or transitional strata  Definitive or distinct strata change	Notes, Samples and Tests U ₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample ASS Acid Sulfate Soil Sample B Bulk Sample	Consistency VS Very Soft <25 S Soft 25 - 50 F Firm 50 - 100 St Stiff 100 - 200 VSt Very Stiff 200 - 400 H Hard >400 Fb Friable	UCS (kPa) <25 25 - 50 50 - 100 100 - 200 200 - 400 >400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)	Density V Very Loose L Loose MD Medium Dense D Dense VD Very Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%	



ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: **BH4**

CLIENT: Constructive Solutions
 PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
 SITE LOCATION: Tommingley
 TEST LOCATION: Refer to Figure 1

PAGE: Page 2 of 3
 JOB NO: RGS32759.1
 LOGGED BY: LD
 DATE: 23/7/21

DRILL TYPE: MD200 EASTING: SURFACE RL:
 BOREHOLE DIAMETER: 100 mm INCLINATION: 90° NORTHING: DATUM: AHD

Drilling and Sampling				Material description and profile information				Testing		Rock Mass Defects	
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	$I_{s(50)}$ D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
			1.0								
			2.0								
			3.0								
			4.0								
			5.0								
			6.0		START CORING AT 5.60m						
NMLC					BRECCIA: SANDSTONE fine to medium grained, with fine to medium grained quartz gravel, indistinctly bedded	MW	L		100	200	Various reheated joints SM Grval, fine to medium grained quartz JT 70° RO PL SN JT 30° RO PL SN JT 20° RO ST SN JT 40° RO PL SN JT 25° RO PL SN

LEGEND:		Bedding		Weathering		Strength		Defect Type			
Method											
WB	Wash Bore	Laminated	<20mm	EW	Extremely Weathered	VL	Very Low	$I_{s(50)}$	<0.1	JT	Joint
RR	Rock Roller	Thinly Bedded	20-200mm	HW	Highly Weathered	L	Low		0.1 - 0.3	PT	Parting
CB	Claw or Blad Bit	Medium Bedded	200-600mm	MW	Moderately Weathered	M	Medium		0.3 - 1	SM	Seam
NMLC	NMLC Core	Thickly Bedded	600-2000mm	SW	Slightly Weathered	H	High		1 - 3	SZ	Shear Zone
NQ,HQ,PQ	Wireline Coring	Very Thickly Bedded	2000mm	FR	Fresh	VH	Very High		3 - 10	CS	Crushed Seam
		Massive	No Visible Bedding			EH	Extremely High		>10		
		Degree of Fracturing				Roughness		Coating		Planarity	
		Fragmented	<20mm			VR	Very Rough	CN	Clean	PL	Planar
		Highly Fractured	20mm to 40mm			RO	Rough	SN	Stained	CU	Curved
		Fractured	40mm to 200mm			SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
		Slightly Fractured	200mm to 1000mm			SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular

RG.LIB.1.05.0.G.L.B. Log.RG.CORED.BOREHOLE.RGS32759.1.LOGS.GPJ. <<DrawingFiles>> 06/10/2021 15:40 10.03.00.09 Datagel Lab and In Situ Tool


ENGINEERING LOG - CORED BOREHOLE

BOREHOLE NO: BH4

CLIENT: Constructive Solutions
PROJECT NAME: Tommingley Mine Expansion Bridge Investigation
SITE LOCATION: Tommingley
TEST LOCATION: Refer to Figure 1

PAGE: Page 3 of 3
JOB NO: RGS32759.1
LOGGED BY: LD
DATE: 23/7/21


DRILL TYPE: MD200 **EASTING:** **SURFACE RL:**
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90° **NORTHING:** **DATUM:** AHD

Drilling and Sampling				Material description and profile information				Testing	Rock Mass Defects		
METHOD	WATER	RL (m)	DEPTH (m)	GRAPHIC LOG	Material Description: Rock type, particle characteristics, colour, minor components, structure	WEATHERING	ESTIMATED STRENGTH	I _{sr(50)} D/A	RQD %	Defect Spacing mm	Defect Description: Type, inclination, planarity, roughness, coating, thickness
NMLC			8.0		BRECCIA: SANDSTONE fine to medium grained, with fine to medium grained quartz gravel, indistinctly bedded (<i>continued</i>)	MW	L		90	75	JT RO PL SN
	340	JT 15° RO PL SN									
	40	JT 25° RO PL SN									
		JT 25° RO PL SN									
		JT 25° RO PL SN									
		JT 20° RO PL SN									
		JT 60° RO PL SN									
		JT 40° RO ST SN									
		JT 40° RO ST SN									
		JT 10° RO PL SN									
		9.0							10		
									50		
									90	300	JT 5° RO PL SN
										450	JT 60° RO ST SN
										150	JT 60° RO PL SN
										500	JT 50° RO PL SN
											JT 50° RO PL SN
										80	PT RO PL CN
											JT 70° RO ST SN
										90	JT 50° RO PL SN
										150	JT 50° RO PL SN
										500	
			12.0		Hole Terminated at 11.60 m						
			13.0								

RG.LIB.1.05.0.G.L.B. Log_RG.CORED.BOREHOLE_RGS32759.1.LOGS.GPJ <<DrawingFile>> 06/10/2021 15:40 10.03.00.09 Datagel Lab and In Situ Tool

LEGEND:		Bedding		Weathering		Strength		Defect Type			
Method		Laminated	<20mm	EW	Extremely Weathered	VL	Very Low	I _{sr(50)}	<0.1	JT	Joint
WB	Wash Bore	Thinly Bedded	20-200mm	HW	Highly Weathered	L	Low		0.1 - 0.3	PT	Parting
RR	Rock Roller	Medium Bedded	200-600mm	MW	Moderately Weathered	M	Medium		0.3 - 1	SM	Seam
CB	Claw or Blad Bit	Thickly Bedded	600-2000mm	SW	Slightly Weathered	H	High		1 - 3	SZ	Shear Zone
NMLC	NMLC Core	Very Thickly Bedded	2000mm	FR	Fresh	VH	Very High		3 - 10	CS	Crushed Seam
NQ,HQ,PQ	Wireline Coring	Massive	No Visible Bedding			EH	Extremely High		>10		
		Degree of Fracturing				Roughness		Coating		Planarity	
		Fragmented	<20mm			VR	Very Rough	CN	Clean	PL	Planar
		Highly Fractured	20mm to 40mm			RO	Rough	SN	Stained	CU	Curved
		Fractured	40mm to 200mm			SO	Smooth	VN	Veneer(<1mm)	ST	Stepped
		Slightly Fractured	200mm to 1000mm			SL	Slickensided	CO	Coating(1-5mm)	IR	Irregular



	Client	Constructive Solutions	Job No.	RGS32759.1
	Project:	Newell Highway Realignment Project Newell Highway, Tomingley	Drawn By:	LD
			Date:	30-Nov-21
	Title:	Core Photograph - BH4	Drawing No	Core Photo 4

Appendix B

Laboratory Test Result Sheets



ANALYSIS REPORT SOIL

PROJECT NO: EW211102

Date of Issue: 13/08/2021

Customer: Geo Lab

Report No: 1

Address: 82 Plain St TAMWORTH NSW 2340

Date Received: 6/08/2021

Matrix: Soil

Attention: Steve Mitchell

Location: RGS32759.1 Tomigley

Phone:

Sampler ID: Client

Fax:

Date of Sampling: 6/08/2021

Email: steve.m@eastwestonline.com.au

Sample Condition: Acceptable

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Signed: Anne Michie



NATA Accredited Laboratory 15708

Accredited for compliance with ISO/IEC 17025 - Testing

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.

results you can rely on



ANALYSIS REPORT

PROJECT NO: EW211102

Location: RGS32759.1 Tomigley Mine Expansion

					215293-1 C15	215293-2 C8	215293-4 C11	215293-6 C2
					CLIENT SAMPLE ID			
					0.5-0.8m	0.3-0.6m	0.5-0.8m	0.5-0.6m
					DEPTH			
Test Parameter	Method Description	Method Reference	Units	LOR	211102-1	211102-2	211102-3	211102-4
pH (1:5 in CaCl ₂)	Electrode	R&L4B2	pH units	na	6.08	5.36	6.76	5.26
Chloride Soluble	DA	DAP-06	mg/kg	2	7.42	18.3	7.05	22.2
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.04	0.07	0.04
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	5.21	7.86	10.8	9.65





ANALYSIS REPORT

PROJECT NO: EW211102

Location: RGS32759.1 Tomigley Mine Expansion

					CLIENT SAMPLE ID	215293-7 C1			
					DEPTH	0.4-0.65m			
Test Parameter	Method Description	Method Reference	Units	LOR	211102-5				
pH (1:5 in CaCl ₂)	Electrode	R&L4B2	pH units	na	5.66				
Chloride Soluble	DA	DAP-06	mg/kg	2	32.5				
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.09				
Sulphate-Sulphur	KCl40/ICP	R&L 10D1	mg/kg	3	7.46				

This Analysis Report shall not be reproduced except in full without the written approval of the laboratory.

Soils are air dried at 40°C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END





eastwest
geo ag enviro

82 Plain Street Tamworth NSW 2340
e admin@eastwestonline.com.au
t 02 6762 1733
f 02 6765 9109
abn 82 125 442 382

eastwestonline.com.au 

ANALYSIS REPORT SOIL

PROJECT NO: EW211162	Date of Issue: 31/08/2021
Customer: Regional Geotechnical Solutions	Report No: 1
Address: Unit 14, 25-27 Hurley Drive Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450 COFFS HARBOUR NSW	Date Received: 18/08/2021
Attention: Adam Holzhauser	Matrix: Soil
Phone: 0423 057 278	Location:
Fax:	Sampler ID: Client
Email: adam.h@regionalgeotech.com.au	Date of Sampling: 17/08/2021
	Sample Condition: Acceptable

Comments:

3b = moderate to slight dispersion of the remould.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

Signed:

Stephanie Cameron
Laboratory Operations Manager



East West is certified by the Australian-Asian Soil & Plant Analysis Council to perform various soil and plant tissue analysis. The tests reported herein have been performed in accordance with our terms of accreditation.

This report must not be reproduced except in full and EWEA takes no responsibility of the end use of the results within this report.

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.

results you can rely on



ANALYSIS REPORT

PROJECT NO: EW211162

Location:

CLIENT SAMPLE ID					C1	C2	C8	C11
					DEPTH			
Test Parameter	Method Description	Method Reference	Units	LOR	211162-1	211162-2	211162-3	211162-4
Gravel	Sieve	ASTMD422-63	%	na	<0.1	0.9	0.5	0.6
Soil Structure (SS)	Visual	McDonald et al	Code	na	1	1	1	2
Profile Permeability Class (PP)	Assessment	Rosewell&Loch	Class	na	5	6	5	4
Soil Erodibility Factor (K)	Assessment	Rosewell&Loch	Factor	na	0.03	0.05	0.04	0.02
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.53	0.63	1.25	0.49
Organic Matter	Calc	na	%	na	0.9	1.1	2.2	0.9
Saturated Hydraulic Conductivity	30cm tension	ASTM F1815-97	mm/hr	0.1	0.13	0.06	0.12	9.70
Emerson Aggregate Test	Class	PMS-21	Number	na	1	3b	3b	3b
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	18.1	27.7	16.7	20.1
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	34.2	41.0	37.2	28.9
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	9.8	11.1	17.0	7.3
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	37.9	19.3	28.6	43.1





ANALYSIS REPORT

PROJECT NO: EW211162

Location:

CLIENT SAMPLE ID					C15			
DEPTH								
Test Parameter	Method Description	Method Reference	Units	LOR	211162-5			
Gravel	Sieve	ASTMD422-63	%	na	0.2			
Soil Structure (SS)	Visual	McDonald et al	Code	na	1			
Profile Permeability Class (PP)	Assessment	Rosewell&Loch	Class	na	5			
Soil Erodibility Factor (K)	Assessment	Rosewell&Loch	Factor	na	0.03			
Organic Carbon (LECO)	LECO	R&L 6B3	%	0.05	0.55			
Organic Matter	Calc	na	%	na	1.0			
Saturated Hydraulic Conductivity	30cm tension	ASTM F1815-97	mm/hr	0.1	0.13			
Emerson Aggregate Test	Class	PMS-21	Number	na	3b			
Coarse Sand 0.2-2.0mm	Sieve	ASTMD422-63	%	na	29.2			
Fine Sand 0.02-0.2mm	Sieve	ASTMD422-63	%	na	31.8			
Silt 0.002-0.02mm	Hydrometer	ASTMD422-63	%	na	9.4			
Clay <0.002mm	Hydrometer	ASTMD422-63	%	na	29.4			

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Soils are air dried at 40°C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END



CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-1
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

SAMPLE DATA

Test Location	TP4
Depth	0.2-0.5m
Material Description	sandy clay

Sample Number	1
Sampling Clause	Client, results apply to samples as received.

LABORATORY COMPACTION DATA

- Australian Standards**
- AS1289.5.1.1 - Standard Compction
- AS1289.5.2.1 - Modified Compaction
- AS1289.2.1.1 - Moisture Content - Oven

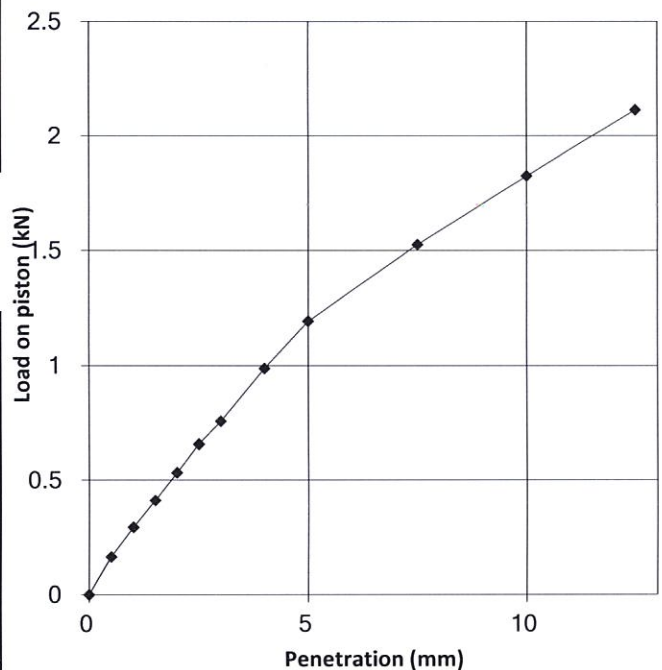
- RTA Methods**
- TfNSW T111 - Standard Compaction
- TfNSW T112 - Modified Compaction
- TfNSW T120 - Moisture Content - Oven

Maximum Dry Density	t/m ³	1.97
Optimum Moisture Content	%	10.8
Curing time	hrs	48
Liquid limit determination	Technician	
Field Moisture Content	%	13.2

- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.97
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	10.8
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.3
Dry Density (After soaking)	t/m ³	1.96
Moisture Content (Top 30mm)	%	11.9
Moisture Content (Remaining Sample)	%	11.2

CBR Value @ 5.0mm Penetration	%	6
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		



Sampled By: Client

Tested By: EW - Tamworth

Comments:



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Approved Signatory

Signatory Name: S Mitchell
 Document ID: REP-119
 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-2
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

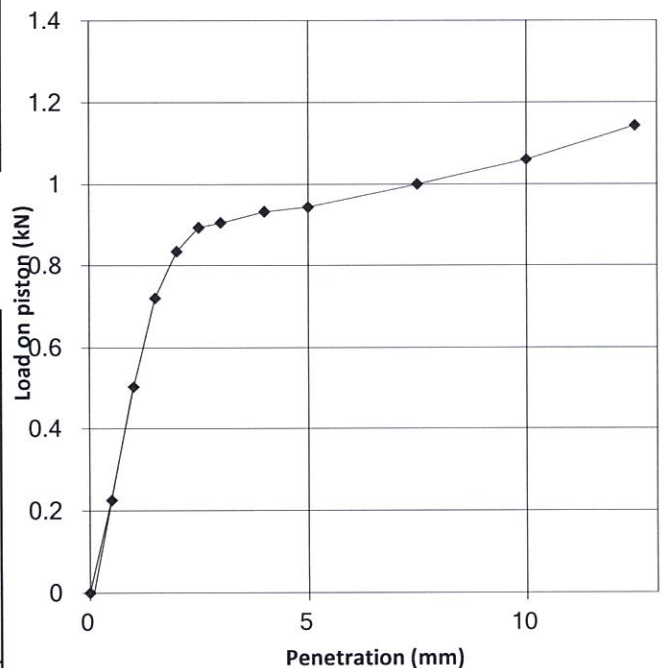
SAMPLE DATA

Test Location TP5	Sample Number 2
Depth 0.4-1.0m	
Material Description CLAY	Sampling Clause Client, results apply to samples as received.

LABORATORY COMPACTION DATA

- | | |
|---|---|
| Australian Standards
<input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction
<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	1.73
Optimum Moisture Content	%	18.6
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	18.6



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1
 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.74
Density Ratio (At Compaction)	%	101
Moisture Content (At Compaction)	%	18.4
Moisture Ratio (At Compaction)	%	99
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	1.4
Dry Density (After soaking)	t/m ³	1.72
Moisture Content (Top 30mm)	%	21.7
Moisture Content (Remaining Sample)	%	19.6

CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:

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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-3
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

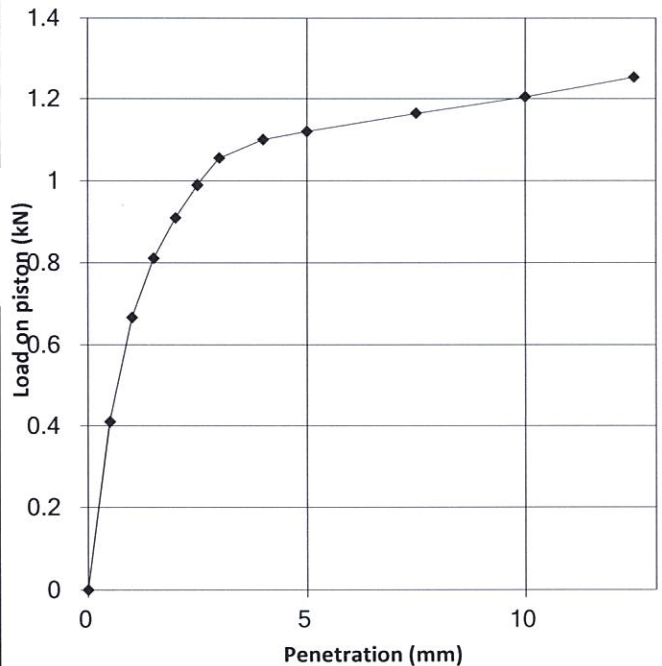
SAMPLE DATA

Test Location	TP6	Sample Number	3
Depth	0.2-0.7m	Sampling Clause	Client, results apply to samples as received.
Material Description	Sandy CLAY		

LABORATORY COMPACTION DATA

- | | |
|--|---|
| <input checked="" type="checkbox"/> Australian Standards | <input type="checkbox"/> RTA Methods |
| <input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction | <input type="checkbox"/> TfNSW T111 - Standard Compaction |
| <input type="checkbox"/> AS1289.5.2.1 - Modified Compaction | <input type="checkbox"/> TfNSW T112 - Modified Compaction |
| <input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | <input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |

Maximum Dry Density	t/m ³	1.81
Optimum Moisture Content	%	15.2
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	15.6



- CALIFORNIA BEARING RATIO TEST RESULTS
 AS1289.6.1.1 TfNSW T117



Dry Density (At Compaction)	t/m ³	1.82
Density Ratio (At Compaction)	%	101
Moisture Content (At Compaction)	%	15.1
Moisture Ratio (At Compaction)	%	99
Days Soaked		4
Surcharge Weight	kg	9
Swell (After soaking)	%	1.0
Dry Density (After soaking)	t/m ³	1.80
Moisture Content (Top 30mm)	%	16.4
Moisture Content (Remaining Sample)	%	16.0

CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0

Oversize retained on the 19mm sieve was not included in CBR test samples

Sampled By: Client
Tested By: EW - Tamworth

Comments:

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	Signatory Name: S Mitchell Document ID: REP-119 Issue No: 4 Date of Issue: 11-Mar-20
	Page 1 of 1

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CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-4
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

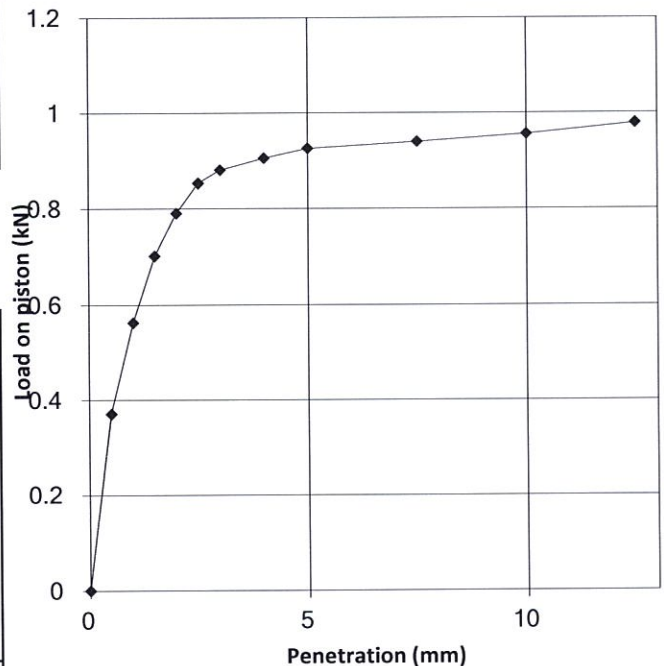
SAMPLE DATA

Test Location TP7	Sample Number 5
Depth 0.6-1.1m	Sampling Clause Client, results apply to samples as received.
Material Description CLAY	

LABORATORY COMPACTION DATA

- | | |
|---|---|
| Australian Standards
<input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction
<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	1.68
Optimum Moisture Content	%	20.3
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	15.8



- CALIFORNIA BEARING RATIO TEST RESULTS**
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.68
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	20.3
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	1.7
Dry Density (After soaking)	t/m ³	1.65
Moisture Content (Top 30mm)	%	24.2
Moisture Content (Remaining Sample)	%	21.6

CBR Value @ 2.5mm Penetration	%	6
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:



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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-5
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

SAMPLE DATA

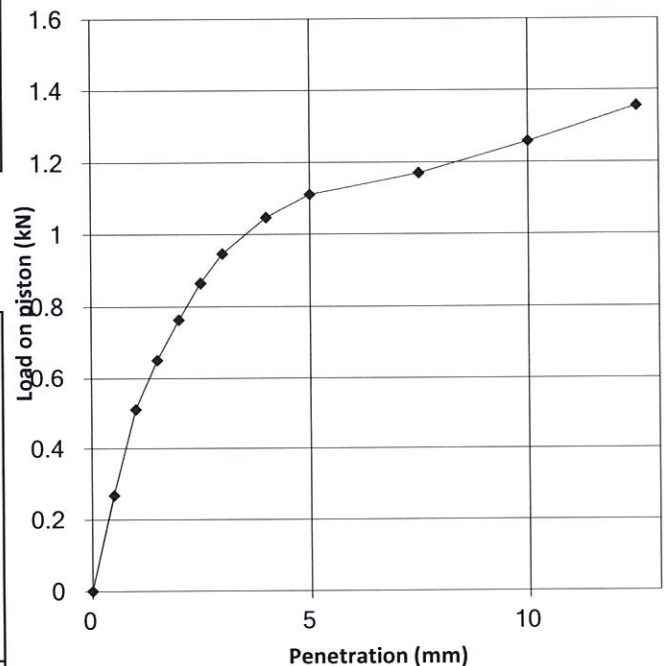
Test Location	TP8
Depth	0.5-1.0m
Material Description	Sandy CLAY

Sample Number	7
Sampling Clause	Client, results apply to samples as received.

LABORATORY COMPACTION DATA

Australian Standards		RTA Methods	
<input checked="" type="checkbox"/>	AS1289.5.1.1 - Standard Compction	<input type="checkbox"/>	TfNSW T111 - Standard Compaction
<input type="checkbox"/>	AS1289.5.2.1 - Modified Compaction	<input type="checkbox"/>	TfNSW T112 - Modified Compaction
<input checked="" type="checkbox"/>	AS1289.2.1.1 - Moisture Content - Oven	<input type="checkbox"/>	TfNSW T120 - Moisture Content - Oven

Maximum Dry Density	t/m ³	1.72
Optimum Moisture Content	%	18.0
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	14.7



CALIFORNIA BEARING RATIO TEST RESULTS
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.71
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	17.9
Moisture Ratio (At Compaction)	%	99
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	2.1
Dry Density (After soaking)	t/m ³	1.68
Moisture Content (Top 30mm)	%	22.1
Moisture Content (Remaining Sample)	%	21.9

CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:



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 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-6
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

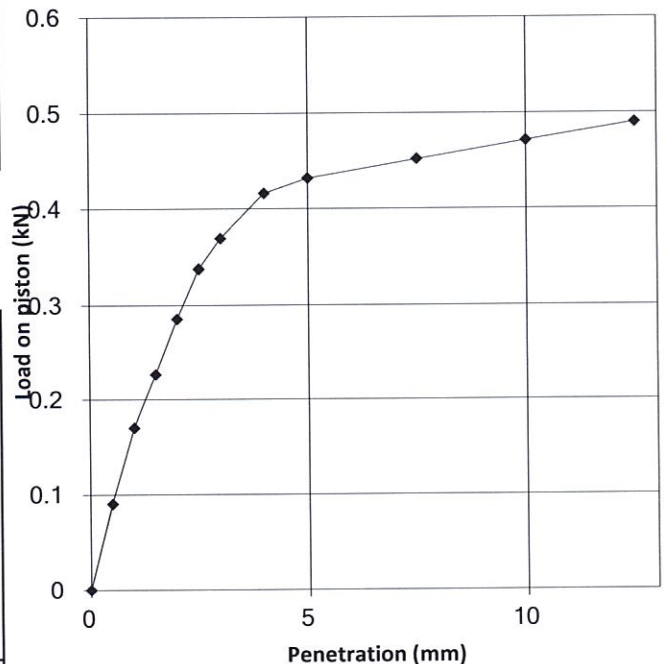
SAMPLE DATA

Test Location TP18	Sample Number 8
Depth 0.1-1.0m	Sampling Clause Client, results apply to samples as received.
Material Description clay	

LABORATORY COMPACTION DATA

- | | |
|---|---|
| Australian Standards
<input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction
<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	1.73
Optimum Moisture Content	%	16.5
Curing time	hrs	96
Liquid limit determination		Technician
Field Moisture Content	%	12.4



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.71
Density Ratio (At Compaction)	%	99
Moisture Content (At Compaction)	%	16.5
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	4.3
Dry Density (After soaking)	t/m ³	1.70
Moisture Content (Top 30mm)	%	24.1
Moisture Content (Remaining Sample)	%	20.3
CBR Value @ 2.5mm Penetration	%	2.5
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

Tested By: EW - Tamworth

Comments:



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 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-7
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

SAMPLE DATA

Test Location	TP19
Depth	0.2-1.0m
Material Description	sandy clay

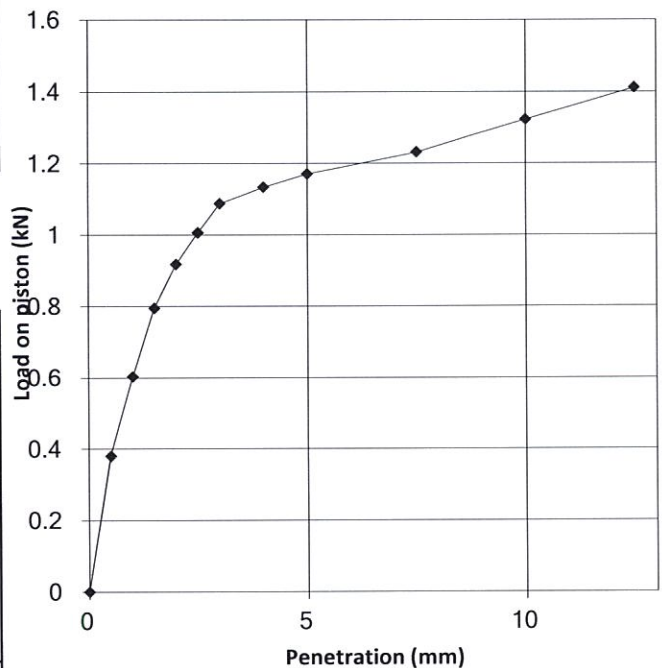
Sample Number	9
Sampling Clause	Client, results apply to samples as received.

LABORATORY COMPACTION DATA

- Australian Standards**
- AS1289.5.1.1 - Standard Compction
- AS1289.5.2.1 - Modified Compaction
- AS1289.2.1.1 - Moisture Content - Oven

- RTA Methods**
- TfNSW T111 - Standard Compaction
- TfNSW T112 - Modified Compaction
- TfNSW T120 - Moisture Content - Oven

Maximum Dry Density	t/m ³	1.90
Optimum Moisture Content	%	13.2
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	11.0



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.91
Density Ratio (At Compaction)	%	101
Moisture Content (At Compaction)	%	13.2
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.6
Dry Density (After soaking)	t/m ³	1.90
Moisture Content (Top 30mm)	%	14.9
Moisture Content (Remaining Sample)	%	13.6

CBR Value @ 2.5mm Penetration	%	8
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

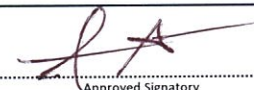
Tested By: EW - Tamworth

Comments:



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Signatory Name: S Mitchell
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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-8
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

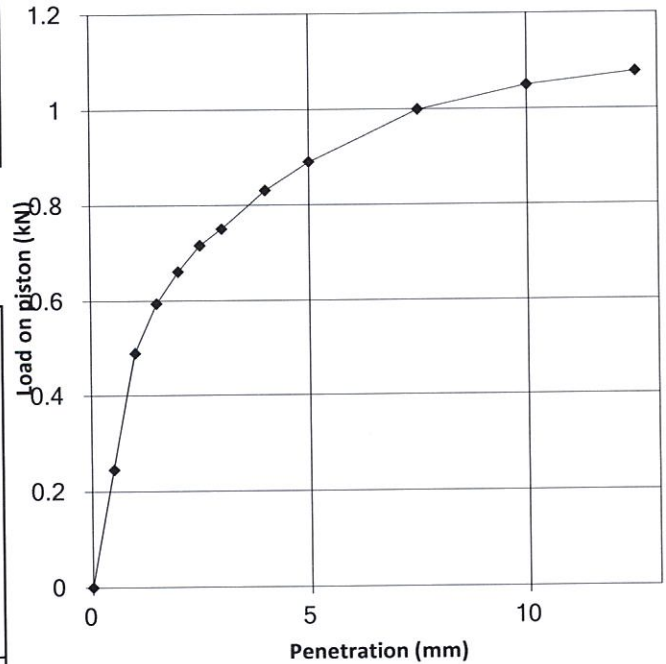
SAMPLE DATA

Test Location TP20	Sample Number 10
Depth 0.1-0.7m	
Material Description CLAY	Sampling Clause Client, results apply to samples as received.

LABORATORY COMPACTION DATA

Australian Standards <input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction <input type="checkbox"/> AS1289.5.2.1 - Modified Compaction <input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven	RTA Methods <input type="checkbox"/> TfNSW T111 - Standard Compaction <input type="checkbox"/> TfNSW T112 - Modified Compaction <input type="checkbox"/> TfNSW T120 - Moisture Content - Oven
---	---

Maximum Dry Density	t/m ³	1.69
Optimum Moisture Content	%	19.1
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	16.9



CALIFORNIA BEARING RATIO TEST RESULTS
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.68
Density Ratio (At Compaction)	%	99
Moisture Content (At Compaction)	%	19.1
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	1.2
Dry Density (After soaking)	t/m ³	1.66
Moisture Content (Top 30mm)	%	22.9
Moisture Content (Remaining Sample)	%	22.1

CBR Value @ 2.5mm Penetration	%	5
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:



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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-9
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 19/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

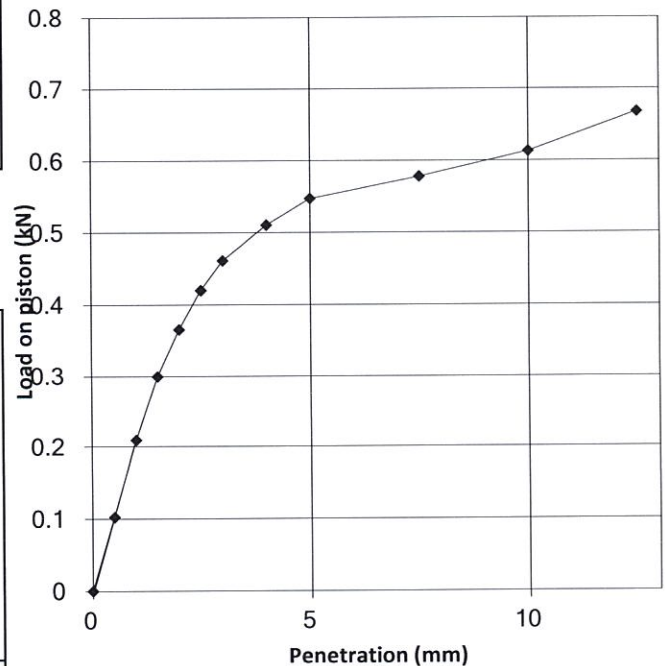
SAMPLE DATA

Test Location	TP21	Sample Number	11
Depth	0.1-0.7m	Sampling Clause	Client, results apply to samples as received.
Material Description	clay		

LABORATORY COMPACTION DATA

- | | |
|--|---|
| <input checked="" type="checkbox"/> Australian Standards | <input type="checkbox"/> RTA Methods |
| <input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction | <input type="checkbox"/> TfNSW T111 - Standard Compaction |
| <input type="checkbox"/> AS1289.5.2.1 - Modified Compaction | <input type="checkbox"/> TfNSW T112 - Modified Compaction |
| <input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | <input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |

Maximum Dry Density	t/m ³	1.64
Optimum Moisture Content	%	19.8
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	21.0



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.64
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	19.8
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	1.2
Dry Density (After soaking)	t/m ³	1.62
Moisture Content (Top 30mm)	%	21.8
Moisture Content (Remaining Sample)	%	19.9
CBR Value @ 2.5mm Penetration	%	3
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client


Tested By: EW - Tamworth

Comments:



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Signed:


Approved Signatory

Signatory Name: S Mitchell
Document ID: REP-119
Issue No: 4
Date of Issue: 11-Mar-20



CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-10
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

SAMPLE DATA

Test Location	TP22
Depth	0.1-0.6m
Material Description	CLAY

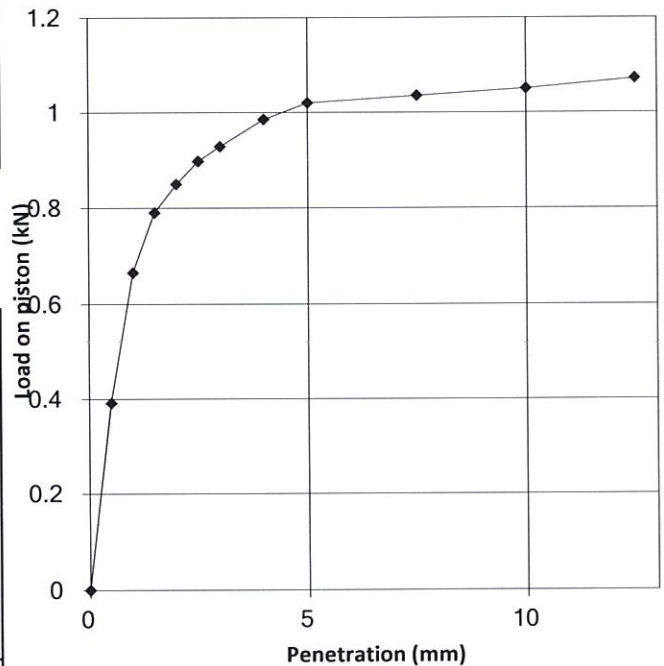
Sample Number	12
Sampling Clause	Client, results apply to samples as received.

LABORATORY COMPACTION DATA

- Australian Standards**
- AS1289.5.1.1 - Standard Compction
 - AS1289.5.2.1 - Modified Compaction
 - AS1289.2.1.1 - Moisture Content - Oven

- RTA Methods**
- TfNSW T111 - Standard Compaction
 - TfNSW T112 - Modified Compaction
 - TfNSW T120 - Moisture Content - Oven

Maximum Dry Density	t/m ³	1.71
Optimum Moisture Content	%	19.2
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	17.2



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1
 - TfNSW T117

Dry Density (At Compaction)	t/m ³	1.71
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	19.2
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	1.3
Dry Density (After soaking)	t/m ³	1.69
Moisture Content (Top 30mm)	%	22.9
Moisture Content (Remaining Sample)	%	20.9
CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:



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Signatory Name: S Mitchell
 Document ID: REP-119
 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-11
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

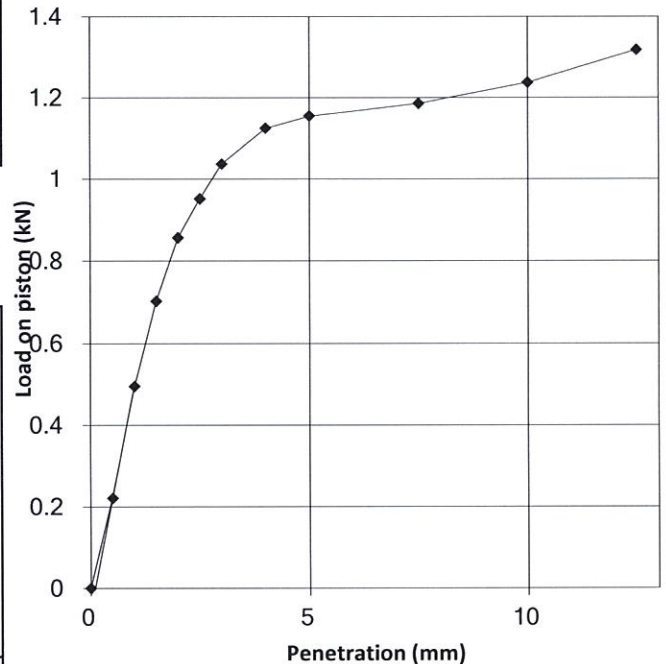
SAMPLE DATA

Test Location TP23	Sample Number 13
Depth 0.4-1.0m	
Material Description Gravelly CLAY	Sampling Clause Client, results apply to samples as received.

LABORATORY COMPACTION DATA

Australian Standards <input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction <input type="checkbox"/> AS1289.5.2.1 - Modified Compaction <input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven	RTA Methods <input type="checkbox"/> TfNSW T111 - Standard Compaction <input type="checkbox"/> TfNSW T112 - Modified Compaction <input type="checkbox"/> TfNSW T120 - Moisture Content - Oven
---	---

Maximum Dry Density	t/m ³	1.78
Optimum Moisture Content	%	17.4
Curing time	hrs	48
Liquid limit determination	Technician	
Field Moisture Content	%	15.8





CALIFORNIA BEARING RATIO TEST RESULTS
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.78
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	17.4
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.6
Dry Density (After soaking)	t/m ³	1.77
Moisture Content (Top 30mm)	%	19.8
Moisture Content (Remaining Sample)	%	19.4

CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:

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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-12
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

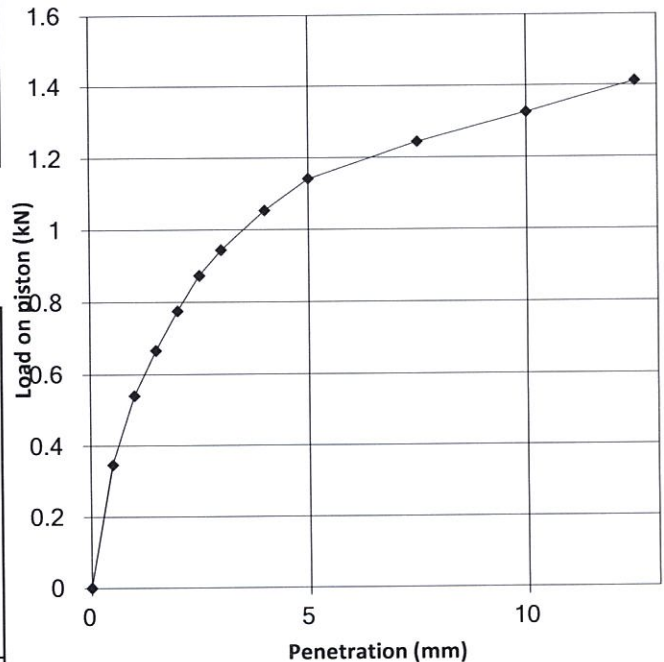
SAMPLE DATA

Test Location	TP24	Sample Number	14
Depth	0.2-0.7m	Sampling Clause	Client, results apply to samples as received.
Material Description	sandy Clay		

LABORATORY COMPACTION DATA

- | | |
|--|--|
| <p>Australian Standards</p> <p><input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction</p> <p><input type="checkbox"/> AS1289.5.2.1 - Modified Compaction</p> <p><input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven</p> | <p>RTA Methods</p> <p><input type="checkbox"/> TfNSW T111 - Standard Compaction</p> <p><input type="checkbox"/> TfNSW T112 - Modified Compaction</p> <p><input type="checkbox"/> TfNSW T120 - Moisture Content - Oven</p> |
|--|--|

Maximum Dry Density	t/m ³	1.91
Optimum Moisture Content	%	13.0
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	14.3



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.91
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	13.0
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	-0.2
Dry Density (After soaking)	t/m ³	1.92
Moisture Content (Top 30mm)	%	14.5
Moisture Content (Remaining Sample)	%	13.1

CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

Tested By: EW - Tamworth

Comments:



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Issue No: 4
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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-13
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

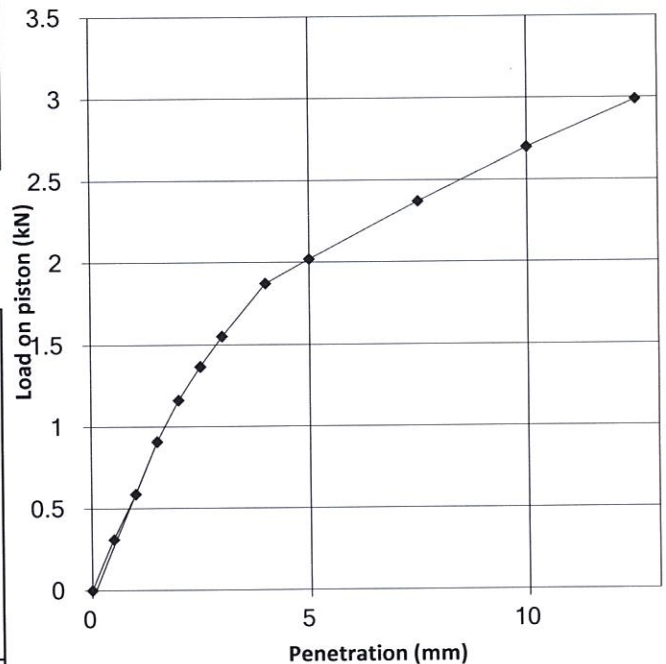
SAMPLE DATA

Test Location TP25	Sample Number 16
Depth 0.8-1.3m	Sampling Clause Client, results apply to samples as received.
Material Description sandy clay	

LABORATORY COMPACTION DATA

- | | |
|---|---|
| Australian Standards
<input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction
<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	2.00
Optimum Moisture Content	%	10.5
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	9.1



- CALIFORNIA BEARING RATIO TEST RESULTS**
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	2.00
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	10.5
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	-0.2
Dry Density (After soaking)	t/m ³	2.00
Moisture Content (Top 30mm)	%	13.2
Moisture Content (Remaining Sample)	%	11.8

CBR Value @ 2.5mm Penetration	%	11
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		


Sampled By: Client
Tested By: EW - Tamworth

Comments:



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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-14
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

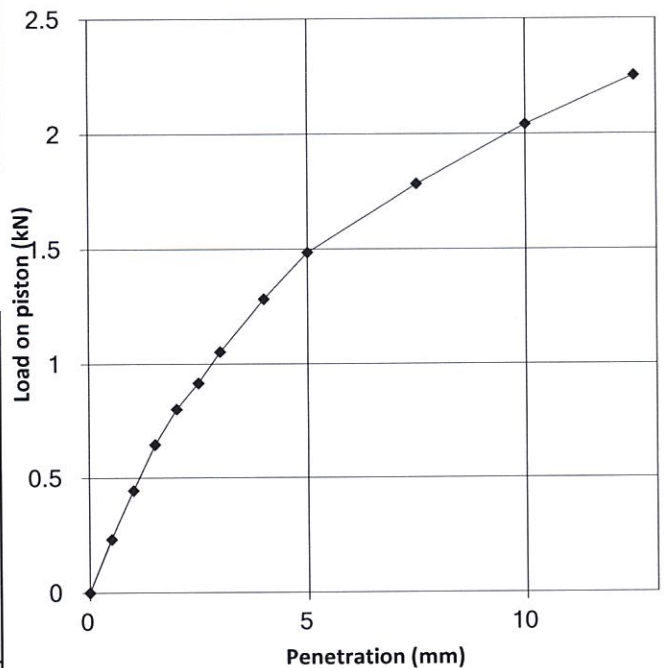
SAMPLE DATA

Test Location	TP27	Sample Number	18
Depth	0.5-1.0m	Sampling Clause	Client, results apply to samples as received.
Material Description	silty clay		

LABORATORY COMPACTION DATA

- | | |
|--|---|
| Australian Standards | RTA Methods |
| <input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction | <input type="checkbox"/> TfNSW T111 - Standard Compaction |
| <input type="checkbox"/> AS1289.5.2.1 - Modified Compaction | <input type="checkbox"/> TfNSW T112 - Modified Compaction |
| <input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | <input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |

Maximum Dry Density	t/m ³	1.98
Optimum Moisture Content	%	10.4
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	5.7



CALIFORNIA BEARING RATIO TEST RESULTS

- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.98
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	10.4
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.0
Dry Density (After soaking)	t/m ³	1.98
Moisture Content (Top 30mm)	%	13.1
Moisture Content (Remaining Sample)	%	11.6
CBR Value @ 2.5mm Penetration	%	7
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:



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Signatory Name: S Mitchell
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 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-15
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

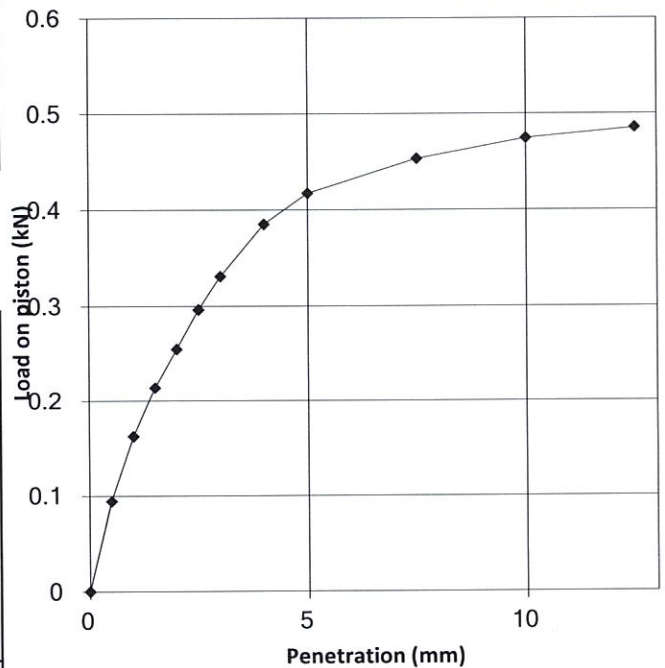
SAMPLE DATA

Test Location TP28	Sample Number 19
Depth 0.3-1.0m	
Material Description clay	Sampling Clause Client, results apply to samples as received.

LABORATORY COMPACTION DATA

- | | |
|---|---|
| Australian Standards
<input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction
<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	1.56
Optimum Moisture Content	%	23.8
Curing time	hrs	96
Liquid limit determination		Technician
Field Moisture Content	%	21.2



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.56
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	23.8
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	5.2
Dry Density (After soaking)	t/m ³	1.48
Moisture Content (Top 30mm)	%	34.4
Moisture Content (Remaining Sample)	%	26.8
CBR Value @ 2.5mm Penetration	%	2.5
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

Tested By: EW - Tamworth

Comments:



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 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-16
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

SAMPLE DATA

Test Location	TP29	Sample Number	20
Depth	0.1-0.4m	Sampling Clause	Client, results apply to samples as received.
Material Description	silty clay		

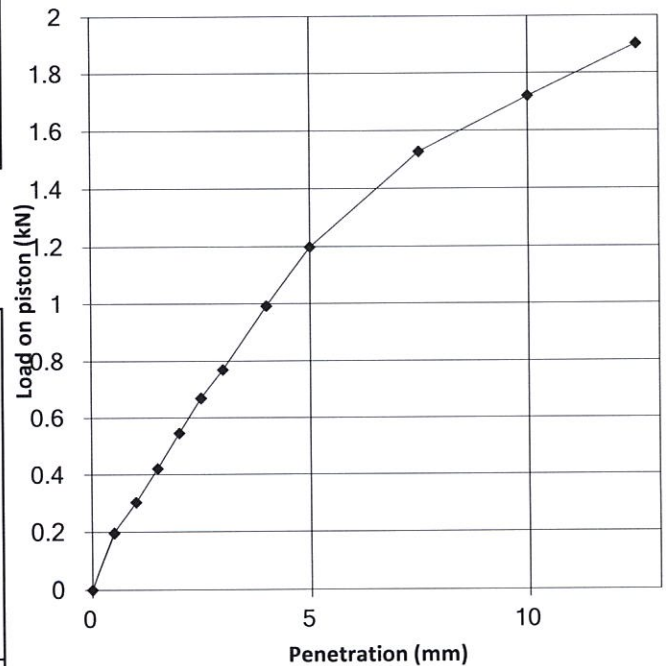
LABORATORY COMPACTION DATA

- | | |
|---|---|
| <input checked="" type="checkbox"/> Australian Standards
<input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction
<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	1.98
Optimum Moisture Content	%	11.0
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	7.1

- CALIFORNIA BEARING RATIO TEST RESULTS**
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.98
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	11.0
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	-0.5
Dry Density (After soaking)	t/m ³	1.99
Moisture Content (Top 30mm)	%	12.6
Moisture Content (Remaining Sample)	%	11.5



Sampled By: Silty clay
Tested By: EW - Tamworth

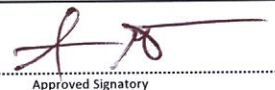
CBR Value @ 5.0mm Penetration	%	6
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Comments:



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 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-17
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion-RGS32759.1	
DATE OF TESTING: 12/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: WS	DATE SAMPLED: 25/06/2021

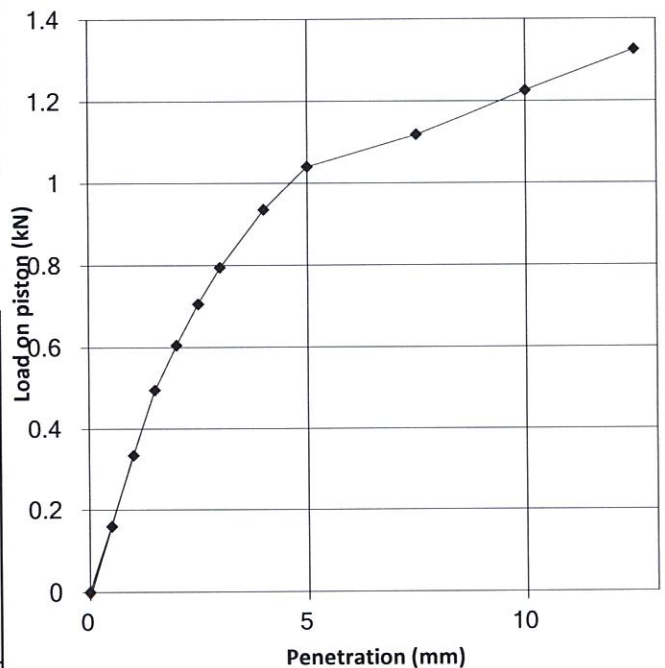
SAMPLE DATA

Test Location TP32	Sample Number 21
Depth 0.1-0.6m	Sampling Clause Client, results apply to samples as received.
Material Description silty clay	

LABORATORY COMPACTION DATA

Australian Standards <input checked="" type="checkbox"/> AS1289.5.1.1 - Standard Compction <input type="checkbox"/> AS1289.5.2.1 - Modified Compaction <input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven	RTA Methods <input type="checkbox"/> TfNSW T111 - Standard Compaction <input type="checkbox"/> TfNSW T112 - Modified Compaction <input type="checkbox"/> TfNSW T120 - Moisture Content - Oven
---	---

Maximum Dry Density	t/m ³	1.91
Optimum Moisture Content	%	12.2
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	8.0



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.91
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	12.2
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.4
Dry Density (After soaking)	t/m ³	1.90
Moisture Content (Top 30mm)	%	13.5
Moisture Content (Remaining Sample)	%	15.0
CBR Value @ 2.5mm Penetration	%	5
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

Tested By: EW - Tamworth

Comments:



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Signatory Name: S Mitchell
 Document ID: REP-119
 Issue No: 4
 Date of Issue: 11-Mar-20



SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215239-18
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215239
PROJECT: Material Evaluation		
SITE LOCATION: Tomingley Mine Expansion		
DATE OF TESTING: 7/07/2021		DATE OF REPORT: 21/07/2021
TECHNICIAN: MC		DATE SAMPLED: 25/06/2021

Sampled By : Client: The results apply to samples as received.

SAMPLE No:	1	2	3
SAMPLE LOCATION:	TP4	TP5	TP6
DEPTH:	0.2-0.5m	0.4-1.0m	0.2-0.7m
MATERIAL DESCRIPTION:	Sandy CLAY	CLAY	Sandy CLAY
WASHED/UNWASHED	-	-	-

AS1289.3.8.1 Water Type & Temperature:

TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	% Passing Sieve Analysis	75.0mm		
		63.0mm		
		53.0mm		
		37.5mm		
		26.5mm		
		19.0mm		
		13.2mm		
		9.5mm		
		6.7mm		
		4.75mm		
AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4		2.36mm		
		1.18mm		
		600µm		
		425µm		
		300µm		
AS1289.3.8.1	EMERSON CLASS NO:			
AS1289.2.1.1	MOISTURE CONTENT: %			
	CODE			

AS1289.3.1.1	LIQUID LIMIT	%			
AS1289.3.1.2	LIQUID LIMIT	%	2,4	21	51
AS1289.3.2.1	PLASTIC LIMIT	%	2,4	13	12
AS1289.3.3.1	PLASTICITY INDEX	%	2,4	8	39
AS1289.3.4.1	LINEAR SHRINKAGE	%			17

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215239-19
PROJECT: Material Evaluation	PROJECT NO: EW215239
SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 7/07/2021	DATE OF REPORT: 21/07/2021
TECHNICIAN: MC	DATE SAMPLED: 25/06/2021

Sampled By : Client: The results apply to samples as received.

	SAMPLE No:	4	5	6
	SAMPLE LOCATION:	TP7	TP7	TP8
	DEPTH:	0.1-0.4m	0.6-1.1m	0.1-0.4m
	MATERIAL DESCRIPTION:	Silty GRAVEL	CLAY	Silty GRAVEL
	WASHED/UNWASHED	Washed	-	Washed

AS1289.3.8.1 Water Type & Temperature:				
TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm			
	19.0mm	98		
	13.2mm	86		98
	9.5mm	71		92
	6.7mm	58		82
	4.75mm	47		71
	2.36mm	34		54
AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4	1.18mm	27		43
	600µm	22		35
	425µm	20		31
	300µm	18		28
	150µm	15		22
	75µm	12		17
AS1289.3.8.1	EMERSON CLASS NO:			
AS1289.2.1.1	MOISTURE CONTENT:	%		

AS1289.3.1.1	LIQUID LIMIT	%			
AS1289.3.1.2	LIQUID LIMIT	%	2,4	18	50
AS1289.3.2.1	PLASTIC LIMIT	%	2,4	13	12
AS1289.3.3.1	PLASTICITY INDEX	%	2,4	5	38
AS1289.3.4.1	LINEAR SHRINKAGE	%			3

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215239-19
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215239
PROJECT: Material Evaluation		
SITE LOCATION: Tomingley Mine Expansion		
DATE OF TESTING: 7/07/2021		DATE OF REPORT: 21/07/2021
TECHNICIAN: MC		DATE SAMPLED: 25/06/2021
Sampled By : Client: The results apply to samples as received.		

SAMPLE No:	4	5	6
SAMPLE LOCATION:	TP7	TP7	TP8
DEPTH:	0.1-0.4m	0.6-1.1m	0.1-0.4m
MATERIAL DESCRIPTION:	Silty GRAVEL	CLAY	Silty GRAVEL
WASHED/UNWASHED	Washed	-	Washed

AS1289.3.8.1 Water Type & Temperature:				
TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm			
	19.0mm	98		
	13.2mm	86	98	
	SAMPLING METHOD	% Passing	9.5mm	71
		Sieve	6.7mm	58
	AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4	Analysis	4.75mm	47
			2.36mm	34
1.18mm			27	
600µm			22	
425µm			20	
300µm			18	
AS1289.3.8.1	EMERSON CLASS NO:	150µm	15	
		75µm	12	
AS1289.2.1.1	MOISTURE CONTENT:	%		

CODE			
AS1289.3.1.1	LIQUID LIMIT	%	
AS1289.3.1.2	LIQUID LIMIT	%	2,4
AS1289.3.2.1	PLASTIC LIMIT	%	18
AS1289.3.3.1	PLASTICITY INDEX	%	50
AS1289.3.4.1	LINEAR SHRINKAGE	%	12
			13
			3

CODES USED	
Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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eastwest
geo ag enviro

East West Enviroag Pty Limited
82 Plain Street Tamworth NSW 2340
ABN 82 125 442 382 124 ph 02 6762 1733 fax 02 6765 9109

SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215239-20
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215239
PROJECT: Material Evaluation		
SITE LOCATION: Tomingley Mine Expansion		
DATE OF TESTING: 7/07/2021		DATE OF REPORT: 21/07/2021
TECHNICIAN: MC		DATE SAMPLED: 25/06/2021
Sampled By : Client: The results apply to samples as received.		

SAMPLE No:	7	8	9
SAMPLE LOCATION:	TP8	TP18	TP19
DEPTH:	0.5-1.0m	0.1-1.0m	0.2-1.0m
MATERIAL DESCRIPTION:	Sandy CLAY	CLAY	CLAY
WASHED/UNWASHED	-	-	-

AS1289.3.8.1 Water Type & Temperature:				
TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm			
	19.0mm			
	13.2mm			
	9.5mm			
	6.7mm			
	4.75mm			
AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4	% Passing Sieve Analysis			
	2.36mm			
	1.18mm			
	600µm			
	425µm			
	300µm			
	150µm			
	75µm			
AS1289.3.8.1	EMERSON CLASS NO:			
AS1289.2.1.1	MOISTURE CONTENT: %			
	CODE			

TEST METHOD	TEST DESCRIPTION				
AS1289.3.1.1	LIQUID LIMIT %				
AS1289.3.1.2	LIQUID LIMIT %	2,4	32	53	39
AS1289.3.2.1	PLASTIC LIMIT %	2,4	14	12	12
AS1289.3.3.1	PLASTICITY INDEX %	2,4	18	41	27
AS1289.3.4.1	LINEAR SHRINKAGE %				

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215239-21
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215239
PROJECT: Material Evaluation		
SITE LOCATION: Tomingley Mine Expansion		
DATE OF TESTING: 7/07/2021		DATE OF REPORT: 21/07/2021
TECHNICIAN: MC		DATE SAMPLED: 25/06/2021
Sampled By : Client: The results apply to samples as received.		

SAMPLE No:	10	11	12
SAMPLE LOCATION:	TP20	TP21	TP22
DEPTH:	0.1-0.7m	0.1-0.7m	0.1-0.6m
MATERIAL DESCRIPTION:	CLAY	CLAY	CLAY
WASHED/UNWASHED	-	-	-

AS1289.3.8.1 Water Type & Temperature:					
TEST METHOD	TEST DESCRIPTION				
AS1289.3.6.1	75.0mm				
	63.0mm				
	53.0mm				
	37.5mm				
	26.5mm				
	19.0mm				
	13.2mm				
	SAMPLING METHOD	% Passing Sieve			
		9.5mm			
	AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4	Analysis			
6.7mm					
4.75mm					
2.36mm					
1.18mm					
600µm					
425µm					
300µm					
AS1289.3.8.1	150µm				
	75µm				
AS1289.3.8.1	EMERSON CLASS NO:				
AS1289.2.1.1	MOISTURE CONTENT: %				
	CODE				

AS1289.3.1.1	LIQUID LIMIT	%			
AS1289.3.1.2	LIQUID LIMIT	%	2,4	44	39
AS1289.3.2.1	PLASTIC LIMIT	%	2,4	12	12
AS1289.3.3.1	PLASTICITY INDEX	%	2,4	32	27
AS1289.3.4.1	LINEAR SHRINKAGE	%			

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215239-22
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215239
PROJECT: Material Evaluation		
SITE LOCATION: Tomingley Mine Expansion		
DATE OF TESTING: 7/07/2021		DATE OF REPORT: 21/07/2021
TECHNICIAN: MC		DATE SAMPLED: 25/06/2021

Sampled By : Client: The results apply to samples as received.

	SAMPLE No:	13	14	15
	SAMPLE LOCATION:	TP23	TP24	TP25
	DEPTH:	0.4-1.0m	0.1-0.5m	0.8-1.3m
	MATERIAL DESCRIPTION:	Gravelly CLAY	CLAY	Sandy Clayey GRAVEL
	WASHED/UNWASHED	-	-	-
AS1289.3.8.1 Water Type & Temperature:				
TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm			100
	19.0mm			96
	13.2mm			85
	9.5mm			73
	6.7mm			63
	4.75mm			54
	2.36mm			40
AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4	1.18mm			29
	600µm			24
	425µm			22
	300µm			20
	150µm			16
	75µm			13
AS1289.3.8.1	EMERSON CLASS NO:			
AS1289.2.1.1	MOISTURE CONTENT: %			

	CODE			
AS1289.3.1.1	LIQUID LIMIT %			
AS1289.3.1.2	LIQUID LIMIT %	2,4	45	27
AS1289.3.2.1	PLASTIC LIMIT %	2,4	11	12
AS1289.3.3.1	PLASTICITY INDEX %	2,4	34	15
AS1289.3.4.1	LINEAR SHRINKAGE %			3

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions			
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		REPORT NO:	EW215239-23
PROJECT: Material Evaluation		PROJECT NO:	EW215239
SITE LOCATION: Tomingley Mine Expansion			
DATE OF TESTING: 7/07/2021		DATE OF REPORT:	21/07/2021
TECHNICIAN: MC		DATE SAMPLED:	25/06/2021
Sampled By : Client: The results apply to samples as received.			

		16	17	18
SAMPLE No:		16	17	18
SAMPLE LOCATION:		TP25	TP27	TP27
DEPTH:		0.8-1.3m	0.1-0.45m	0.5-1.0m
MATERIAL DESCRIPTION:		Silty CLAY	Sandy Clayey GRAVEL	Silty CLAY
WASHED/UNWASHED		-	Washed	-
AS1289.3.8.1 Water Type & Temperature:				
TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm		100	
	19.0mm		95	
	13.2mm		90	
	9.5mm		80	
	6.7mm		69	
	4.75mm		60	
	2.36mm		46	
	1.18mm		41	
	600µm		35	
	425µm		29	
300µm		26		
150µm		19		
75µm		15		
AS1289.3.8.1	EMERSON CLASS NO:			
AS1289.2.1.1	MOISTURE CONTENT: %			

		CODE			
AS1289.3.1.1	LIQUID LIMIT %		21	24	19
AS1289.3.1.2	LIQUID LIMIT %	2,4	12	15	13
AS1289.3.2.1	PLASTIC LIMIT %	2,4	9	9	6
AS1289.3.3.1	PLASTICITY INDEX %	2,4			
AS1289.3.4.1	LINEAR SHRINKAGE %				

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215239-24	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215239	
PROJECT: Material Evaluation		SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 7/07/2021		DATE OF REPORT: 21/07/2021	
TECHNICIAN: MC		DATE SAMPLED: 25/06/2021	
Sampled By : Client: The results apply to samples as received.			

SAMPLE No:	19	20	21
SAMPLE LOCATION:	TP28	TP29	TP32
DEPTH:	0.3-1.0m	0.1-0.4m	0.1-0.6m
MATERIAL DESCRIPTION:	CLAY	Silty CLAY	Silty CLAY
WASHED/UNWASHED	-	-	-

AS1289.3.8.1 Water Type & Temperature:				
TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm			
	19.0mm			
	13.2mm			
	9.5mm			
	6.7mm			
	4.75mm			
AS1289.1.2.1.6.4 AS1289.1.2.1.6.5.1 AS1289.1.2.1.6.5.3 AS1289.1.2.1.6.5.4	2.36mm			
	1.18mm			
	600µm			
	425µm			
	300µm			
AS1289.3.8.1	150µm			
	75µm			
	EMERSON CLASS NO:			
AS1289.2.1.1	MOISTURE CONTENT: %			
	CODE			

AS1289.3.1.1	LIQUID LIMIT	%				
AS1289.3.1.2	LIQUID LIMIT	%	2,4	59	20	24
AS1289.3.2.1	PLASTIC LIMIT	%	2,4	11	11	12
AS1289.3.3.1	PLASTICITY INDEX	%	2,4	48	9	12
AS1289.3.4.1	LINEAR SHRINKAGE	%				

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions		REPORT NO: EW215293-1	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450		PROJECT NO: EW215293	
PROJECT: Material Evaluation			
SITE LOCATION: Tomingley Mine Expansion			
DATE OF TESTING: 10/08/2021		DATE OF REPORT: 25/08/2021	
TECHNICIAN: BF		DATE SAMPLED: 4/08/2021	

Sampled By : Client: The results apply to samples as received.

SAMPLE No:	1	2	3
SAMPLE LOCATION:	C15	C8	TP1
DEPTH:	0.5-0.8m	0.3-0.6m	0.3-0.8m
MATERIAL DESCRIPTION:	Sandy CLAY	Sandy CLAY	silty CLAY
WASHED/UNWASHED	-	-	-

AS1289.3.8.1 Water Type & Temperature:			
TEST METHOD	TEST DESCRIPTION		
AS1289.3.6.1	75.0mm		
	63.0mm		
	53.0mm		
	37.5mm		
	26.5mm		
	19.0mm		
	13.2mm		
	9.5mm		
	6.7mm		
	4.75mm		
	2.36mm		
	1.18mm		
	600µm		
	425µm		
300µm			
150µm			
75µm			
AS1289.3.8.1	EMERSON CLASS NO:		
AS1289.2.1.1	MOISTURE CONTENT: %	21.1	24.8
	CODE		22.6

AS1289.3.1.1	LIQUID LIMIT %			
AS1289.3.1.2	LIQUID LIMIT %	2,4	28	26
AS1289.3.2.1	PLASTIC LIMIT %	2,4	13	12
AS1289.3.3.1	PLASTICITY INDEX %	2,4	15	14
AS1289.3.4.1	LINEAR SHRINKAGE %			24

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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SOIL CLASSIFICATION TEST REPORT

AUSTRALIAN STANDARDS METHODS

CLIENT: Regional Geotechnical Solutions	REPORT NO: EW215293-2
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	PROJECT NO: EW215293
PROJECT: Material Evaluation	
SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 10/08/2021	DATE OF REPORT: 25/08/2021
TECHNICIAN: BF	DATE SAMPLED: 4/08/2021

Sampled By : Client: The results apply to samples as received.

SAMPLE No:	4	6	7
SAMPLE LOCATION:	C11	C2	C1
DEPTH:	0.5-0.8m	0.5-0.6m	0.4-0.65m
MATERIAL DESCRIPTION:	silty CLAY	Clayey sand	Sandy CLAY
WASHED/UNWASHED			

AS1289.3.8.1 Water Type & Temperature:

TEST METHOD	TEST DESCRIPTION			
AS1289.3.6.1	75.0mm			
	63.0mm			
	53.0mm			
	37.5mm			
	26.5mm			
	19.0mm			
	13.2mm			
	9.5mm			
	6.7mm			
	4.75mm			
AS1289.1.2.1.6.4	2.36mm			
	1.18mm			
	600µm			
	425µm			
	300µm			
AS1289.1.2.1.6.5.1	150µm			
	75µm			
	EMERSON CLASS NO:			
AS1289.3.8.1				
AS1289.2.1.1	MOISTURE CONTENT: %	21.0	15.0	22.0

CODE

AS1289.3.1.1	LIQUID LIMIT	%				
AS1289.3.1.2	LIQUID LIMIT	%	2,4	37	18	29
AS1289.3.2.1	PLASTIC LIMIT	%	2,4	15	12	13
AS1289.3.3.1	PLASTICITY INDEX	%	2,4	22	6	16
AS1289.3.4.1	LINEAR SHRINKAGE	%				

CODES USED

Sample history for plasticity tests	
Air Dried	1
Low temperature oven (<50°) dried	2
Other/Unknown	3

Method of preparation for plasticity tests	
Dry sieved	4
Wet sieved	5
Natural	6



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CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215293-3
PROJECT: Material Evaluation	PROJECT NO: EW215293
SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 23/08/2021	DATE OF REPORT: 25/08/2021
TECHNICIAN: MG	DATE SAMPLED: 4/08/2021

SAMPLE DATA

Test Location	TP1
Depth	0.3-0.8m
Material Description	silty CLAY

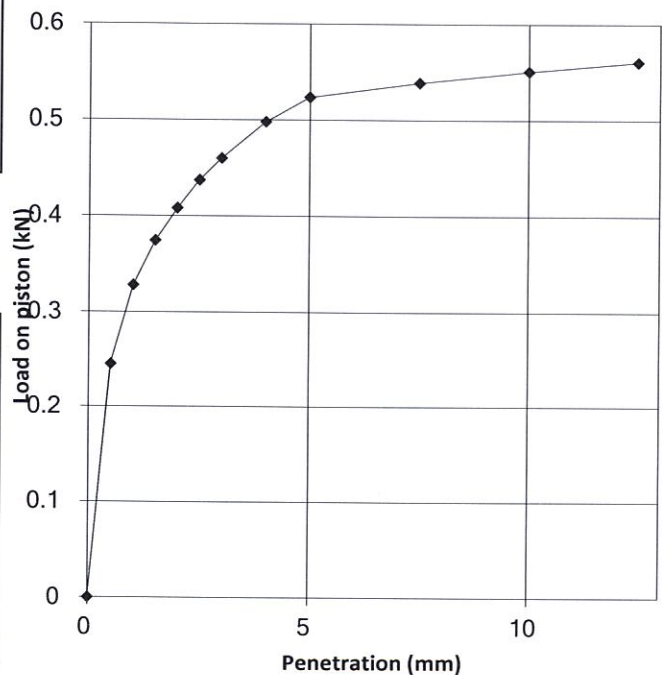
Sample Number	3
Sampling Clause	Client, Results apply to sample as received.

LABORATORY COMPACTION DATA

- Australian Standards**
- AS1289.5.1.1 - Standard Compaction
- AS1289.5.2.1 - Modified Compaction
- AS1289.2.1.1 - Moisture Content - Oven

- RTA Methods**
- TfNSW T111 - Standard Compaction
- TfNSW T112 - Modified Compaction
- TfNSW T120 - Moisture Content - Oven

Maximum Dry Density	t/m ³	1.81
Optimum Moisture Content	%	15.9
Curing time	hrs	48
Liquid limit determination	Technician	
Field Moisture Content	%	19.3



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.82
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	15.9
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.1
Dry Density (After soaking)	t/m ³	1.82
Moisture Content (Top 30mm)	%	19.7
Moisture Content (Remaining Sample)	%	18.1
CBR Value @ 2.5mm Penetration	%	3.5
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

Tested By: EW - Tamworth

Comments:



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NATA Accredited Laboratory Number. 12360

Signed:



Approved Signatory

Signatory Name: S Mitchell

Document ID: REP-119

Issue No: 4

Date of Issue: 11-Mar-20

Page 1 of 1

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215293-4
PROJECT: Material Evaluation	PROJECT NO: EW215293
SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 23/08/2021	DATE OF REPORT: 25/08/2021
TECHNICIAN: MG	DATE SAMPLED: 4/08/2021

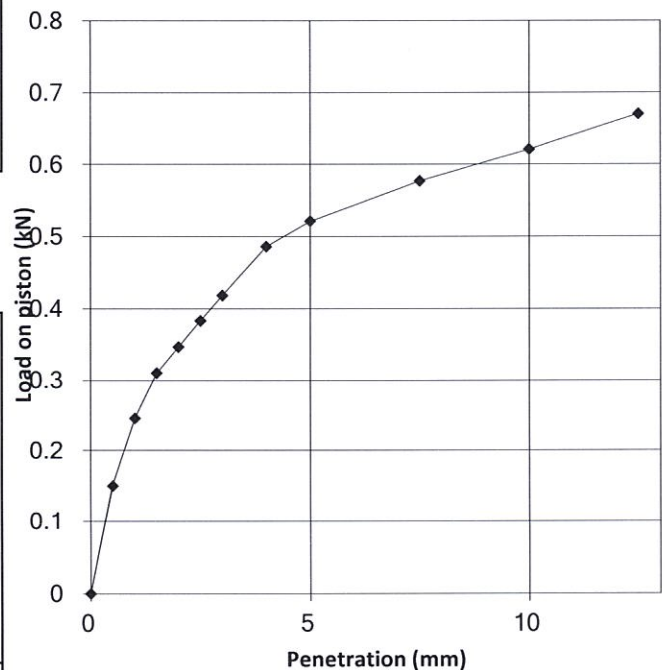
SAMPLE DATA

Test Location TP16	Sample Number 5
Depth 0.3-0.8m	
Material Description silty CLAY	Sampling Clause Client, results apply to sample as received.

LABORATORY COMPACTION DATA

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---	---

Maximum Dry Density	t/m ³	1.93
Optimum Moisture Content	%	11.3
Curing time	hrs	48
Liquid limit determination	Technician	
Field Moisture Content	%	13.5



CALIFORNIA BEARING RATIO TEST RESULTS
 AS1289.6.1.1 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.90
Density Ratio (At Compaction)	%	99
Moisture Content (At Compaction)	%	11.3
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	-0.2
Dry Density (After soaking)	t/m ³	1.91
Moisture Content (Top 30mm)	%	12.1
Moisture Content (Remaining Sample)	%	11.3

CBR Value @ 2.5mm Penetration	%	3
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client
Tested By: EW - Tamworth

Comments:



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 Approved Signatory

Signatory Name: S Mitchell

Document ID: REP-119

Issue No: 4

Date of Issue: 11-Mar-20

Page 1 of 1

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215293-5
PROJECT: Material Evaluation	PROJECT NO: EW215293
SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 23/08/2021	DATE OF REPORT: 25/08/2021
TECHNICIAN: MG	DATE SAMPLED: 4/08/2021

SAMPLE DATA

Test Location TP11	Sample Number 8
Depth 0.3-0.8m	Sampling Clause Client, results apply to samples as received.
Material Description Sandy CLAY	

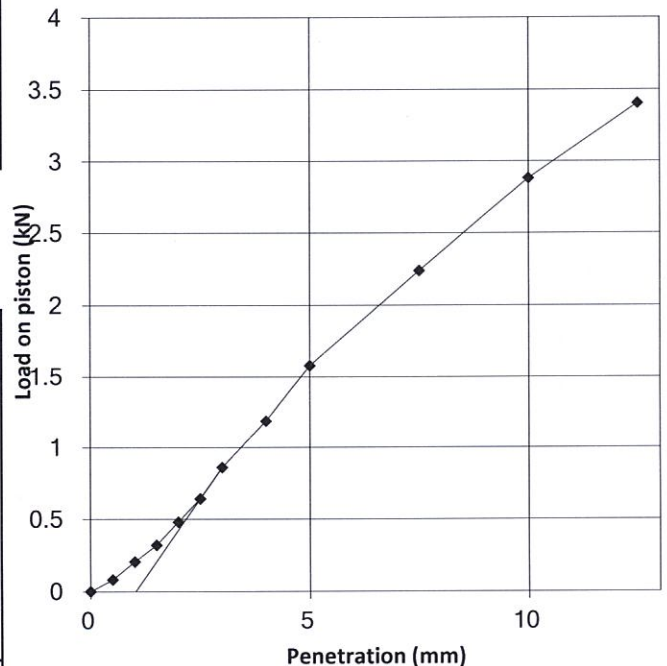
LABORATORY COMPACTION DATA

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<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	2.00
Optimum Moisture Content	%	9.4
Curing time	hrs	48
Liquid limit determination		Technician
Field Moisture Content	%	17.1

- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1
 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.99
Density Ratio (At Compaction)	%	100
Moisture Content (At Compaction)	%	9.4
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.2
Dry Density (After soaking)	t/m ³	1.99
Moisture Content (Top 30mm)	%	10.6
Moisture Content (Remaining Sample)	%	10.3



Sampled By: Client

Tested By: EW - Tamworth

CBR Value @ 5.0mm Penetration	%	9
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		


Comments:



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Signatory Name: S Mitchell
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 Issue No: 4
 Date of Issue: 11-Mar-20

CALIFORNIA BEARING RATIO REPORT SHEET

CLIENT: Regional Geotechnical Solutions	
CLIENT ADDRESS: Unit 14, 25-27 Hurley Drive, Coffs Harbour NSW 2450	REPORT NO: EW215293-6
PROJECT: Material Evaluation	PROJECT NO: EW215293
SITE LOCATION: Tomingley Mine Expansion	
DATE OF TESTING: 23/08/2021	DATE OF REPORT: 25/08/2021
TECHNICIAN: MG	DATE SAMPLED:

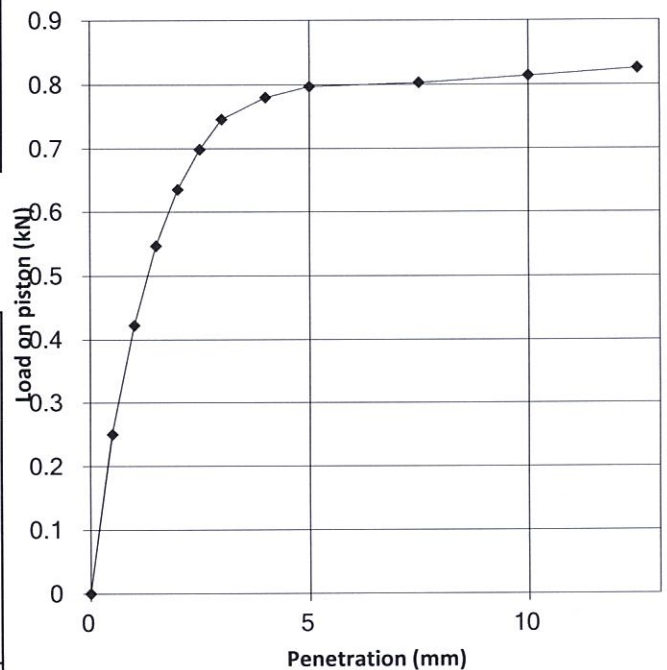
SAMPLE DATA

Test Location TP10	Sample Number 9
Depth 0.3-0.8m	
Material Description silty CLAY	Sampling Clause Client, results apply to sample as received.

LABORATORY COMPACTION DATA

- | | |
|---|---|
| Australian Standards
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<input type="checkbox"/> AS1289.5.2.1 - Modified Compaction
<input checked="" type="checkbox"/> AS1289.2.1.1 - Moisture Content - Oven | RTA Methods
<input type="checkbox"/> TfNSW T111 - Standard Compaction
<input type="checkbox"/> TfNSW T112 - Modified Compaction
<input type="checkbox"/> TfNSW T120 - Moisture Content - Oven |
|---|---|

Maximum Dry Density	t/m ³	1.60
Optimum Moisture Content	%	22.4
Curing time	hrs	48
Liquid limit determination	Technician	
Field Moisture Content	%	24.9



- CALIFORNIA BEARING RATIO TEST RESULTS**
- AS1289.6.1.1
 TfNSW T117

Dry Density (At Compaction)	t/m ³	1.59
Density Ratio (At Compaction)	%	99
Moisture Content (At Compaction)	%	22.4
Moisture Ratio (At Compaction)	%	100
Days Soaked		10
Surcharge Weight	kg	9
Swell (After soaking)	%	0.6
Dry Density (After soaking)	t/m ³	1.58
Moisture Content (Top 30mm)	%	27.6
Moisture Content (Remaining Sample)	%	26.1

CBR Value @ 2.5mm Penetration	%	5
Percentage of sample retained on 19mm Sieve		0
Oversize retained on the 19mm sieve was not included in CBR test samples		

Sampled By: Client

Tested By: EW - Tamworth

Comments:



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Approved Signatory

Signatory Name: S Mitchell
 Document ID: REP-119
 Issue No: 4
 Date of Issue: 11-Mar-20

RESULTS OF ACID SULFATE ROCK ANALYSIS

14 samples supplied by Regional Geotechnical Solutions Pty Ltd on 11/08/2021. Lab Job No. M0179.

Analysis requested by Joel Babbage. Your Job: RGS32759.1.

44 Bent Street WINGHAM NSW 2429

Sample Site	EAL Lab Code	Moisture		Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)		Total Sulfur		Acid Neutralising Capacity (ANC _{BT})		NAG pH	NAG Net Acidity to pH 7 (Net Acid Generation) kg H ₂ SO ₄ /t	CLASSIFICATION (based on NAG pH and NAPP) (ie. NAF, PAF, UC)	ANC/MPA RATIO (as kg H ₂ SO ₄ /t > 2 ideal)	NAPP (Net Acid Producing Potential) kg H ₂ SO ₄ /t (Based on total sulfur: does not include actual acidity)	CLASSIFICATION (based on NAPP) (i.e. 1- ACM; 2- NAF, 3- PAF-LC, 4- PAF)
		(% moisture of total wet weight)	(g moisture / g of oven dry soil)	(% S _{cr})	(mol H ⁺ /t)	%S	(mol H ⁺ /t)	(% CaCO ₃)	(mol H ⁺ /t)						
BH1 5.55-5.6	M0179/9	3.8	0.04	<0.005	0	..	..	1.07	213	7.54	0.0	NAF	..	-11	ACM
BH2 8.26-8.3	M0179/10	4.1	0.04	<0.005	0	..	..	1.28	255	7.95	0.0	NAF	..	-13	ACM
BH3 2.85-2.9	M0179/11	15.3	0.18	<0.005	0	..	..	5.00	999	8.62	0.0	NAF	..	-50	ACM
BH4 6.22-6.34	M0179/12	12.0	0.14	<0.005	0	..	..	0.79	158	6.84	0.3	NAF	..	-8	ACM

NOTE:

- All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
- Rock methods and classification from AMIRA international, May 2002. ARD Test Handbook, Project P387A Prediction and Kinetic Control of Acid Mine Drainage. Ian Walk Institute, Melbourne.
- Soil Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
- Results at or below detection limits are replaced with '0' for calculation purposes.
- Rock Classification = 1-ACM: acid consuming potential; 2-NAF: non-acid forming; 3-PAF-LC: potentially acid forming, low capacity (<5kg H₂SO₄/tonne); 4-PAF: potentially acid forming); UC = Uncertain.
- Analysis conducted between sample arrival date and reporting date.
- ** NATA accreditation does not cover the performance of this service.
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- All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs or on request).
- Results relate only to the samples tested.
- This report was issued on 20/08/2021.



checked:
Graham Lancaster
Laboratory Manager

RESULTS OF SOIL ANALYSIS

14(3) samples supplied by Regional Geotechnical Solutions Pty Ltd on 11/08/2021 - Lab Job No. M0179

Analysis requested by Joel Babbage. - **Your Project: RGS32759.1**

44 Bent Street WINGHAM NSW 2429

	Method	Sample 1	Sample 2	Sample 3
		C6 1.8-2.0	BH2 2.5-2.6	BH3 2.5-2.6
	EAL job No.	M0179/3	M0179/7	M0179/8
Moisture (%)	<i>inhouse</i>	19	5	15
Texture	<i>See note 2 below.</i>	FINE	COARSE	MEDIUM
pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.13	8.23	8.75
Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.872	0.074	0.061
Resistivity (ohm.mm)	** Calculation	5,342	134,318	165,017
Resistivity (ohm.cm)	** Calculation (ohm.mm / 10)	534	13,432	16,502
Chloride (mg/kg)	** Water Extract - ISE (1:5 Water)	1216	71.5	44.0
Chloride (as %)	** Calculation	0.122	0.007	0.004
Sulfate (mg/kg)	** Water Extract-APHA 3120 ICPOES	2,517	236	142
Sulfate (as % SO ₄)	** Calculation	0.252	0.024	0.014
Chloride / Sulfate Ratio	** Calculation	0.5	0.3	0.3

Notes:

1. ppm = mg/kg dried soil
2. For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
3. All results as dry weight DW - soils were dried at 60°C for 48hrs prior to crushing and analysis.
4. For conductivity 1 dS/m = 1 mS/cm = 1000 µS/cm
5. Methods from Rayment and Lyons, 2011. Soil Chemical Methods - Australasia. CSIRO Publishing: Collingwood.
6. Based on Australian Standard AS: 2159-2009
7. Methods from Ahern, CR, McElnea AE, Sullivan LA (2004). *Acid Sulfate Soils Laboratory Methods Guidelines*. QLD DNRME.
8. Analysis conducted between sample arrival date and reporting date.
9. ** NATA accreditation does not cover the performance of this service.
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13. Results relate only to the samples tested.
14. This report was issued on 19/08/2021.



Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked:
Graham Lancaster
Laboratory Manager

Point Load Strength Report - Diametral and Axial Testing of Rock Core



Client:	Constructive Solutions	Job Number:	RGS32759.1
Project:	Gold Mine Expansion Project	Date:	10/09/2021
Location:	Tomingley	By:	JB

Date Sampled:	
Date Tested:	10-Sep-21

Test Method: AS4133.4.1 - 2007

Test Machine: HMA 6510

Date of Calibration: 18-Aug-20

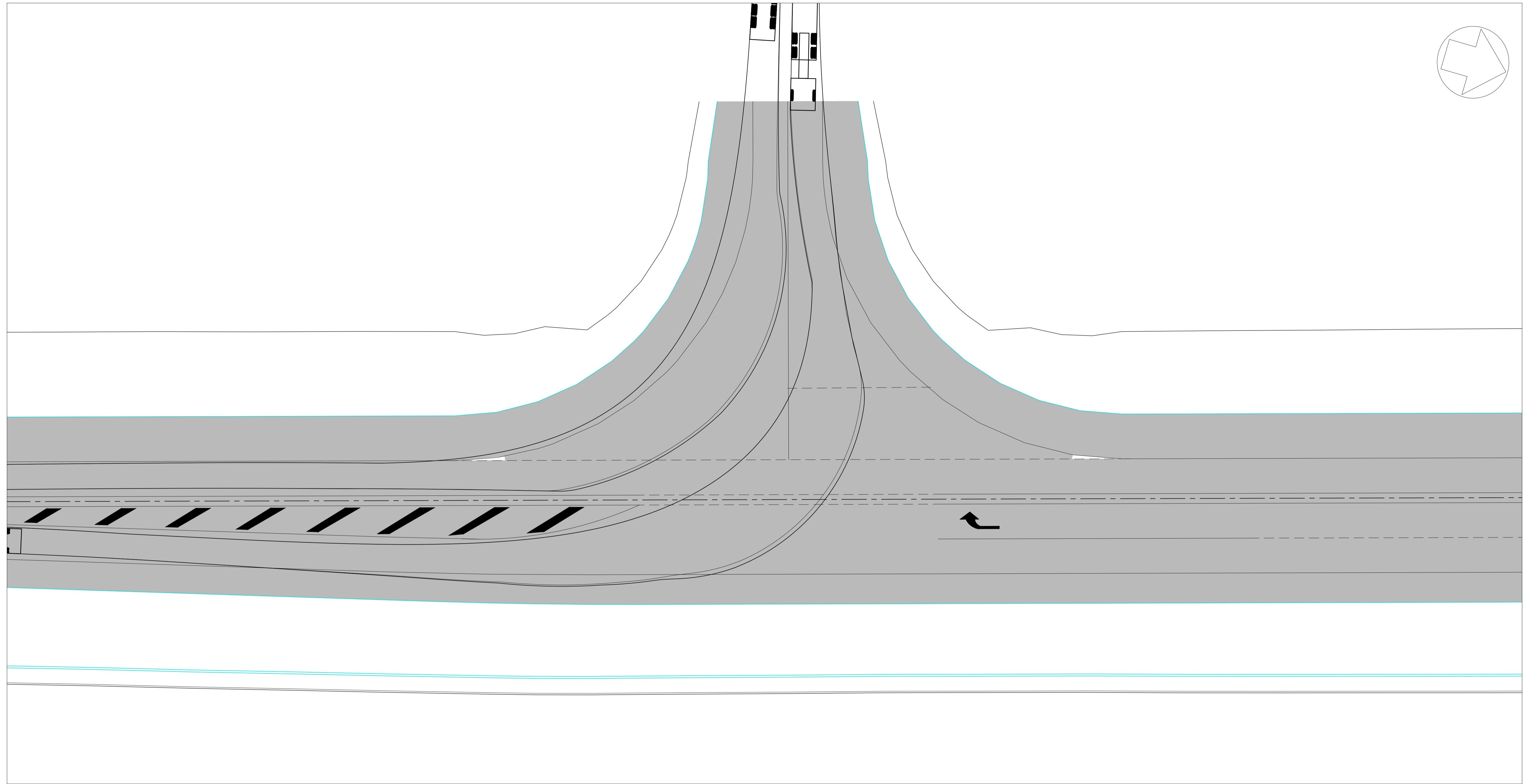
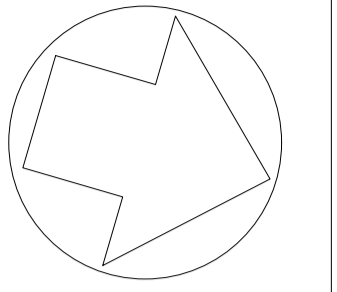
Borehole	Test Depth (m)	Rock Type	Moisture Condition	Diametral Test							Axial Test								
				Length L (mm)	Diameter D (mm)	Load P (kN)	I _s (Mpa)	Size Correction	I _{s(50)} (Mpa)	Strength Classification	Width W (diameter)	Platen Separation	Load P (kN)	I _s (Mpa)	Size Correction	I _{s(50)} (Mpa)	Strength Classification	UCS (Mpa)	Anisotropy Index I _{a(50)}
BH1	3.9		N	120.0	51.0	0.97	0.37	1.01	0.38	M	51	39	0.58	0.23	1.003	0.23	L	4.59	1.64
	5		N	80.0	51.0	0.26	0.10	1.01	0.10	L	-	-	-	-	-	-	-	-	-
	6		N	90.0	51.0	0.63	0.24	1.01	0.24	L	51	41	0.60	0.23	1.014	0.23	L	4.57	1.07
	7.1		N	120.0	51.0	0.40	0.15	1.01	0.16	L	51	36	0.32	0.14	0.985	0.13	L	2.70	1.15
BH4	6.5		N	130.0	51.0	0.47	0.18	1.01	0.18	L	51	40	0.61	0.23	1.009	0.24	L	4.74	0.77
	7.6		N	120.0	51.0	0.46	0.18	1.01	0.18	L	51	38	0.41	0.17	0.997	0.17	L	3.31	1.08
	8.8		N	140.0	51.0	0.91	0.35	1.01	0.35	M	-	-	-	-	-	-	-	-	-
	10		N	80.0	51.0	0.62	0.24	1.01	0.24	L	-	-	-	-	-	-	-	-	-
BH2	3.2		N	80.0	51.0	5.78	2.22	1.01	2.24	H	51	43	4.11	1.47	1.025	1.51	H	30.18	1.49
	4.5			-	-	-	-	-	-	-	51	50.0	0.15	0.05	1.061	0.05	VL	0.98	
	5.2		N	110.0	51.0	0.26	0.10	1.01	0.10	L	-	-	-	-	-	-	-	-	-
BH1	5.6		N	60.0	51.0	0.18	0.07	1.01	0.07	VL	-	-	-	-	-	-	-	-	-
	6.8		N	100.0	51.0	0.20	0.08	1.01	0.08	VL	51	50	4.07	1.25	1.061	1.33	H		0.06
	8		N	110.0	51.0	5.12	1.97	1.01	1.99	H	-	-	-	-	-	-	-	-	-

Moisture Condition:	D = Dry N = Natural S = Saturated	Strength Classification:	I _{s(50)} Mpa > 10 3 to 10 1 to 3 0.3 to 1 0.1 to 0.3 < 0.1	Term Extremely High Strength Very High Strength High Strength Medium Strength Low Strength Very Low Strength	Abbreviation EH VH H M L VL
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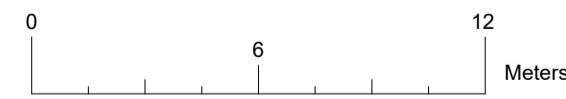
APPENDIX 2: Pavement Design Report

Not undertaken at the time of this submission

APPENDIX 3: Swept Path Diagrams



PLAN
1:200



REV	DATE	REVISION DETAILS
A	12-05-21	100% CONCEPT DESIGN FOR INTERNAL REVIEW

APPROVED
SOR

DRAWN
L.BAYNHAM
DESIGNED
L.BAYNHAM
CHECKED
S.O'ROURKE
APPROVED
S.O'ROURKE

PROJECT
NARROMINE SHIRE COUNCIL, HW17 - NEWELL HIGHWAY DEVIATION 56.3km TO 64.1km NORTH OF PARKES
DRAWING TITLE
BACK TOMINGLEY WEST ROAD - LEFT IN, RIGHT OUT

CLIENT



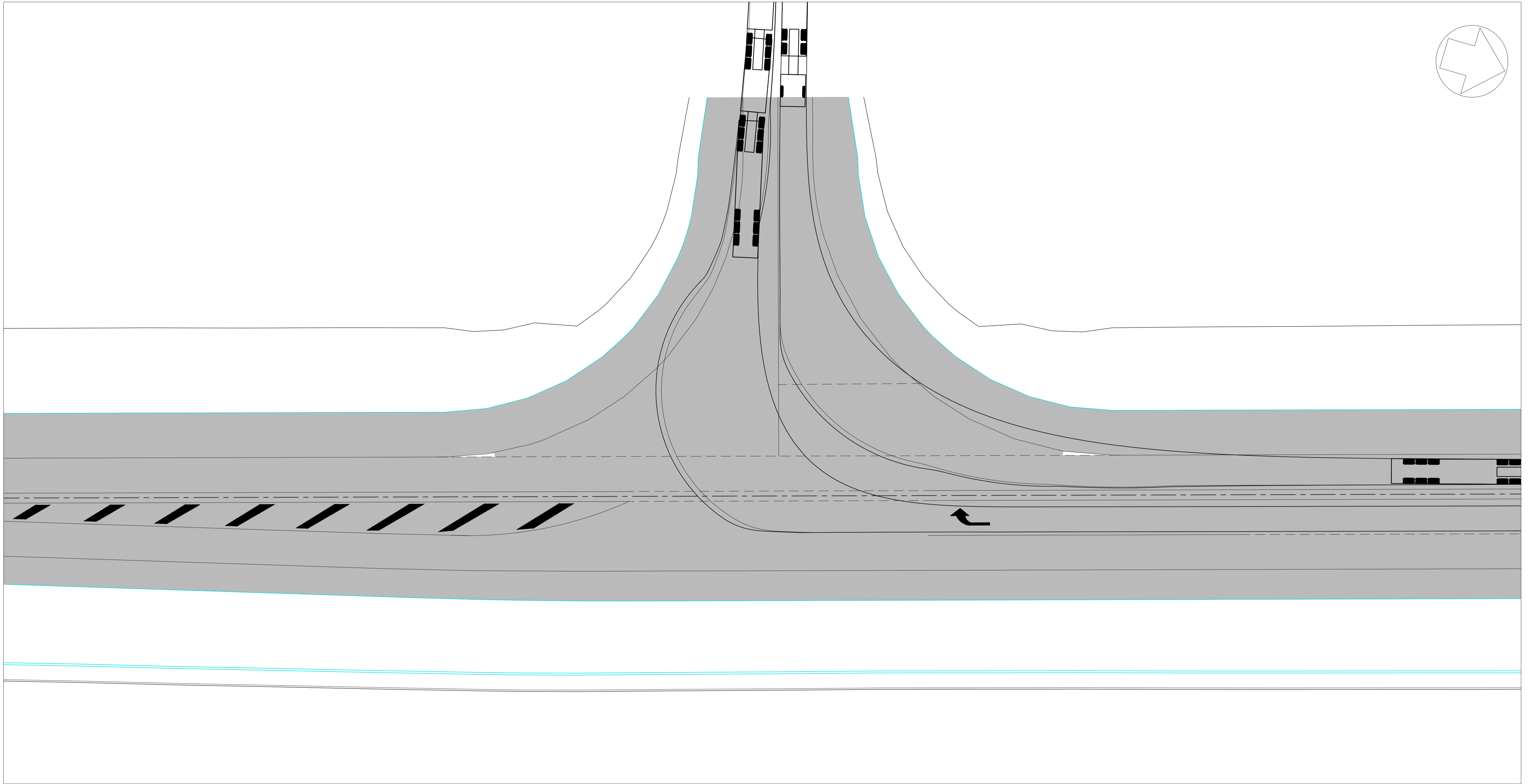
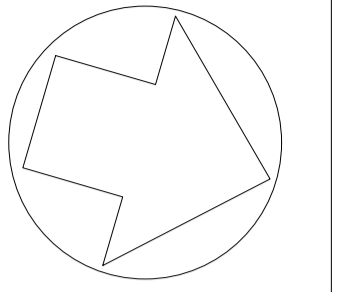
TOMINGLEY
GOLD OPERATIONS PTY LTD
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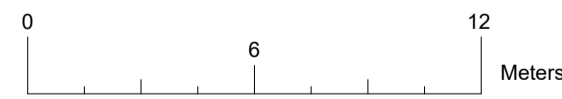
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TBC	A1
DRAWING NUMBER	REV
TP-101	A



PLAN
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CHECKED
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APPROVED
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PROJECT
NARROMINE SHIRE COUNCIL, HW17 - NEWELL HIGHWAY DEVIATION 56.3km TO 64.1km NORTH OF PARKES
DRAWING TITLE
BACK TOMINGLEY WEST ROAD - RIGHT IN, LEFT OUT

CLIENT



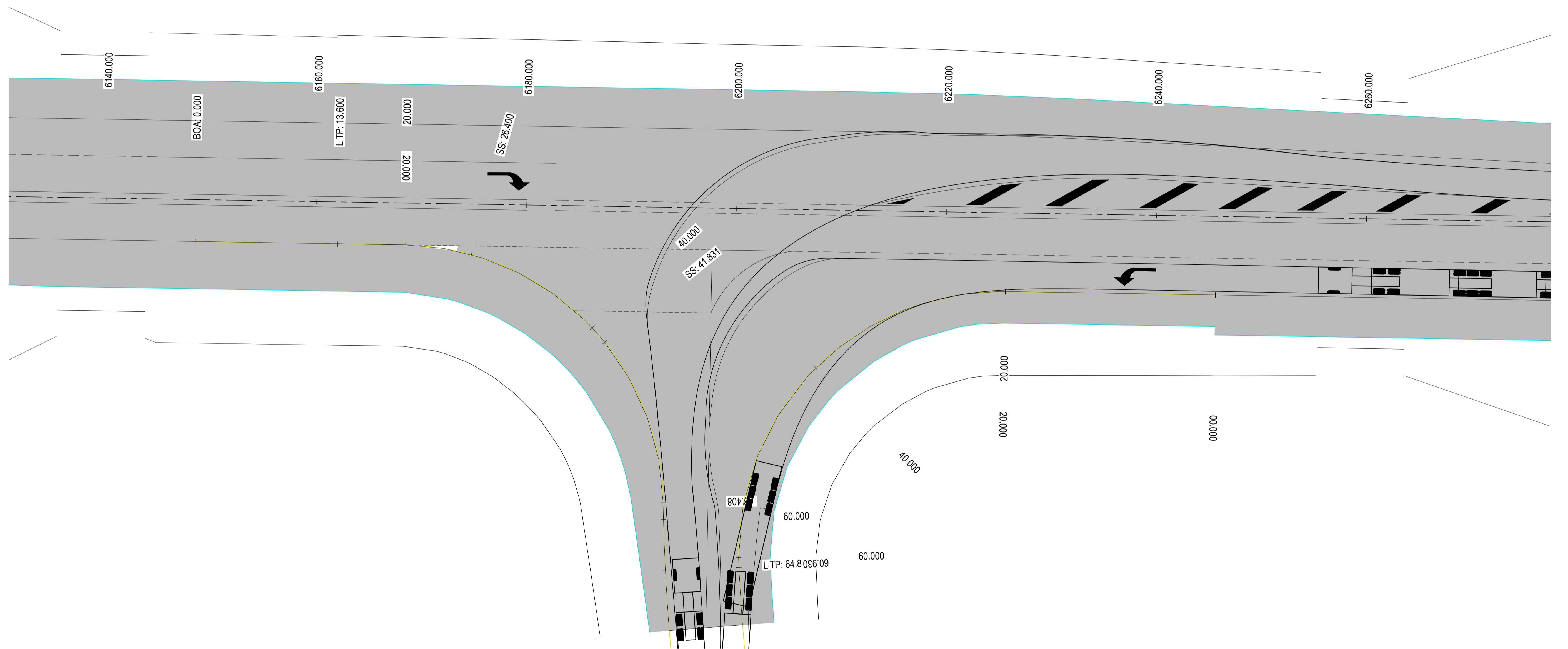
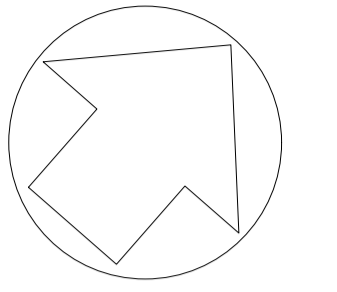
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DRAWING NUMBER	REV
TP-102	A



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REV	DATE	REVISION DETAILS
A	12-05-21	100% CONCEPT DESIGN FOR INTERNAL REVIEW

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PROJECT
NARROMINE SHIRE COUNCIL, HW17 - NEWELL HIGHWAY DEVIATION 56.3km TO 64.1km NORTH OF PARKES
DRAWING TITLE
KYALITE ROAD - LEFT IN, RIGHT OUT

CLIENT



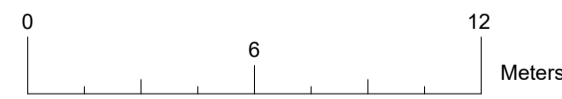
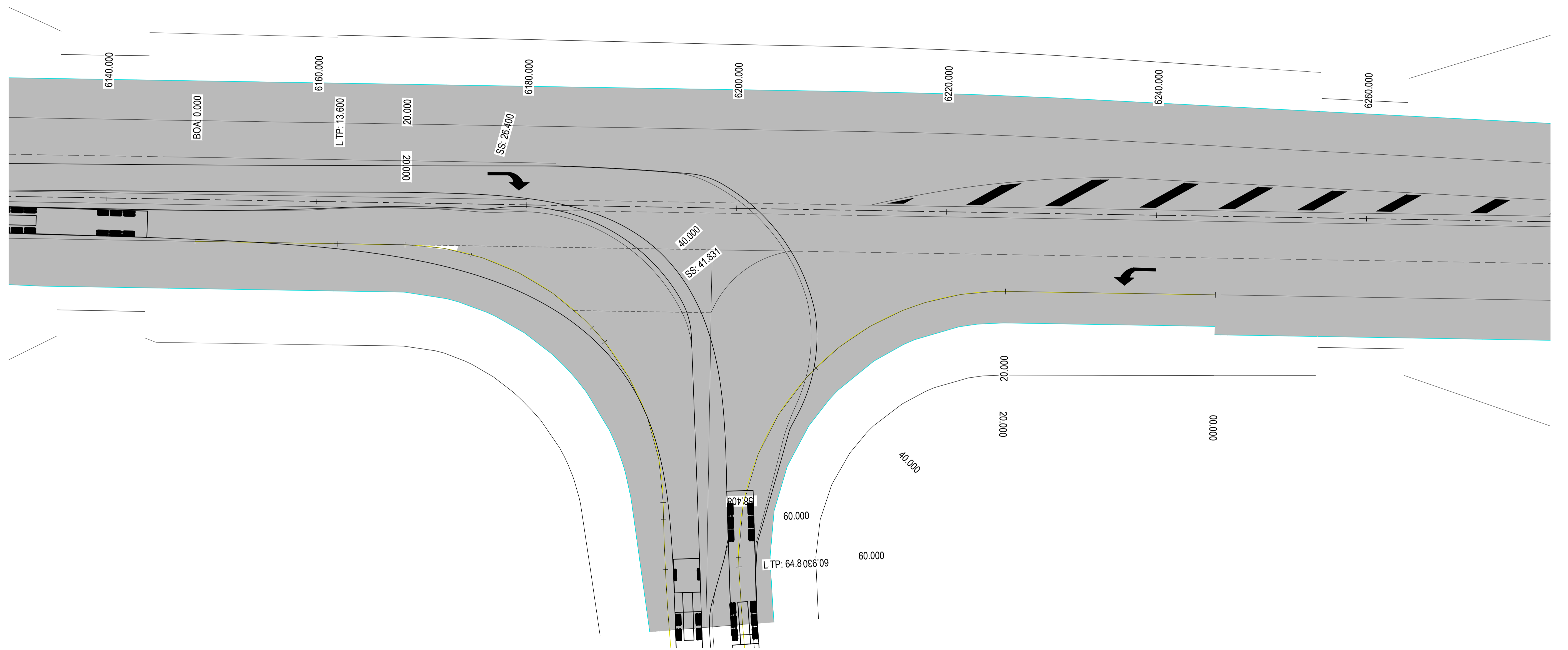
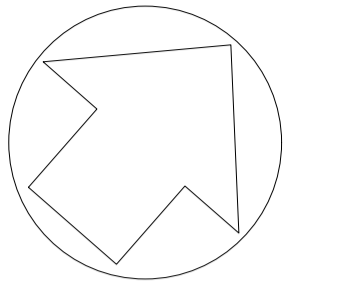
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TNWS REGISTRATION No.	SIZE
TBC	A1
DRAWING NUMBER	REV
TP-103	A



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PROJECT
NARROMINE SHIRE COUNCIL, HW17 - NEWELL HIGHWAY DEVIATION 56.3km TO 64.1km NORTH OF PARKES
DRAWING TITLE
KYALITE ROAD - RIGHT IN, LEFT OUT

CLIENT



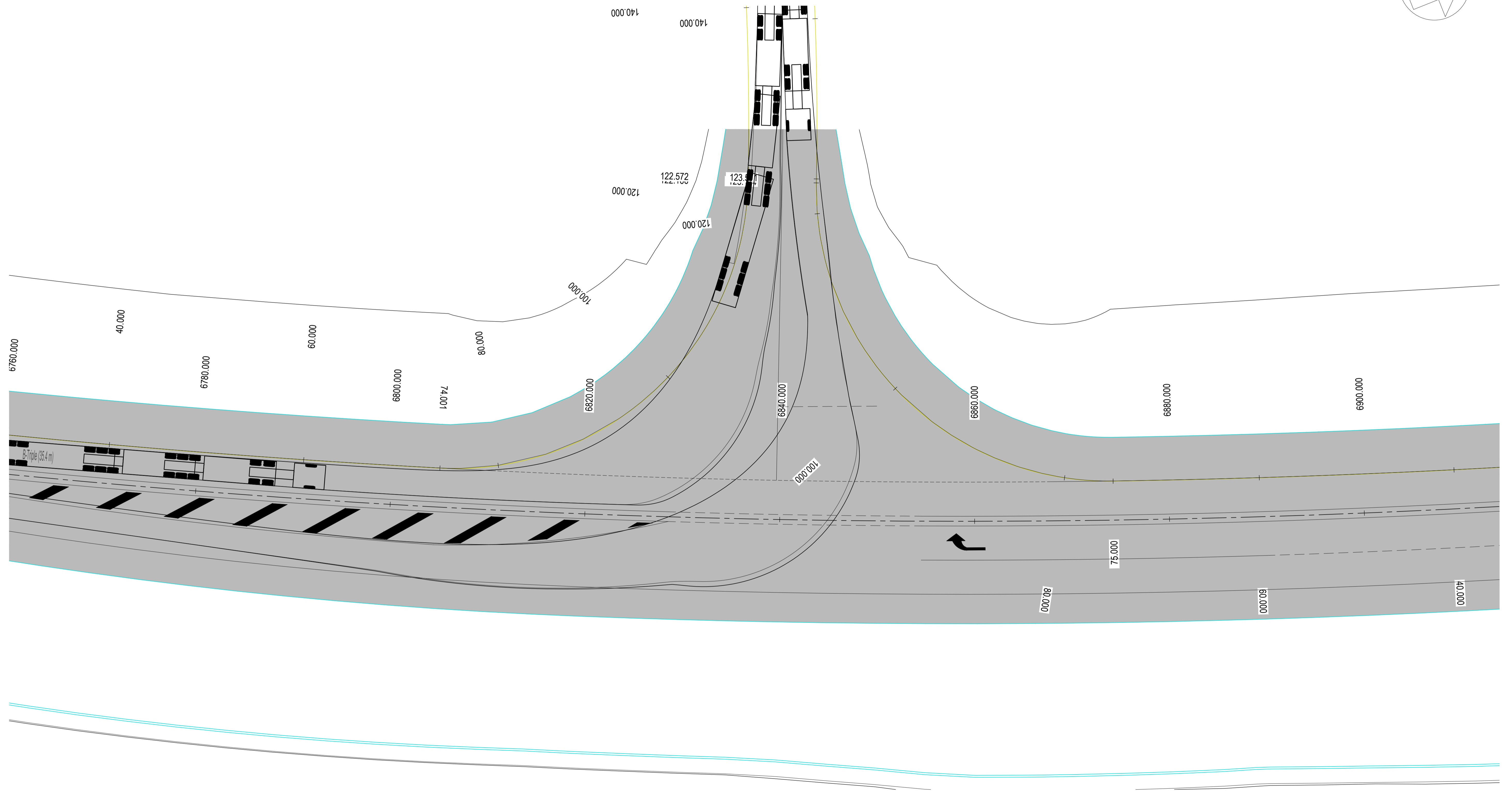
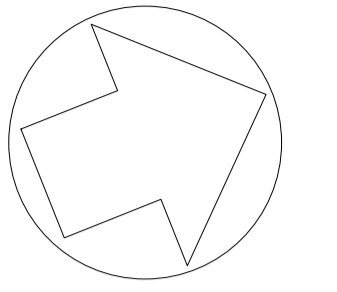
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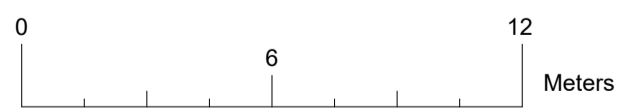
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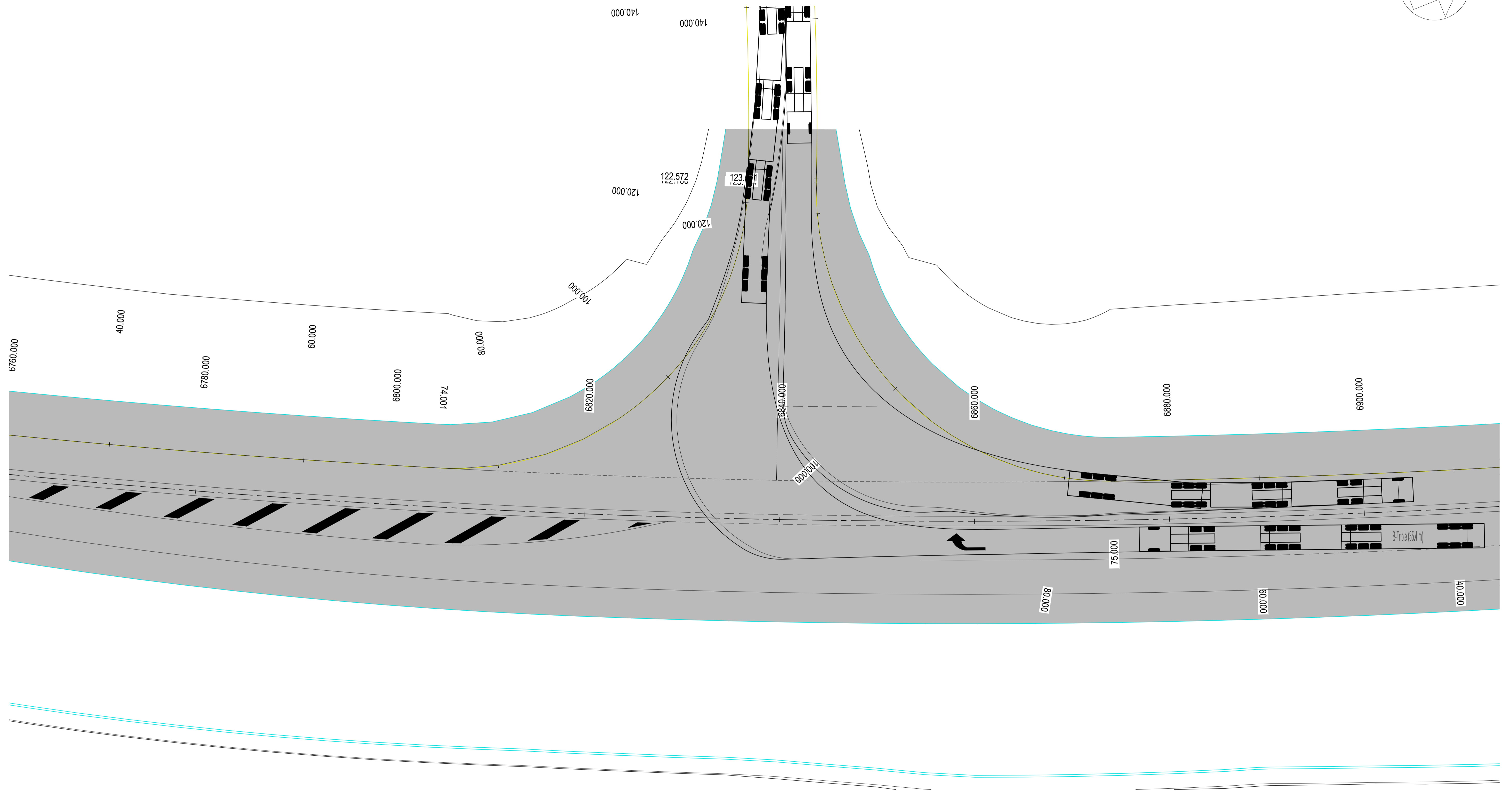
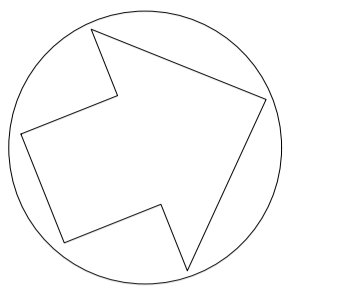
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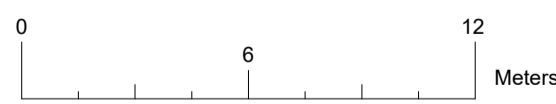
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NARROMINE SHIRE COUNCIL, HW17 - NEWELL HIGHWAY DEVIATION 56.3km TO 64.1km NORTH OF PARKES	McNIVENS ROAD - RIGHT IN, LEFT OUT

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APPENDIX 4: Hydrology Report

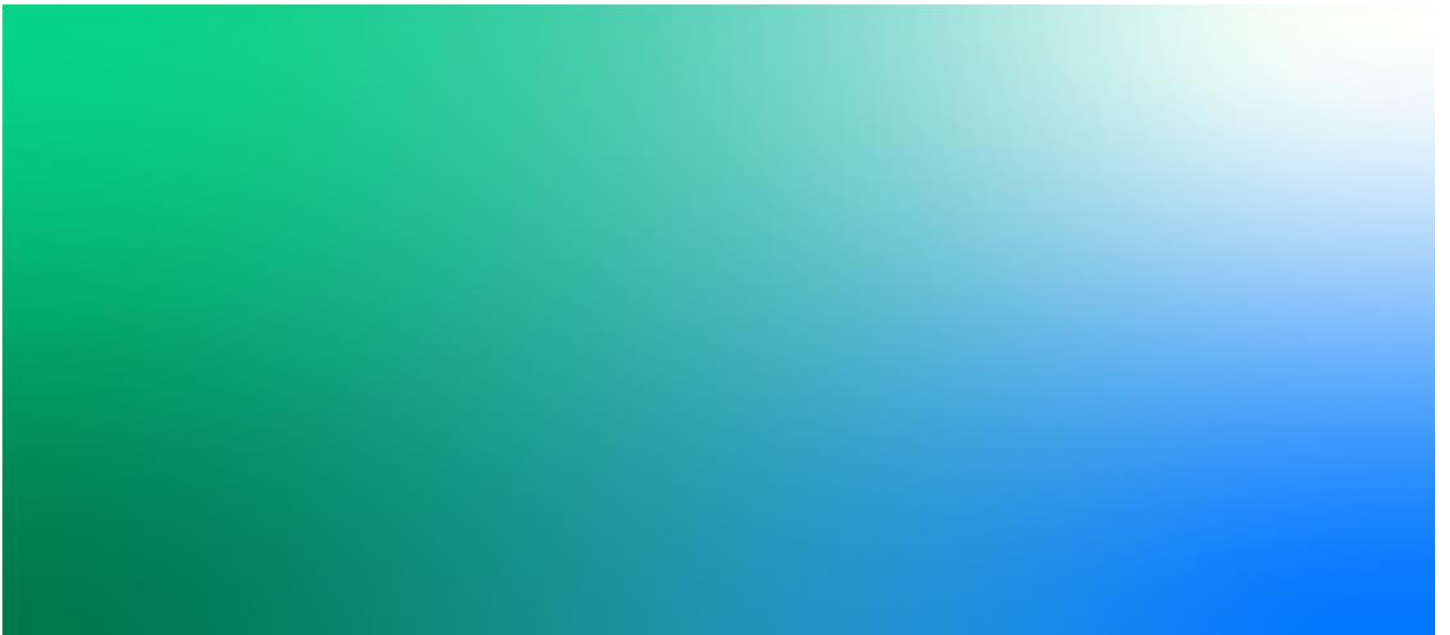


Tomingley Gold Mine Expansion Project
Hydrology and Hydraulics Technical Report

002 | 0

September 24, 2021

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Jacobs Group (Australia) Pty Limited
 ABN 37 001 024 095
 32 Cordelia Street
 PO Box 3848
 South Brisbane, QLD 4101
 Australia
 T +61 7 3026 7100
 F +61 7 3026 7300
www.jacobs.com

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Important note about your report

This report is confidential and is provided solely for the purposes of the Tomingley Gold Mine Expansion Project. This report is provided pursuant to a Consultancy Agreement between the Jacobs and RW Corkery & Co to perform a specific and limited task for RW Corkery & Co. This report is strictly limited to the matters stated in it and subject to the various assumptions, qualifications and limitations in it and does not apply by implication to other matters. Jacobs makes no representation that the scope, assumptions, qualifications and exclusions set out in this report will be suitable or sufficient for other purposes nor that the content of the report covers all matters which you may regard as material for your purposes.

This report must be read as a whole. The executive summary is not a substitute for this. Any subsequent report must be read in conjunction with this report.

The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters which might have a material effect on its contents or which come to light after the date of the report. Jacobs is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which Jacobs becomes aware, after the date of this report.

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Australian Rainfall and Runoff (ARR 2019) outlines several fundamental themes which are also particularly relevant to this Study:

- All models are coarse simplifications of very complex processes. No model can therefore be perfect, and no model can represent all of the important processes accurately.
- Model accuracy and reliability will always be limited by the accuracy of the terrain and other input data.
- Model accuracy and reliability will always be limited by the reliability / uncertainty of the inflow data.
- No model is 'correct' therefore the results require interpretation.
- A model developed for a specific purpose is probably unsuitable for another purpose without modification, adjustment, and recalibration. The responsibility must always remain with the modeller to determine whether the model is suitable for a given problem.
- Recognition that no two flood events behave in exactly the same manner.
- Design floods are a best estimate of an "average" flood for their probability of occurrence.

The interpretation of results and other presentations in this report should be done with an appreciation of any limitations in their accuracy, as noted above.

1. Introduction

Tomingley Gold Operations Pty Ltd (the Applicant), a subsidiary company of Alkane Resources Ltd, owns and operates Tomingley Gold Operations (TGO), an active gold mine, located immediately to the south of the town of Tomingley approximately 50 km southwest of Dubbo in central-western NSW.

The Applicant is proposing additional or modified TGO operations, plus extension of open cut and underground mining, at the San Antonio and Roswell Deposits (SAR) approximately 2 km south of TGO, hereafter referred to as SAR. Collectively, TGO and SAR are referred to as the Tomingley Gold Extension Project (TGEP or the Project).

The Project has been classified as a “State Significant Development” under Schedule 1 (7(a)) of the State Environmental Planning Policy (State and Regional Development) 2011. As a result, the application for development consent is made under Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Purpose of this document

Jacobs Australia Pty Ltd (Jacobs) has been commissioned by RW Corkery & Co, on behalf of the Applicant, to prepare a Surface Water Impact Assessment for the Project’s Environmental Impact Statement (EIS). The scope of Jacobs’ assessment is as follows:

- Establishment of existing surface water conditions;
- Development of hydrologic and hydraulic model of the SAR Infrastructure Area for the flood impact assessment; and
- Water quality impact assessment

The following elements are **excluded** from Jacobs’ scope of works:

- Stormwater Management Plan;
- Erosion and Sediment Control Plan; and
- SAR Infrastructure Area Water Balance Assessment

This Hydrology and Hydraulics Technical Report is supplementary to the Surface Water Assessment Report and provides technical details on the development of the hydrologic and hydraulic models and the hydraulic assessment of the TGEP. It is intended to be read in conjunction with the main Surface Water Assessment Report.

1.2 Glossary

The following terms and acronyms are used within this document.

Table 1-1 Terms and Acronyms used in this Report

Term or Acronym	Description
AEP	Annual Exceedance Probability. The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year. For example, the 1% AEP flood would have a 1% chance of occurring in any given year.
AHD	Australian Height Datum
ARF	Areal Reduction Factor
ARR 2019	Australian Rainfall and Runoff Guidelines – 2019 Edition
BoM	Bureau of Meteorology
Design Case	Hydraulic modelling case with Project in place
EIS	Environmental Impact Statement
EP&A	Environmental Planning and Assessment
Existing Case	Hydraulic modelling case pre- Project
FFA	Flood Frequency Analysis
IFD	Intensity-Frequency-Duration
LiDAR	Light Detection and Ranging
PMF	Probable Maximum Flood
SAR	San Antonio and Roswell Deposits
TGEP	Tomingley Gold Extension Project
TGO	Tomingley Gold Operations
RCBC	Reinforced Concrete Box Culvert
RCP	Reinforced Concrete Pipe (in the context of pipe materials)
RCP (Climate Change)	Representative Concentration Pathway (in the context of Climate Change scenarios)

2. Hydrologic Modelling

The hydrologic modelling was undertaken using the software XP-RAFTS 2018.1. The model was parametrised with catchment areas, fractions impervious, Manning's n values and lag times. The RAFTS model was simulated using Storm Injector, a hydrologic modelling and post processing tool.

The following events were simulated for the project:

- 20% AEP
- 10% AEP
- 5% AEP
- 5% AEP with Climate Change
- 2% AEP
- 1% AEP
- 0.1% AEP

2.1 Catchment Representation

The catchment details adopted within the XP-RAFTS model can be seen in **Appendix D**. The catchment to downstream of the Newell Highway was delineated into 30 sub-catchments as shown in **Figure 2-1**. The catchment delineation was undertaken using QGIS and based on available 5 m contour data. Manual corrections of the automated process were undertaken during the review of the sub-catchments.

The total catchment area is approximately 209.6 km².

All sub-catchments were represented as fully pervious as the current land use is exclusively agricultural and mining.

2.2 Design rainfall

Design rainfall depths and intensities were adopted based on the Bureau of Meteorology (BoM) IFD for the centroid of the full catchment. The IFD was extracted in July 2021, representing the most up-to-date rainfall information at the time of writing. It was found that spatial variation of rainfall across the sub-catchments was less than 2% across the modelled events for durations up to 12 hours. No spatial variation was therefore applied.

Table 2-1: Adopted IFD Rainfall Depth (2021)

Duration	Rainfall Depth (mm)					
	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.1% AEP
30 min	25.4	30.5	35.7	42.9	48.6	72.4
45 min	29.3	35.2	41.2	49.5	56.1	83.4
1 hour	32.1	38.6	45.2	54.2	61.3	91.1
1.5 hour	36.3	43.6	51	61	68.9	102
2 hour	39.4	47.3	55.3	65.9	74.3	111
3 hour	44.4	53	61.7	73.4	82.5	123

Duration	Rainfall Depth (mm)					
	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.1% AEP
4.5 hour	49.9	59.4	68.8	81.6	91.5	137
6 hour	54.4	64.5	74.5	88.1	98.7	148
9 hour	61.5	72.5	83.3	98.4	110	166
12 hour	67.1	78.9	90.3	107	119	180

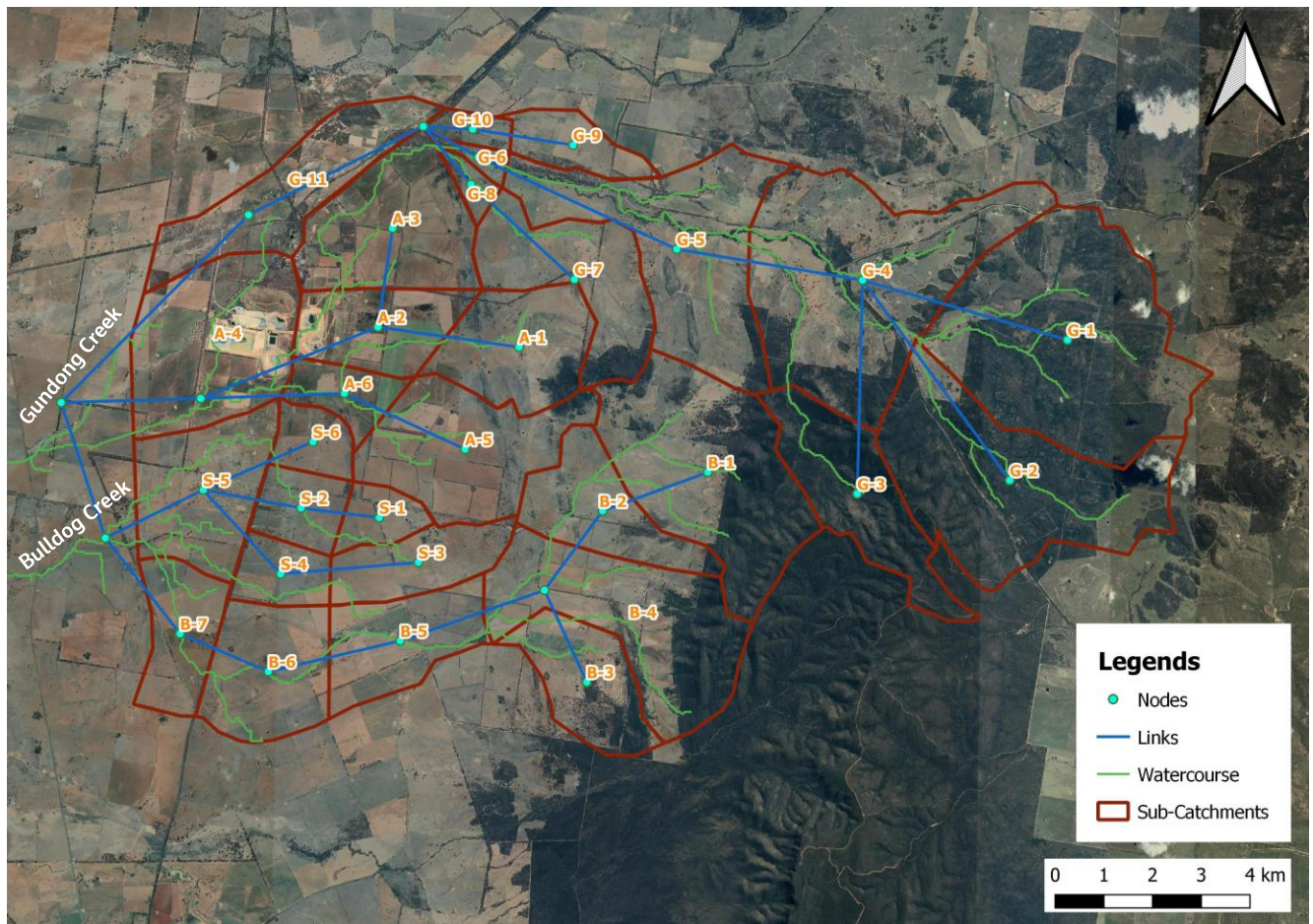


Figure 2-1: Bulldog and Gundong Creek Catchment Layout

2.3 Temporal patterns

An ensemble of 10 temporal patterns using ARR 2019 point temporal patterns were modelled in XP-RAFTS for the 20 to 0.1% AEP flood events.

The ten temporal patterns were simulated in the hydraulic model, rather than the hydrologic model, to identify the critical duration and temporal pattern. This methodology was adopted as the hydraulic model is able to provide a more accurate representation of catchment storage, ponding and routing, compared to the hydrologic model.

2.4 Areal Reduction Factor

The Areal Reduction Factor (ARF) applied to the rainfall was determined based on the size of the catchment to the combined catchment area at the model outlet. This catchment had a total area of 209.6 km² which resulted in ARFs at the SAR Infrastructure Area as shown in **Table 2-2**.

Table 2-2: Adopted Areal Reduction Factors (TGO Expansion Catchment)

Duration	Areal Reduction Factor (ARF)					
	20% AEP	10% AEP	5% AEP	2% AEP	1% AEP	0.1% AEP
30 min	0.69	0.68	0.67	0.66	0.65	0.62
45 min	0.74	0.73	0.72	0.70	0.69	0.66
1 hour	0.76	0.75	0.74	0.72	0.71	0.67
1.5 hour	0.80	0.78	0.77	0.75	0.74	0.69
2 hour	0.81	0.80	0.78	0.76	0.75	0.69
3 hour	0.84	0.82	0.80	0.78	0.76	0.70
4.5 hour	0.86	0.85	0.83	0.81	0.80	0.75
6 hour	0.88	0.88	0.87	0.85	0.84	0.81
9 hour	0.91	0.90	0.90	0.89	0.88	0.87
12 hour	0.92	0.91	0.91	0.90	0.89	0.88

2.5 Catchment losses

The initial and continuing losses were based on the FFA-Reconciled (Probability Neutral) losses specific to NSW developed by the NSW Office of Environment and Heritage. These losses supersede those recommended by ARR 2019. The adopted initial loss was the Probability Neutral loss and the adopted continuing loss was 1.9 mm.

Table 2-3: Adopted Initial and Continuing Losses

Event AEP	Initial Loss	Continuing Loss
20% AEP	15.1	1.9
10% AEP	12.4	1.9
5% AEP	11	1.9
2% AEP	8.7	1.9
1% AEP	4.7	1.9
0.1% AEP	4.7	1.9

2.6 Flow validation

Due to the absence of flow gauging data in the region, a calibration to historical flood events was not possible.

The flows from the RAFTS model were instead validated to flows from the RFFE (Regional Flood Frequency Estimation) tool. The Bulldog Creek catchment (confluence of Catchment B7 and S5) was selected for the analysis as it was found that this catchment produced the greatest variance in flow between the RAFTS model and the RFFE.

The catchment similarity and consistency with the donor catchments was compared. It was found that the Bulldog Creek catchment was on the smaller end of the catchments used to derive the RFFE flows, but still considered acceptable.

Initial estimates using the recommended ARR 19 and RAFTS parameters produced peak flows that were up to 200% higher than the median flows estimated by the RFFE (in the 20% AEP event). The difference was around 100% for the 1% AEP event.

The Mannings' n value, losses and storage factor were adjusted, within reasonable bounds, until the modelled design flows were within the confidence limits of the RFFE. This process was an iterative one and the parameters presented in the previous sections represent the adopted parameters.

The adopted flows, whilst falling within the 5% and 95% confidence limits, are still significantly higher than the RFFE flows. Any further changes to the parameters would be considered outside of reasonable bounds. At this stage of design, the higher flows would give a more conservative estimate of flood levels and is considered appropriate.

A comparison of the RFFE and adopted flows for the Bulldog Creek catchment is shown in **Figure 2-2** and **Table 2-4**

Table 2-4: Comparison of RFFE and Adopted Flows (Catchment B7/S5)

Event AEP	RFFE Median Flows (m ³ /s)	Adopted Peak Flow (m ³ /s)	Difference (%)
20% AEP	43	83	94%
10% AEP	67	109	62%
5% AEP	98	139	42%
2% AEP	150	169	13%
1% AEP	201	208	4%
0.1% AEP	-	331.5	-

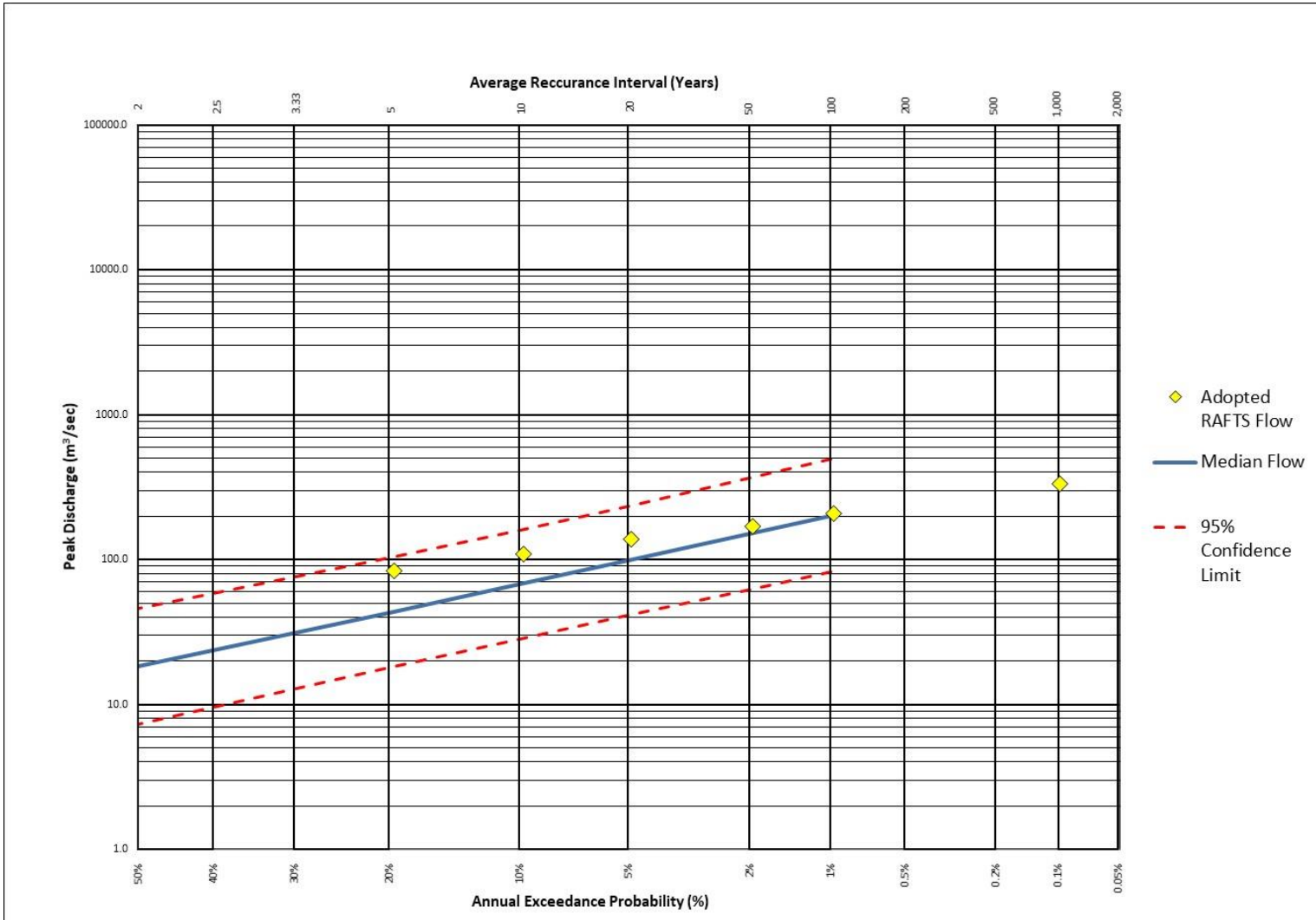


Figure 2-2: Comparison of RFFE Confidence Limits and Adopted Flows (Catchment B7/S5)

2.7 Climate Change

The 5% AEP with climate change has been included as a sensitivity run. The ARR 2019 guidelines for climate change are based on the Representative Concentration Pathways, which predict time-dependent future scenarios of greenhouse gas emissions. The RCPs describe four different 21st century pathways of greenhouse gas emissions and atmospheric concentrations, air pollutant emissions and land use. They include a stringent mitigation scenario (RCP2.6), two intermediate scenarios (RCP4.5 and RCP6) and one scenario with very high greenhouse gas emissions (RCP8.5),

For this project, RCP6 for the year 2090 was selected. This equates to a 13.1% increase in rainfall intensity.

The temperature change and rainfall intensity growth factors for RCP 6 are shown from 2030 to the year 2090 in **Table 2-5**.

Table 2-5: Interim Climate Change Factors – RCP 6

Year	RCP 6
	Temperature Increase (Rainfall Intensity % Increase)
2030	0.847 (4.2%)
2040	1.127 (5.7%)
2050	1.406 (7.1%)
2060	1.685 (8.6%)
2070	1.963 (10.1%)
2080	2.241 (11.6%)
2090	2.518 (13.1%)

3. Hydraulic Modelling

A 1D/2D hydrodynamic TUFLOW model was developed to estimate flood levels and flow velocities at the transverse drainage structures on the Newell Highway and assess the flood immunity and impacts of the proposed design. TUFLOW is a two-dimensional (2D) hydrodynamic modelling software, which is the industry standard for modelling of both urban and rural waterways or rivers. TUFLOW includes the 1D modelling engine 'Estry', which allows for embedded 1D pipes and culverts for representation of storm water networks and transverse drainage structures. For this project the TUFLOW HPC (Heavily Parallelised Compute) has been used.

HPC allows for faster run times than what would be typically expected when running TUFLOW Classic. TUFLOW version 2020-01-AB-iSP-w64 (the most up-to-date version at the time of model development) has been used. The model utilised the flows generated by the XP-RAFTS hydrologic model described in **Section 2**.

3.1 Hydraulic Model Setup – Existing Situation

3.1.1 Model Extent & Terrain

The model consists of one domain with a regular grid cell size of 5 m. This grid size was deemed appropriate as it enabled a good representation of the area while maintaining a practicable simulation time. The sub-grid sampling (SGS) function was applied, with a sample distance of 1m. This was considered a fine enough resolution to adequately represent micro-terrain features such as open drains.

The model extent covers 10.7 km length of the Newell Highway and extends approximately 3.5 km upstream and 3.7 km downstream of the road as shown in **Figure 3-1**. The total area of the 2D domain is 58 km². The 2D model terrain was based on a 1 m resolution LiDAR, which was flown in 2020.

2D Z Shapes were used to enhance the representation of topographical features, such as soil stockpile areas, diversion bunds, and the road median. Z-shapes were used to adjust the terrain level at the inlet of the exiting culverts.

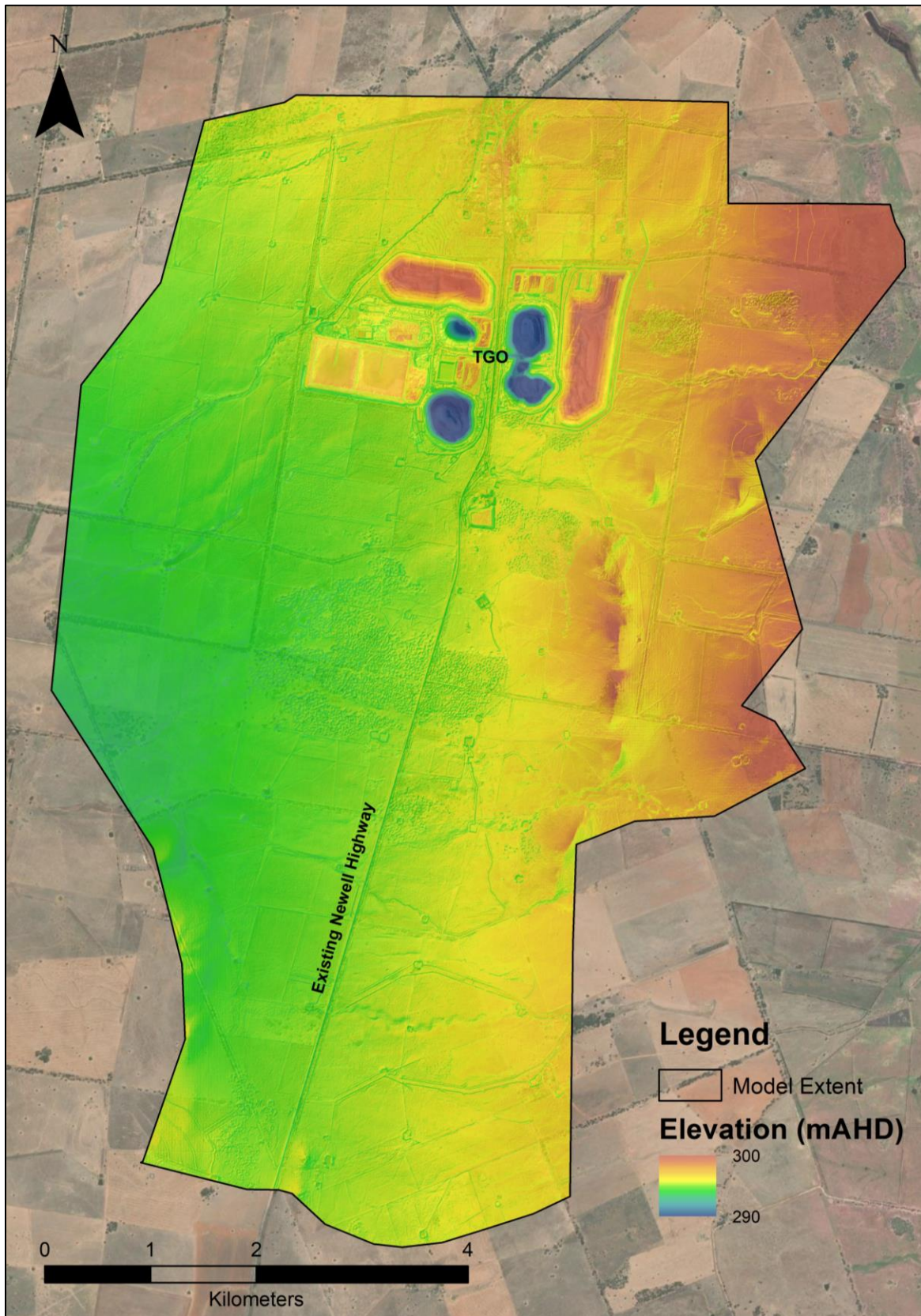


Figure 3-1: Existing Situation - Model extent and terrain

3.1.2 Boundary Conditions

The direct rainfall approach (rain-on-grid) was applied to most of the active 2D domain using a RF rainfall layer. Direct rainfall allows rainfall hyetographs to be applied directly on the active cells. Runoff is routed within the hydraulic model using the underlying DEM. The advantage of using direct rainfall on the SAR Infrastructure Area is that it allows for a high definition of flow behaviour, and more accurate representation of change in flow when comparing the existing and design scenarios.

The rainfall data applied to the hydraulic model was sourced from the ARR data Hub as described in **Section 2.2**. The losses on the direct rainfall area were applied through the materials database and were the same as those adopted in the XP-RAFTS model (refer to **Section 2.5**).

Additional inflows representing the catchments external to the rain-on-grid model area were incorporated based on the flows generated by the XP-RAFTS hydrologic model described in **Section 2**. The external catchment inflow locations can be seen in **Figure 3-2**.

The downstream boundary was modelled as a free flow boundary (HQ) with a slope of 0.004 which is consistent with the hydraulic grade at that location.

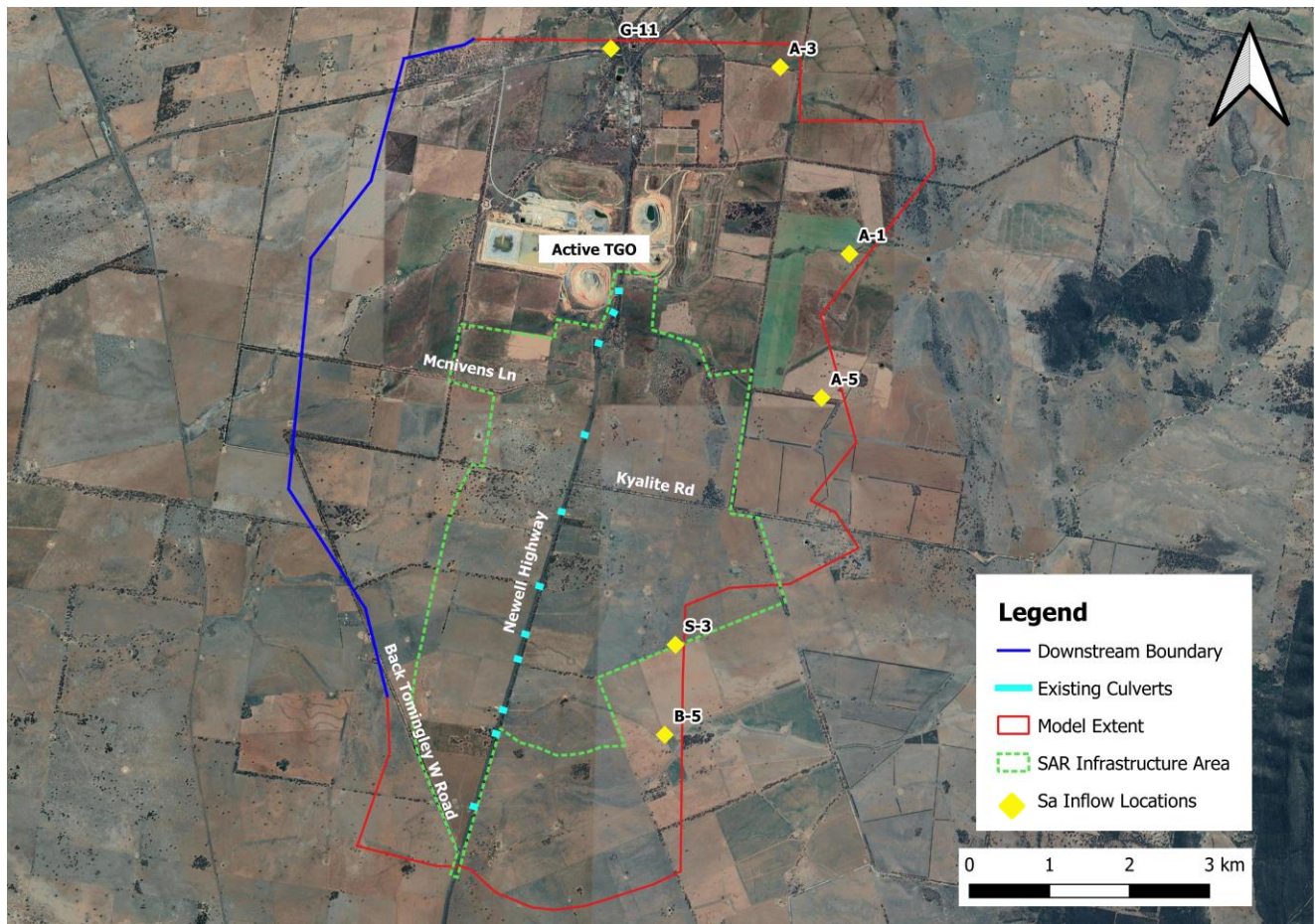


Figure 3-2: Existing case - Hydraulic model schematisation

3.1.3 Manning's n Roughness

Each grid cell is assigned a Manning's 'n' roughness value based upon land use. The GIS layer of existing land use was generated using a combination of aerial imagery, street-view photography, and engineering experience in 2D hydraulic modelling. **Table 3-1** shows the roughness "n" applied to each particular land use. These values are consistent with those recommended by ARR2019. A different material layer was used for the design scenario, which considers the changes in the design road footprint and the extension of the mine.

The manning's n definitions file also defines the rainfall losses for the rain on grid component of the model. These are also shown in **Table 3-1** and have only been applied to permeable land use areas. The losses have been adopted as described in **Section 2.5**.

Table 3-1: Material's layer parameters

Material ID	Land Use	Adopted Manning's n	Initial and Continuing Losses
1	Roads	0.018	IL=0.0, CL=0.0
4	Unmaintained Grass	0.05	As per RAFTS losses
7	Medium to dense vegetation	0.07	As per RAFTS losses
8	Mine/soil stockpile areas	0.04	As per RAFTS losses
9	Low density residential area	0.15	As per RAFTS losses

3.1.4 Hydraulic Structures

Existing transverse culverts along the Newell Highway were modelled as 1D structures within the TUFLOW model. The culvert sizes were defined based on as constructed drawings, site photos and confirmation from site personnel. Engineering judgement was applied at some locations to set the culvert invert levels in the absence of better information. It was assumed that all structures were clear of debris and without blockage. **Table 3-2** presents the transverse culvert information and **Figure 3-3** identifies their location.

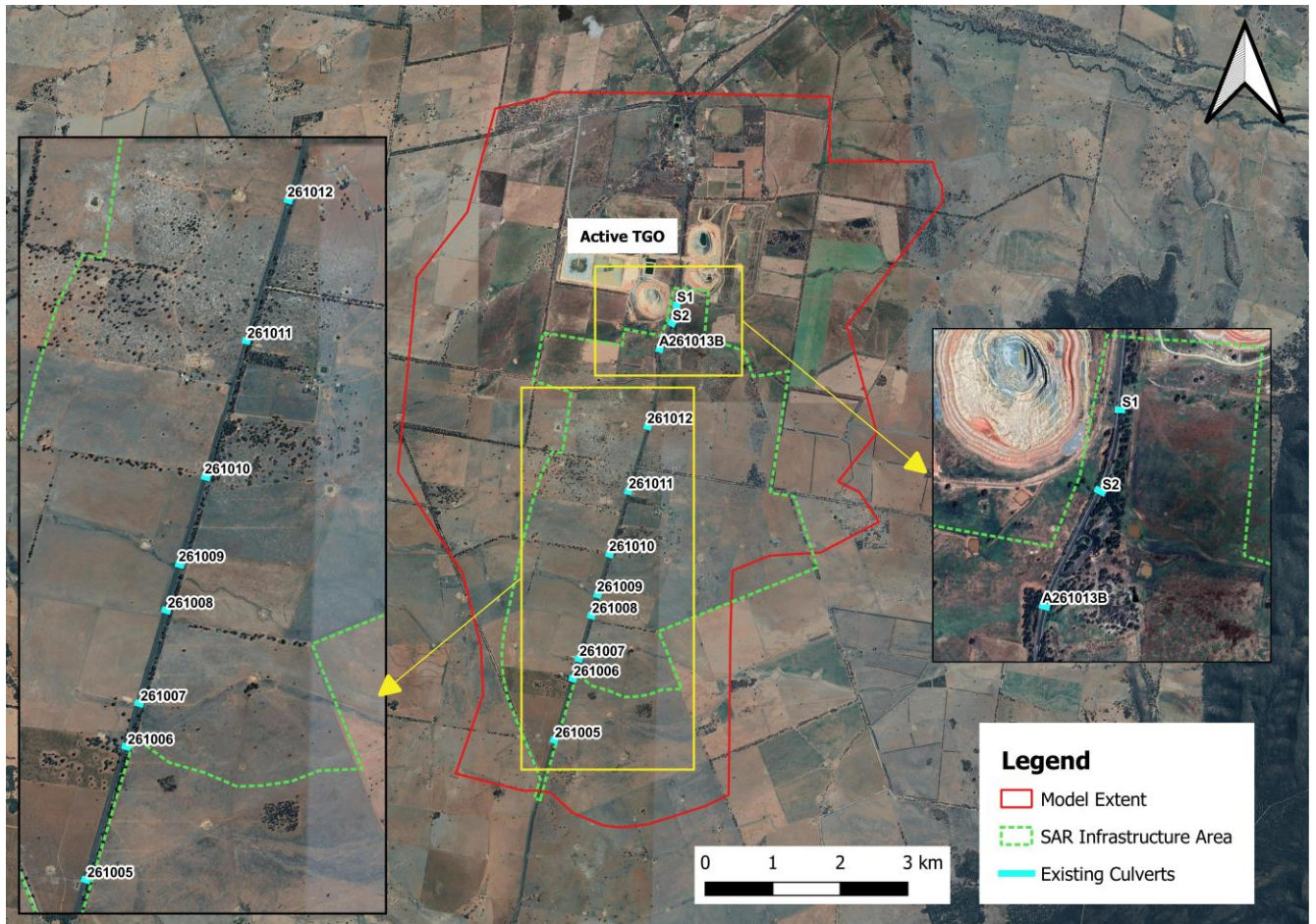


Figure 3-3: Existing Transverse Culverts

Table 3-2: Existing Transverse culverts

Culvert ID	Type	Dimensions (mm)
261005	RCBC	1800 x 600 (x6)
261006	RCBC	1800 x 600 (x3)
261007	RCBC	1800 x 450 (x3)
261008	RCBC	1800 x 450 (x2)
261009	RCBC	1800 x 450 (x5)
261010	RCBC	1800 x 450 (x3)
261011	RCBC	1800 x 600 (x1)
261012	RCBC	1800 x 450 (x2)
A261013B	RCBC	1800 x 450 (x2)
S2	RCBC	1800 x 450 (x2)
S1	RCBC	1800 x 600 (x2)

Note: RCBC = Reinforced Concrete Box Culvert

3.1.5 Critical Durations and Temporal Patterns

A range of durations from 30 minutes to 720 minutes was simulated to establish the critical duration for the seven events assessed (20% AEP, 10% AEP, 5% AEP, 2% AEP, 1% AEP, 0.1% AEP, and 5% AEP event with Climate Change). All ten (10) ARR 2019 temporal patterns were simulated and the temporal pattern that generated the storm above the median (Rank 6) flood level was identified as the critical storm.

In some AEP events, multiple durations and/or temporal patterns were critical in different locations of the model and it was difficult to select a single representative temporal pattern. In these cases, the temporal pattern which was critical upstream of the Newell Highway was selected as the highway was a primary location of interest. It was found that the difference in flood level between the different critical durations was less than 50 mm which was not considered significant.

The adopted temporal pattern and storm duration for each event is summarised **Table 3-3**.

Table 3-3: Adopted Durations Temporal Patterns

ARR 2019	Event	Critical Storm Duration	Adopted Temporal Pattern
Temporal Group		(min)	
Frequent	20% AEP	540	TP-03
Intermediate	10% AEP	360	TP-08
	5% AEP	360	TP-08
	5% AEP + CC	360	TP-08
Rare	2% AEP	360	TP-01
	1% AEP	360	TP-01
	0.1% AEP	360	TP-01

3.2 Hydraulic Model Results – Existing Situation

The critical storms identified in **Table 3-3** were used for analysis of the existing situation. **Appendix A** shows the flood levels, flood depths and velocities under the existing situation for the events assessed.

3.2.1 Existing Flood Behaviour

Runoff from the upstream catchments flows generally from east to west through three main flow paths. The northern flow path corresponds to Gundong Creek which flows towards the south-west passing by Tomingley township and the current active mine site. The central flow path (Drainage Line D) crosses the Newell Highway in the vicinity of South Tomingley Rest Area between culverts A261013B and S2, south of the active mine site. The most southern flow path corresponds to minor tributaries that eventually join with Bulldog creek downstream of the Newell Highway as shown in **Figure 3-4**.

The model suggests that a peak flow of 63 m³/s and 120 m³/s would arrive at the Newell Highway through the Drainage Line D and southern flow path (Bulldog Creek) respectively in the 5% AEP event. The 120 m³/s is comparable to the 98 m³/s predicted by the RFFE. It is less than the 139 m³/s predicted by RAFTS model which can be explained by attenuation in the hydraulic model.

Flood depths of up to 1.4 m immediately upstream of Newell Highway (in the vicinity of South Tomingley Rest Area) and up to 1.2 m upstream of culvert 261005 at the Bulldog Creek crossing can be observed. Flow

downstream of the highway is conveyed via the existing culverts under the Newell Highway, as well as via overtopping of the highway in the larger events (see Section 3.2.3).

In the 5% AEP event, modelled peak flood levels in the study area range from approximately 269 m AHD at the northern section of Newell Highway to approximately 265 m AHD at the southern section, near the intersection with Back Tomingley West Road.

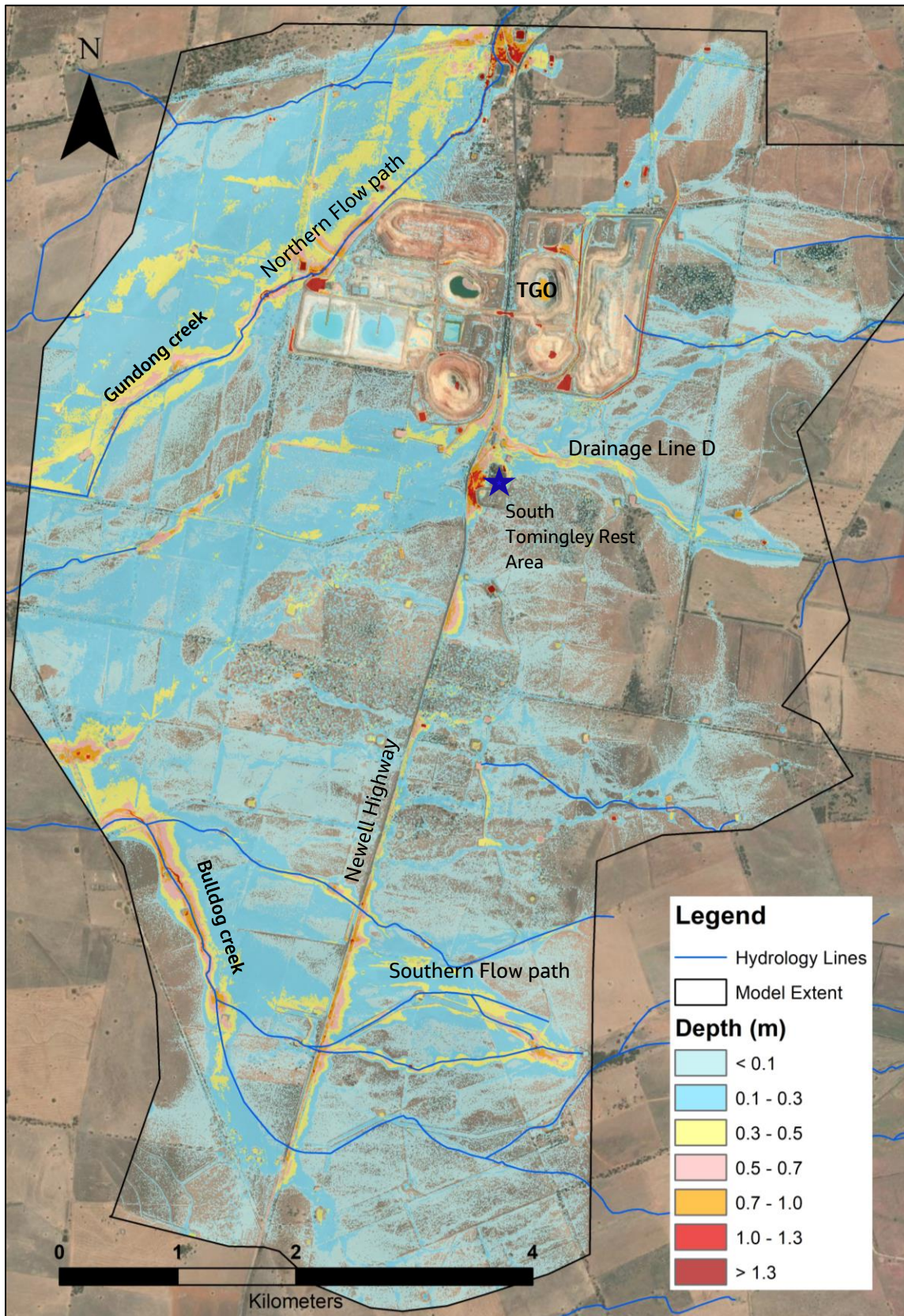


Figure 3-4: Indicative existing flow paths

3.2.2 Existing Transverse Culvert Crossings

Table 3-4 presents peak flows, peak velocities and peak flood levels upstream of the existing transverse culverts for the 5% AEP event.

Table 3-4: Existing Case transverse culverts - 5% AEP event

Culvert ID	Peak Flow	Peak Velocity	Peak Upstream Flood level	Remarks
	(m ³ /s)	(m/s)	(mAHD)	
261005	11.48	1.8	264.69	Overtopping
261006	9.10	4.7	265.28	Overtopping
261007	5.46	3.7	265.26	Overtopping
261008	3.39	2.1	265.43	Overtopping
261009	9.81	4.0	265.31	Overtopping
261010	3.92	1.6	265.58	No overtopping
261011	1.76	1.9	266.72	No overtopping
261012	2.94	3.0	267.03	Overtopping
A261013B	3.74	3.9	268.53	Overtopping
S2	3.68	3.9	268.71	Overtopping
S1	4.29	2.0	268.64	Overtopping

3.2.3 Newell Highway Immunity

The existing Newell Highway flood immunity varies across the study area. Overall, most sections of the existing highway have a flood immunity below the 20% AEP event (i.e. overtopped in the 20% AEP). Events smaller than the 20% AEP have not been modelled. The section of the road in the vicinity of culvert 261007 has the lowest flood immunity since it represents a road sag on the highway. **Table 3-5** presents the minimum road immunity at each existing culvert crossing, the respective freeboard in the identified immunity event, the overtopping event, and the respective overtopping depth. shows the locations of the existing culverts.

Table 3-5: Newell Highway immunity and overtopping event at the existing culvert locations

Culvert ID	Minimum Immunity	Freeboard (mm)	Overtopping Event	Overtopping Depth (mm)
261005	10% AEP	100	5% AEP	35
261006	< 20% AEP	-	20% AEP	95
261007	< 20% AEP	-	20% AEP	295
261008	20% AEP	10	10% AEP	100
261009	< 20% AEP	-	20% AEP	80
261010	1% AEP	150	0.1% AEP	10
261011	0.1% AEP	90	> 0.1% AEP	-
261012	20% AEP	10	10% AEP	100
A261013B	< 20% AEP	-	20% AEP	200
S2	< 20% AEP	-	20% AEP	200
S1	< 20% AEP	-	20% AEP	140

3.3 Hydraulic Model Setup - Design Case

This section of the report outlines the changes made to the existing case model to represent the design scenario with the proposed TGO expansion. The TGO expansion design has aimed to meet the following design criteria in relation to flooding:

- Achieve 5% AEP flood immunity for the realigned Newell Highway;
- Keep outlet velocities at the new Newell Highway culverts below 3 m/s;
- Minimise the loss of overland flow volume to properties downstream of the new Newell Highway.

An iterative design approach in collaboration with the road design team has been undertaken to achieve the design criteria set out above.

The following design elements were considered relevant to the flood assessment and were represented in the hydraulic model:

- Realigned Newell Highway and Kyalite Road and associated intersections with Back Tomingley West Road and McNivens Lane and Kyalite Road overpass
- The SAR Open Cut
- The Soil Stockpiles and the SAR waste rock emplacement
- Haul Road and Services Road between the SAR Open Cut and the Caloma 2 Open Cut
- Flood diversion bund (Inundation Bund)
- The Administration Area

Unless otherwise stated, no other changes have been made to the existing case model.

3.3.1 Terrain Modifications

The terrain was modified to represent the proposed development. The Newell Highway and Kyalite Road were represented using the Digital Elevation Model (DEM) provided by the road design team from Constructive Solutions on the 3rd September 2021.

The SAR Open Cut, soil stockpiles, flood diversion bunds, administration area and haul road were represented by raising or lowering the terrain following the outline of the 'Limit of Disturbance' provided by R W Corkery.

The Haul Road has been assumed to have the same height above ground as the proposed Newell Highway.

Sections of the existing Newell Highway were removed where it was considered that removal is necessary. Where possible, the existing Newell Highway and transverse culverts were retained.

Figure 3-5 shows the modified terrain adopted for the Design case and **Figure 3-6** shows the model schematisation.

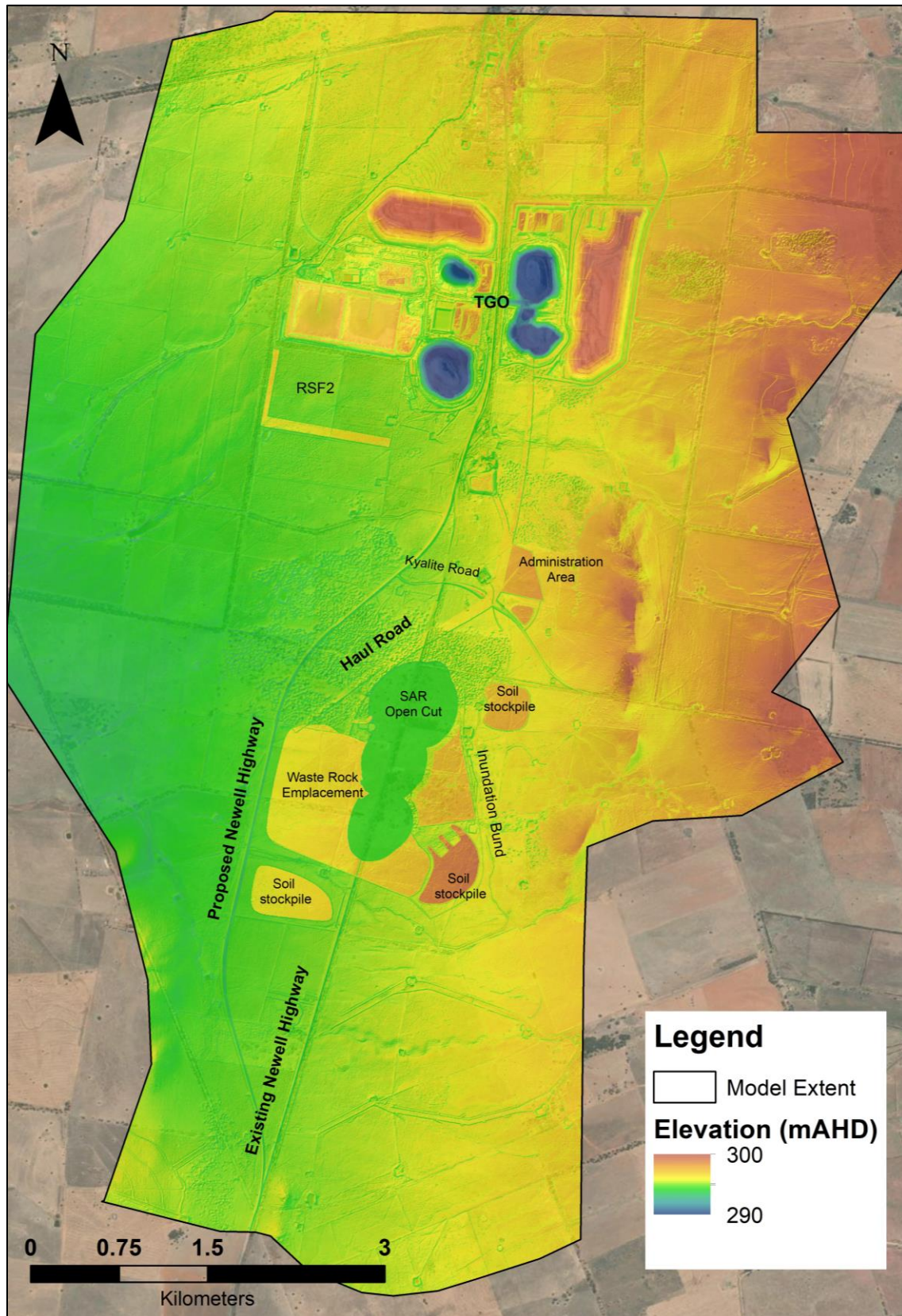


Figure 3-5: Design Case - Model extent and terrain

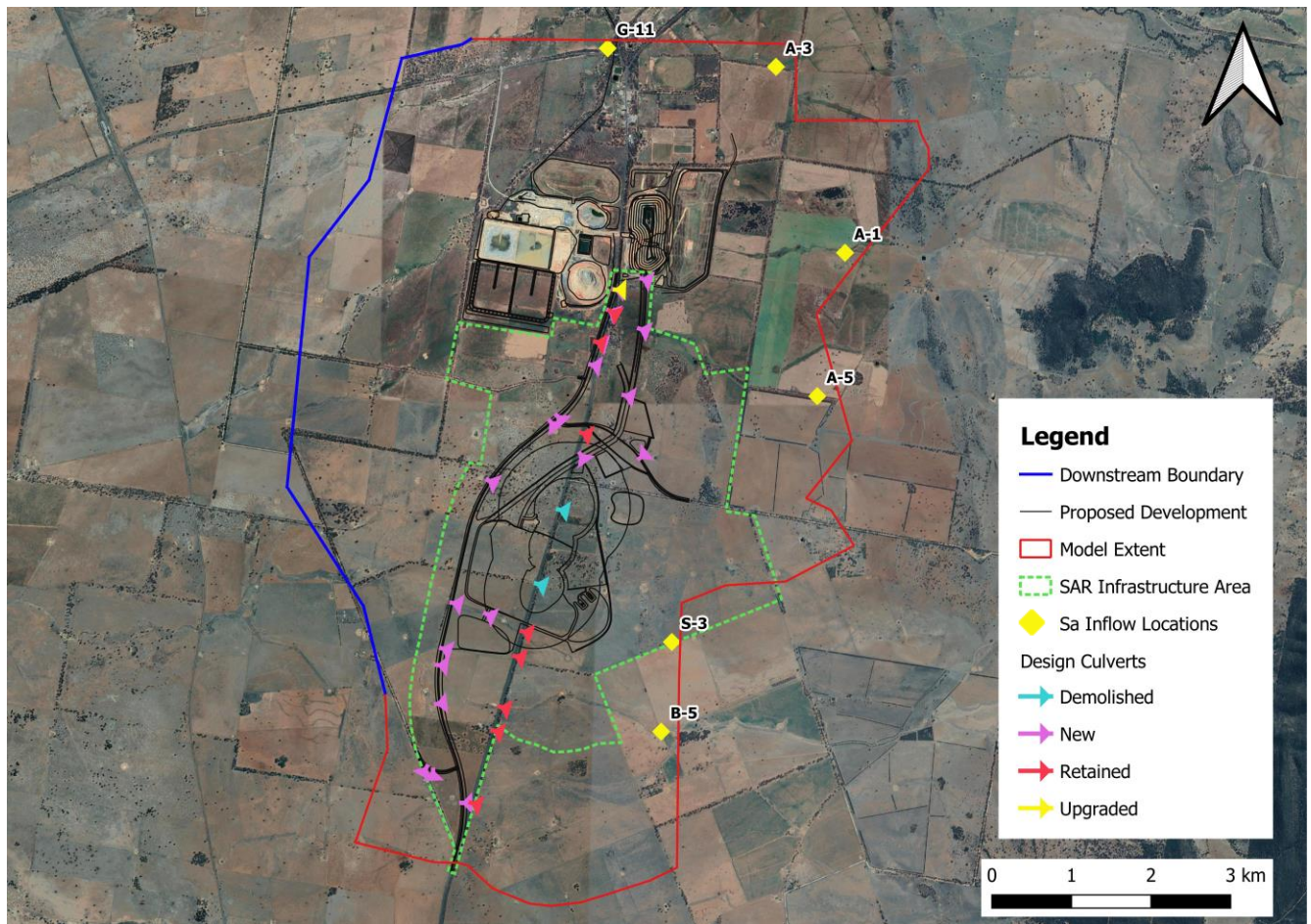


Figure 3-6: Design Case - Hydraulic model schematisation

3.3.2 Manning's n Roughness

The materials layer was adjusted to represent the new mine area, as well as the re-alignment of the Newell Highway, Kyalite road and the incorporation of the Haul Road. The Administration Area was represented with the same Manning's n values as roads to account for a hard and impermeable surface. The SAR Open Cut, soil stockpiles and SAR Waste Rock Emplacement were represented as Mine/soil stockpile areas. No further changes to the materials layer were made compared to the existing case model. The adopted Mannings' n values can be seen in **Table 3-6**.

Table 3-6: Material's layer parameters

Material ID	Land Use	Adopted Manning's n	Initial and Continuing Losses
1	Roads/ Administrative area	0.018	IL=0.0, CL=0.0
4	Unmaintained grass	0.05	As per RAFTS losses
7	Medium to dense vegetation	0.07	As per RAFTS losses
8	Mine/soil stockpile areas	0.04	As per RAFTS losses
9	Low density residential area	0.15	As per RAFTS losses

3.3.3 Hydraulic Structures

A series of modifications to the transverse drainage is required to facilitate the mine expansion. These have been simulated in the model as:

- 12 culverts to be constructed under the proposed alignment of Newell Highway;
- Four (4) culverts to be constructed under the Haul Road;
- One (1) culvert to be constructed under Kyalite Road;
- One (1) existing culvert under the existing Newell Highway to be upgraded; and,
- Two (2) existing culverts under the existing Newell Highway to be removed.

New culverts were designed to be aligned with existing flow paths or at low points in the terrain. Culverts have been sized to achieve a 5% AEP event flood immunity and less than 3 m/s in outlet velocity.

Table 3-7 presents the proposed dimensions of the design culverts. shows the design culvert locations. Blockage assessment has been performed in accordance with ARR 2019 requirements for the culverts along the proposed corridor of the realigned Newell Highway (refer to **Section 3.4.6**).

Table 3-7: Design Transverse Culverts

Road	Culvert ID	Type	Dimension (mm)	Note
Proposed Newell Highway	20	RCBC	1200 x 450	New
Proposed Newell Highway	1	RCBC	1800 x 900 (10)	New
Proposed Newell Highway	2	RCBC	1800 x 900 (3)	New
Proposed Newell Highway	3	RCBC	1800 x 1200 (10)	New
Proposed Newell Highway	4	RCBC	1800 x 900 (14)	New
Proposed Newell Highway	5	RCP	750	New
Proposed Newell Highway	16	RCBC	1800 x 900 (4)	New
Proposed Newell Highway	7	RCBC	1800 x 1200 (5)	New
Proposed Newell Highway	8	RCBC	1800 x 900 (4)	New
Proposed Newell Highway	18	RCBC	1800 x 450 (2)	New
Proposed Newell Highway	9	RCBC	1800 x 1200 (4)	New
Proposed Newell Highway	19	RCBC	1800 x 600 (5)	New
Existing Newell Highway	S1	RCBC	1800 x 600 (5)	Upgraded
Existing Newell Highway	261010	RCBC	1800 x 450 (x3)	Demolished
Existing Newell Highway	261011	RCBC	1800 x 600 (x1)	Demolished
Haul Road	14	RCBC	1800 x 900 (4)	New
Haul Road	13	RCP	375	New
Haul Road	12	RCBC	1800 x 1200 (8)	New
Haul Road	11	RCBC	1800 x 900 (3)	New
Kyalite Road	15	RCBC	1800 x 900 (2)	New
Back Tomingley West Road	6	RCP	450 (2)	New
Back Tomingley West Road	6B	RCP	450 (3)	New

Note: RCBC = Reinforced Concrete Box Culvert; RCP = Reinforced Concrete Pipe

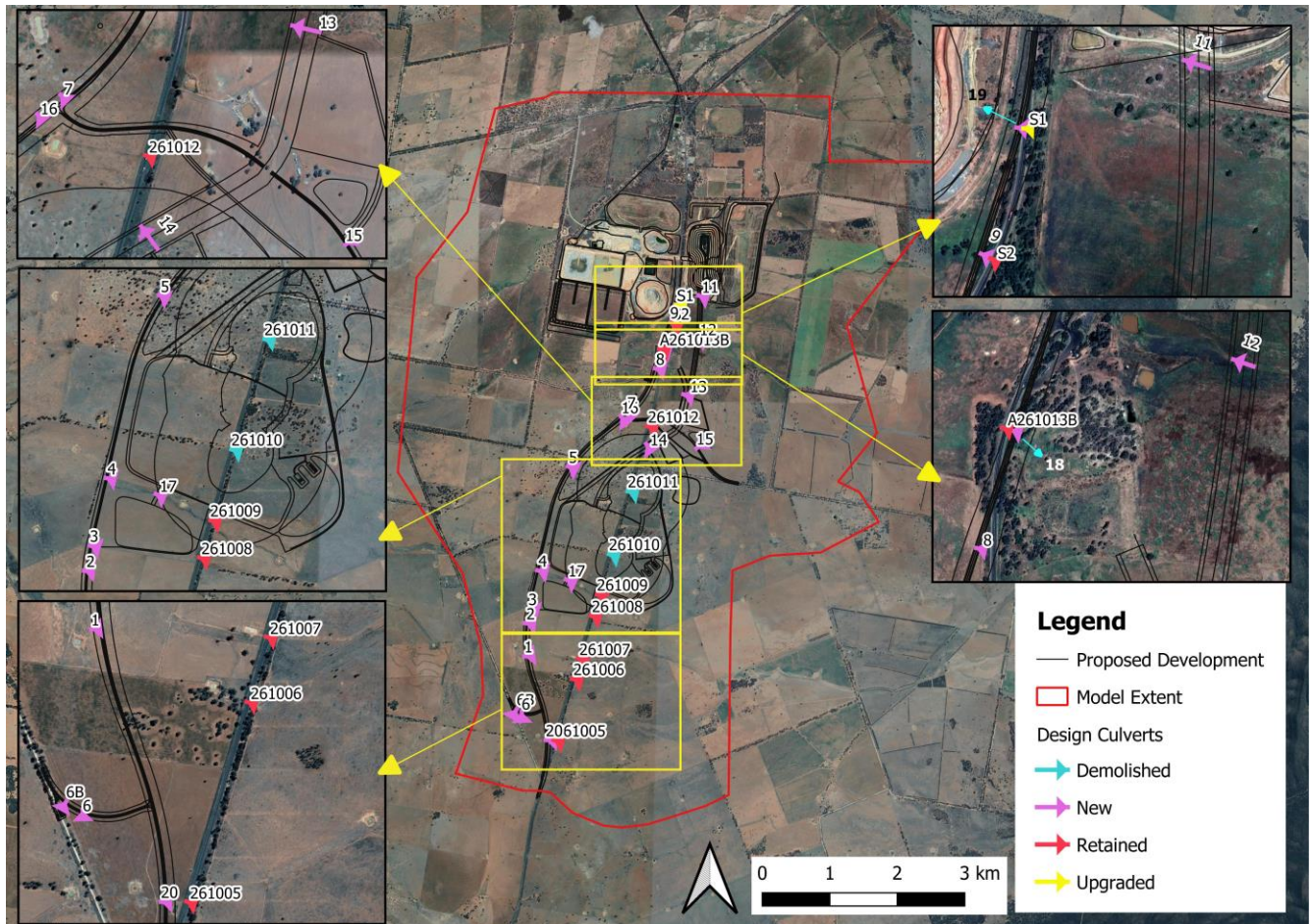


Figure 3-7: Design Transverse Culverts

3.4 Hydraulic Model Results – Design Case

The critical storms identified for the existing situation (refer to **Table 3-3**), have been adopted to produce the final results of the design case. Due to attenuation of flow upstream of the proposed new Newell Highway, these critical storms may have changed in the design case. This risk is considered low as there were minor flood level differences observed amongst the different storms. Nonetheless, the critical storms for the design case should be confirmed during detailed design. **Appendix B** shows the flood levels, flood depths and velocities under the Design Situation for the events assessed.

3.4.1 Flood Behaviour – Design Case

Modelling results suggest that the same three main flow paths discussed in **Section 3.2.1** are maintained in the design case. The northern flow path remains unchanged as the proposed TGO expansion proposes no further disturbances at this location.

The Haul Road acts as an obstruction to flow and ponding of up to 2 m is observed upstream of culvert 12 in the 5% AEP event, at the peak of the flood. The Haul Road is acting as a control structure for flow arriving at the Newell Highway.

Ponding at the peak of the flood was observed to occur at the Newell Highway between culverts 8 and 19. A maximum depth of 1.5 m was identified in this section in the 5% AEP event.

At Bulldog Creek, the existing Newell Highway has been retained and acts as the first obstruction to flow with ponding of up to 1 m at the peak of the flood identified in the 5% AEP event. As flow progresses to the west through the existing culverts and by overtopping the existing road, flow is obstructed by the realigned and lifted Newell Highway. Ponding of up to 1.5 m at the peak of the event was identified in the 5% AEP event at the new Newell Highway. **Figure 3-8** shows the identified flow paths and the main ponding areas in the 5% AEP event.

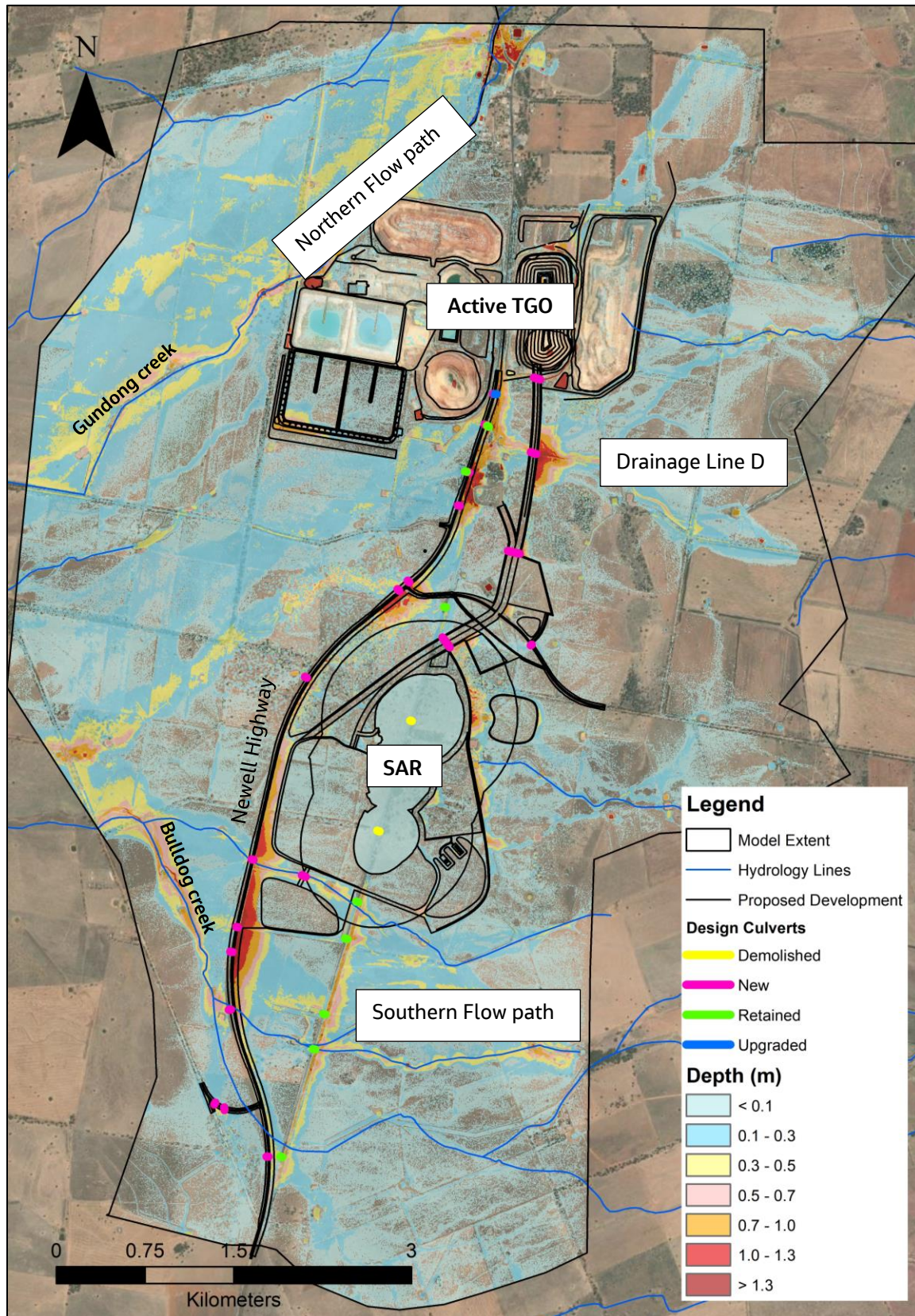


Figure 3-8: Indicative Design flow paths and main ponding areas in the 5% AEP event

3.4.2 Design Transverse Culvert Crossings

Table 3-8 presents peak flows, peak velocities and peak flood levels upstream of the design (new and upgraded) transverse culverts for the 5% AEP event.

Table 3-8: Design Case transverse culverts - 5% AEP event

Road	Culvert ID	Peak Flow	Peak Velocity	Peak Upstream Flood level	Remarks
		(m ³ /s)	(m/s)	(mAHD)	
Proposed Newell Highway	20	0.67	1.6	264.35	No overtopping
Proposed Newell Highway	1	23.47	2.4	261.56	No overtopping
Proposed Newell Highway	2	11.92	2.4	261.56	No overtopping
Proposed Newell Highway	3	42.20	2.8	261.51	No overtopping
Proposed Newell Highway	4	36.98	2.2	261.48	No overtopping
Proposed Newell Highway	5	0.72	2.0	262.57	No overtopping
Proposed Newell Highway	16	13.28	2.1	265.47	No overtopping
Proposed Newell Highway	7	8.46	1.0	265.40	No overtopping
Proposed Newell Highway	8	11.77	2.6	268.65	No overtopping
Proposed Newell Highway	18	2.47	1.5	268.77	No overtopping
Proposed Newell Highway	9	4.34	1.9	268.17	No overtopping
Proposed Newell Highway	19	11.58	2.2	268.72	No overtopping
Existing Newell Highway	S1	11.59	2.2	269.00	No overtopping
Haul Road	14	11.32	2.6	268.40	No overtopping
Haul Road	13	0.18	1.7	271.82	No overtopping
Haul Road	12	47.88	2.8	271.09	No overtopping
Haul Road	11	12.03	2.5	271.54	No overtopping
Kyalite Road	15	3.25	2.1	272.59	No overtopping
Back Tomingley West Road	6	0.47	1.5	262.64	No overtopping
Back Tomingley West Road	6B	0.78	1.6	262.62	Overtopped by 100 mm

As shown in **Table 3-8**, velocities for all of the culverts have been kept below 3 m/s to minimise scour protection requirements. The model results indicate that velocities would be below 3 m/s in all the events assessed up to the 5% AEP event.

3.4.3 Culvert Outlet Design

Outlet protection at the transverse culverts under the new Newell Highway has been considered using the Austroads (2013) guidance. The average rock size (d₅₀) and length (L) of the downstream protection has been sized based on Section 3.13 (Guide to Road Design Part 5B - AustRoads, 2013).

The guideline for the recommended minimum average rock size (d₅₀) for a 'multiple' pipe outlet is presented in **Figure 3-9**. A 36% increase in rock size is recommended if rounded rocks are used instead of angular rock.

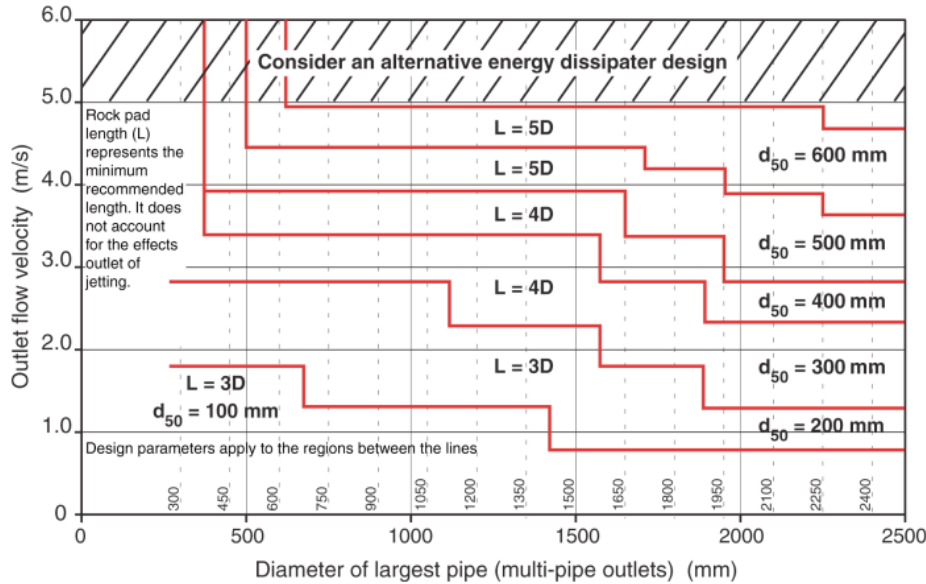


Figure 3-9: Sizing of rock pads for ‘multiple’ pipe outlets

A minimum thickness of $2 \times d_{50}$ has been adopted. The recommended minimum width of the rock pad at the outlet (W1) is the greater of the width of the outlet apron or the pipe diameter plus 0.6 m. The minimum width of the rock pad at the downstream end of the rock pad (W2) is the greater of W1 or $(D + 0.4L)$.

A typical layout for the protection is shown in **Figure 3-10**. The recommended scour protection details are shown in **Table 3-9**.

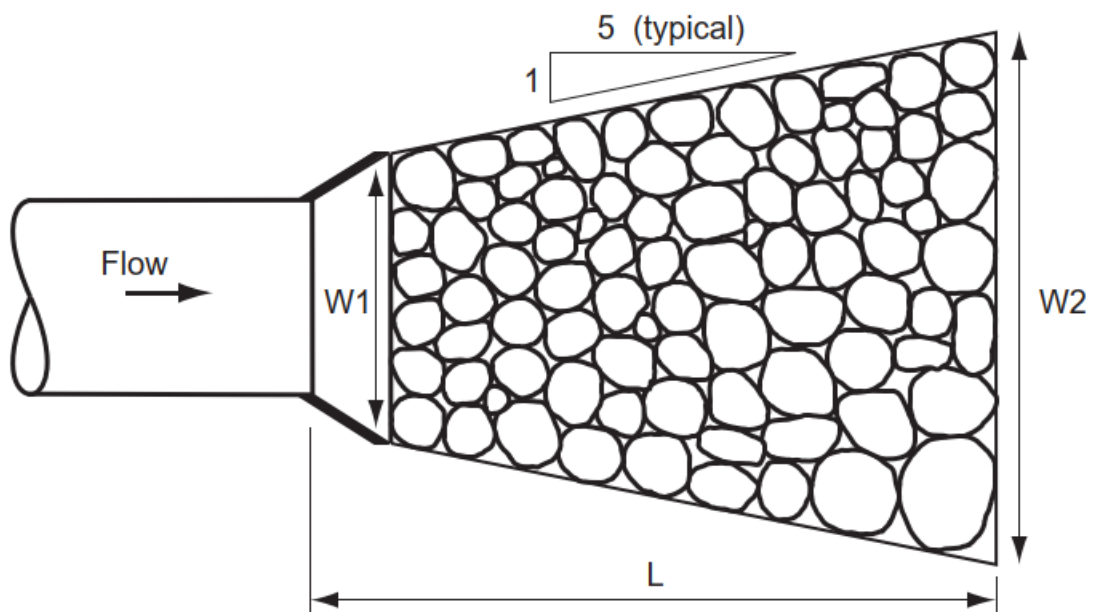


Figure 3-10: Typical layout of a rock pad outlet structure

Table 3-9: Scour Protection of Transverse Culverts at Newell Highway, Haul Road, Kyalite Road and BTW Road

Culvert ID	Culvert Diameter (D)	Peak Velocity	Length (L)	d50	Thickness
	m	(m/s)	(m)	mm	mm
20	1.2	1.6	3.6	200	400
1	1.8	2.4	7.2	300	600
2	1.8	2.4	7.2	300	600
3	1.8	2.8	7.2	300	600
4	1.8	2.2	5.4	300	600
5	0.75	2.0	2.25	200	400
16	1.8	2.1	7.2	300	600
7	1.8	1.0	5.4	200	400
8	1.8	2.6	7.2	300	600
18	1.8	1.5	5.4	200	400
9	1.8	1.9	5.4	200	400
19	1.8	2.2	7.2	300	600
14	1.8	2.6	7.2	400	800
13	0.375	1.7	1.125	100	200
12	1.8	2.8	7.2	400	800
11	1.8	2.5	7.2	400	800
15	1.8	2.1	7.2	300	600
6	0.45	1.5	1.35	100	200
6B	0.45	1.6	1.35	100	200

The rock pad should be aligned with the direction of flow. The surface elevation of the downstream end of the rock pad should be level with the invert of the receiving channel. The placement of a filter cloth under the rock pad is recommended. If larger rocks become difficult to source, reno mattresses can be used instead. Reno mattresses can either be filled with smaller sized rock which would work with improved restraint from the mattress, or be filled with more readily available fill material such as concrete demolition rubble to act in the prevention of scour from the outlet velocities.

3.4.4 Newell Highway Immunity

The proposed Newell Highway achieves a 1% AEP flood immunity across the entire stretch assessed and fully meets the 5% AEP design criteria. Most sections of the road achieve immunity up to the 0.1% AEP event. The section near culvert five (5), is the lowest point and would be overtopped by 40 mm in the 0.1% AEP event. **Table 3-10** presents the road immunity at each existing culvert crossing, the freeboard in the identified immunity event, the overtopping event, and the overtopping depth.

Table 3-10: Newell Highway immunity and overtopping event at the design culvert locations

Culvert ID	Minimum Immunity	Freeboard (mm)	Overtopping Event	Overtopping Depth (mm)
20	0.1% AEP	790	> 0.1% AEP	-
1	0.1% AEP	420	> 0.1% AEP	-
2	0.1% AEP	380	> 0.1% AEP	-
3	0.1% AEP	280	> 0.1% AEP	-

Culvert ID	Minimum Immunity	Freeboard (mm)	Overtopping Event	Overtopping Depth (mm)
4	0.1% AEP	60	> 0.1% AEP	-
5	1% AEP	200	0.1% AEP	40
16	0.1% AEP	640	> 0.1% AEP	-
7	0.1% AEP	60	> 0.1% AEP	-
8	0.1% AEP	60	> 0.1% AEP	-
18	0.1% AEP	240	> 0.1% AEP	-
9	1% AEP	210	0.1% AEP	10
19	0.1% AEP	200	> 0.1% AEP	-

3.4.5 Flood Impacts

Figures showing the change in flood level relative to existing conditions are shown in **Appendix C**. Overall, flood levels have increased upstream of Haul Road and upstream of the proposed Newell Highway. Downstream of the Newell Highway, flow paths have changed due to the location of the new culverts. Where there are new flow paths (downstream of culverts 3, 4 and 16), flood levels have increased whilst at other locations, flood levels have reduced.

3.4.5.1 Afflux in the 1% AEP Event

Modelling results show that, at the peak of the flood, there would be an increase of flood levels up to 115 mm and 65 mm at two private properties outside of Alkane Controlled land as shown in **Figure 3-11**. These properties do not contain habitable structures and the impacts are limited to the agricultural land. The afflux is caused by the concentration of flow being conveyed through culverts 16 and 7.

Two properties outside of Alkane Controlled land would have a reduction in flood levels up to 390 mm at the peak of the flood in the 1% AEP event. On Lot 165 Plan DP755093, four sheds and one house were identified to be in the zone of reduced flood depths. The floor level of the house has not been surveyed and the model currently assumes ground level to be the floor level. The depth of flooding based on the ground level was predicted to be 126 mm in the 1% AEP in the existing case, and 32 mm in the design case. There would a reduction of 94 mm as a result of the changed flow paths, i.e. a net flood benefit. As the house is lifted above ground, the flood depths indicate that the floor level would not be inundated in either the existing or design cases. Similar to the house, the depth of flooding would be reduced at the shed locations.

The properties affected in the 1% AEP event are summarised in **Table 3-11**.

The difference in flood level at the model boundary would be, on average, less than -100 mm. The model was not extended due to the combination of a lack of LiDAR, the fact that there are no more increases in flood level, only decreases, and the expectation that this impact would dissipate to be negligible at the confluence of Bulldog Creek and Gundong Creek.

Table 3-11: Impacted properties in the 1% AEP event

Lot/Plan	Tenure	Afflux (mm)	Depth of Flooding Existing (mm)	Depth of Flooding Design (mm)	Land Use
163/DP755093	Freehold	-390		-	Agricultural
165/DP755093	Freehold	-306		-	Agricultural
165/DP755093	Freehold	-133	160	27	Shed 1
165/DP755093	Freehold	-128	147	19	Shed 2

Lot/Plan	Tenure	Afflux (mm)	Depth of Flooding Existing (mm)	Depth of Flooding Design (mm)	Land Use
165/DP755093	Freehold	-165	237	72	Shed 3
165/DP755093	Freehold	-114	180	66	Shed 4
165/DP755093	Freehold	-94	126	32	House (not flooded above habitable floor level)
100A/DP1271511	Freehold	115		-	Agricultural
100B/DP1271511	Freehold	65		-	Agricultural

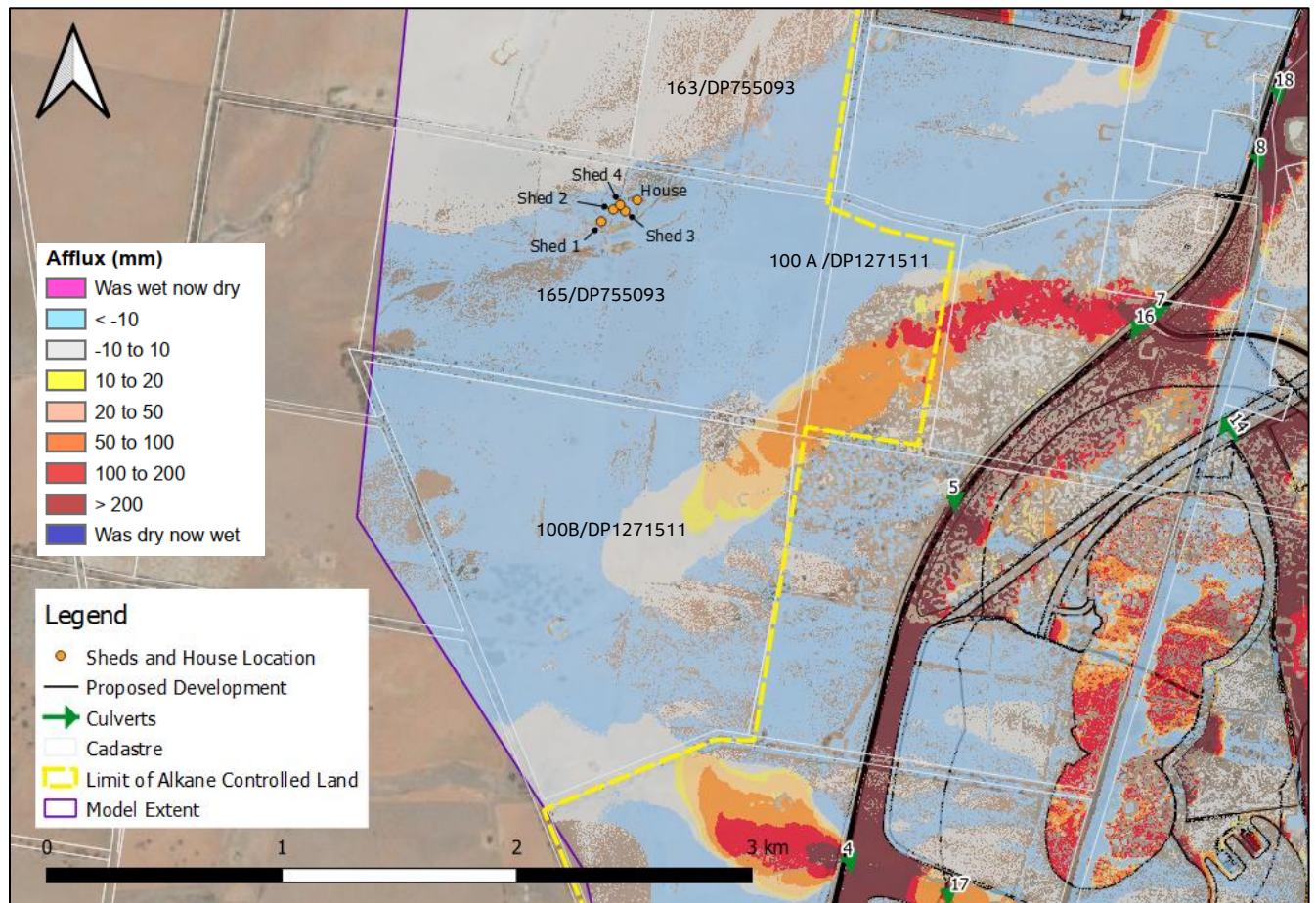


Figure 3-11: Impacted properties in the 1% AEP event

3.4.5.2 Afflux in the 5% AEP Event

Modelling results show that there would be an increase of flood levels up to 220 mm and 110 mm at two private properties outside the Alkane Controlled land as shown in Figure 3-12. These properties do not contain habitable

structures and the impacts are limited to agricultural land. The afflux is caused by the concentration of flow being conveyed through culverts 16 and 7.

Two properties outside of the Alkane Controlled land would have a reduction in flood levels up to 370 mm in the 5% AEP event. On Lot 165 Plan DP755093, two sheds and one house were identified to be in the zone of reduced flood depths. The floor level of the house has not been surveyed and the model currently assumes ground level to be the floor level. The depth of flooding based on the ground level was predicted to be 78 mm in the 1% AEP in the existing case, and 23 mm in the design case. There would a reduction of 55 mm as a result of the changed flow paths, i.e. a net flood benefit. As the house is lifted above ground, the flood depths indicate that the floor level would not be inundated in either the existing or design cases. Similar to the house, the depth of flooding would be reduced at the shed locations.

The properties affected in the 5% AEP event are summarised in **Table 3-12**.

The difference in flood level at the model boundary would be, on average, less than -100 mm. The model was not extended due to the combination of a lack of LiDAR, the fact that there are no more increases in flood level, only decreases, and the expectation that this impact would dissipate to be negligible at the confluence of Bulldog Creek and Gundong Creek.

Table 3-12: Impacted properties in the 5% AEP event

Lot/Plan	Tenure	Afflux (mm)	Depth of Flooding Existing (mm)	Depth of Flooding Design (mm)	Land Use
163/DP755093	Freehold	-370	-	-	Agricultural
165/DP755093	Freehold	-290	-	-	Agricultural
165/DP755093	Freehold	-143	184	41	Shed 3
165/DP755093	Freehold	-104	142	38	Shed 4
165/DP755093	Freehold	-55	78	23	House (not flooded above habitable floor level)
100A/DP1271511	Freehold	220	-	-	Agricultural
100B/DP1271511	Freehold	110	-	-	Agricultural

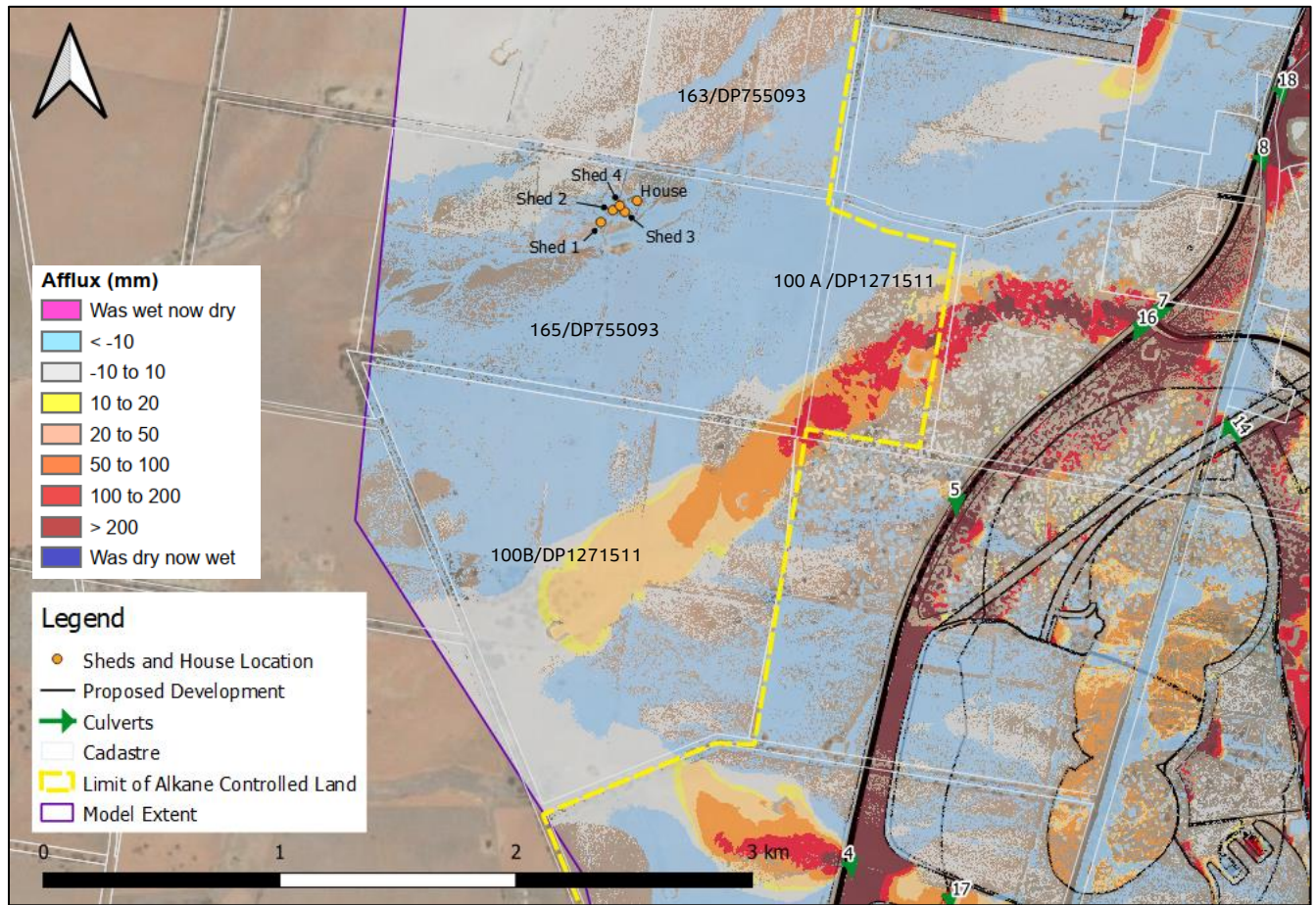


Figure 3-12: Impacted properties in the 5% AEP event

3.4.5.3 Volume Impact Downstream of Newell Highway

The Newell Highway has been raised to achieve 5% AEP flood immunity, from an existing immunity of less than 20% AEP. As a result, there are some differences in the flow behaviour downstream of the new Newell Highway. **Figure 3-13** and **Figure 3-14** show the comparison between the hydrographs downstream of the new Newell Highway for the Existing and Design case.

As shown in **Figure 3-13** and **Figure 3-14**, the peak flow is predicted to be lower in the design case compared to the existing case by 16 m³/s (or 9% lower than the existing peak flow) and by 46 m³/s (or 16% lower than the existing peak flow) for the 5% AEP event and the 1% AEP event respectively. Additionally, in both events, the time to peak is delayed by at least 2 hours in the design case. This can be explained by the higher highway acting to retard flow and only allowing flow downstream in a slower manner through the culverts as opposed to the overtopping of the road in the existing case.

The flood volume reaching downstream properties, is estimated to be lower in the design case compared to the existing case by 2.9% and 2.8% for the 5% AEP event and the 1% AEP event respectively. This is consistent with the reduced catchment size that results from the SAR open cut in the developed scenario.

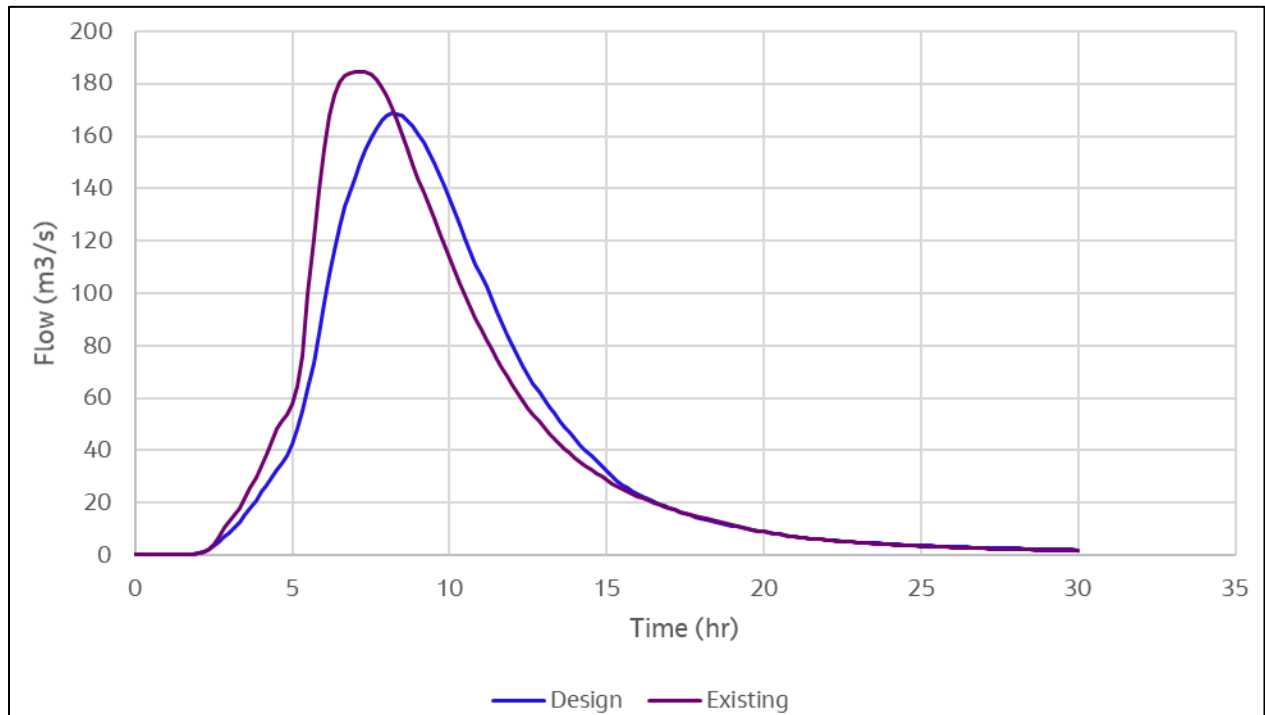


Figure 3-13: Existing vs Design hydrographs downstream the proposed Newell Highway in the 5% AEP event

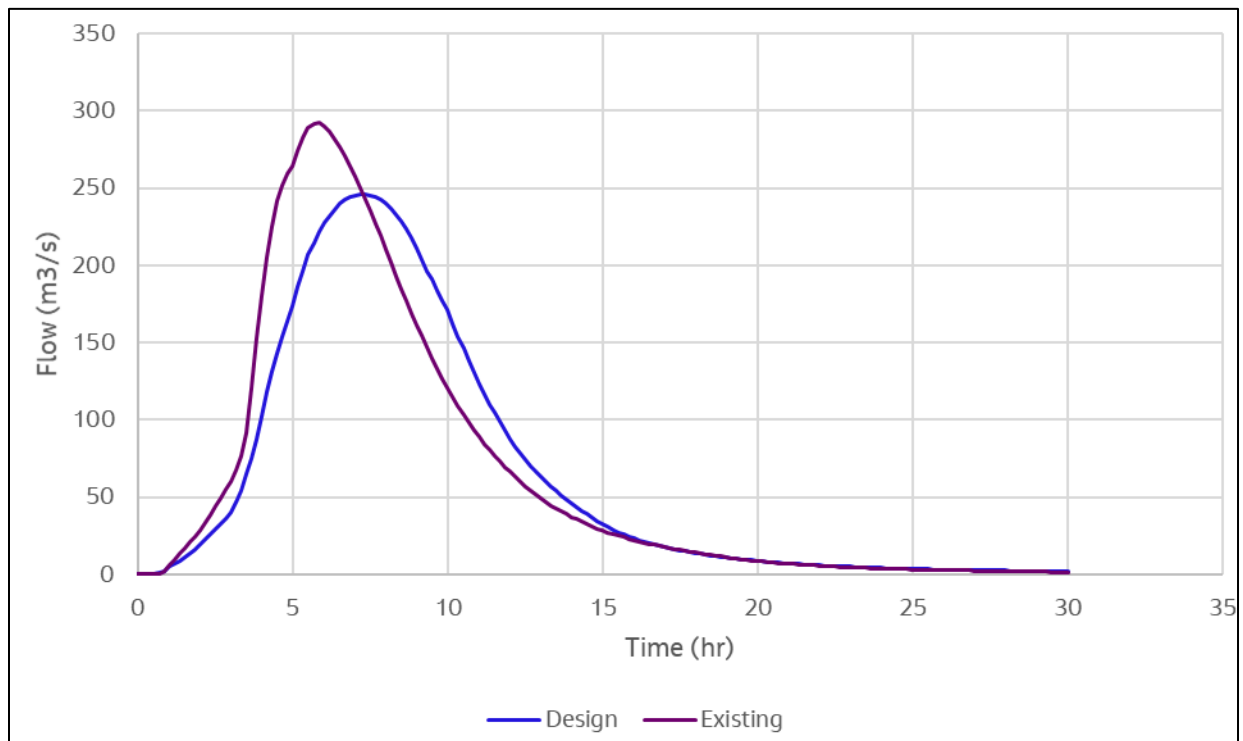


Figure 3-14: Existing vs Design hydrographs downstream the proposed Newell Highway in the 1% AEP event

3.4.6 Culvert Blockage Sensitivity Analysis

A blockage assessment was undertaken for the transverse culverts along the proposed Newell Highway as per ARR 2019 guidelines. Given the nature of the catchment and the proximity of the mine to the road embankment, it was considered appropriate to assess the Inlet and Barrel blockage mechanisms. While the Inlet mechanism accounts for floating and non-floating debris, the Barrel mechanism is typical for sediment material which progressively arrives and is deposited at the inlet and in the barrel itself. This leads to bottom-up blockage of both the barrel and inlet to the structure. The blockage mechanism which results in a larger impact on flood behaviour would be adopted.

One of the key parameters of the ARR 2019 Inlet blockage assessment is the L10 (the average length of the longest 10% of the debris that could arrive at the site), which heavily influences the percentage of blockage required. The ARR 2019 guidelines suggest sampling the debris trapped upstream of the culverts to estimate the L10. A conservative approach has been used to estimate the L10. The L10 was estimated to be 15m, which conservatively represents natural vegetation and mining artifacts in the upper catchments. With the low velocities and depth, it is unlikely that such large obstructions would be washed up against the culverts, therefore the blockage assessment was completed for sensitivity testing purposes only. **Table 3-13** and **Table 3-14** presents the parameters adopted for the Inlet and Barrel blockage assessments respectively.

Table 3-13: Inlet Blockage Assessment

Culvert ID	Dimension	L10	Debris Availability	Debris Mobility	Debris Transportability	Debris Potential	AEP Adjusted Debris Potential	Blockage percentage
	(mm)	(m)					AEP 5% - AEP 0.5%	W < L10
All	Various	15	Medium	Medium	Low	Low	Low	25%

Table 3-14: Barrel Blockage Assessment

Culvert ID	Peak Velocity	Mean Sediment Size	Likelihood of Sediment Being Deposited in Barrel	AEP Adjusted Debris Potential	Depositional Blockage
	(m/s)			AEP 5% - AEP 0.5%	
All	Various	Clay/Silt (0.001 to 0.04 mm)	Low	Low	0%

According to the assessment, the Inlet blockage mechanism would lead to a worse impact on flood behavior. Therefore, a 25% blockage was adopted for all of the culverts and simulated for the 5% AEP event in order to assess the impact on the proposed Newell Highway immunity.

When compared to the design scenario with no blockage, the maximum freeboard reduction occurs upstream of culvert 4. At this location, differences in flood level between the blocked and unblocked scenario reach up to 300 mm in the 5% AEP event (refer to **Figure 3-15**). Despite this, a 5% AEP flood immunity would still be achieved at this location and at all other locations along the proposed Newell Highway. The road design, therefore, has sufficient freeboard to account for blockage.

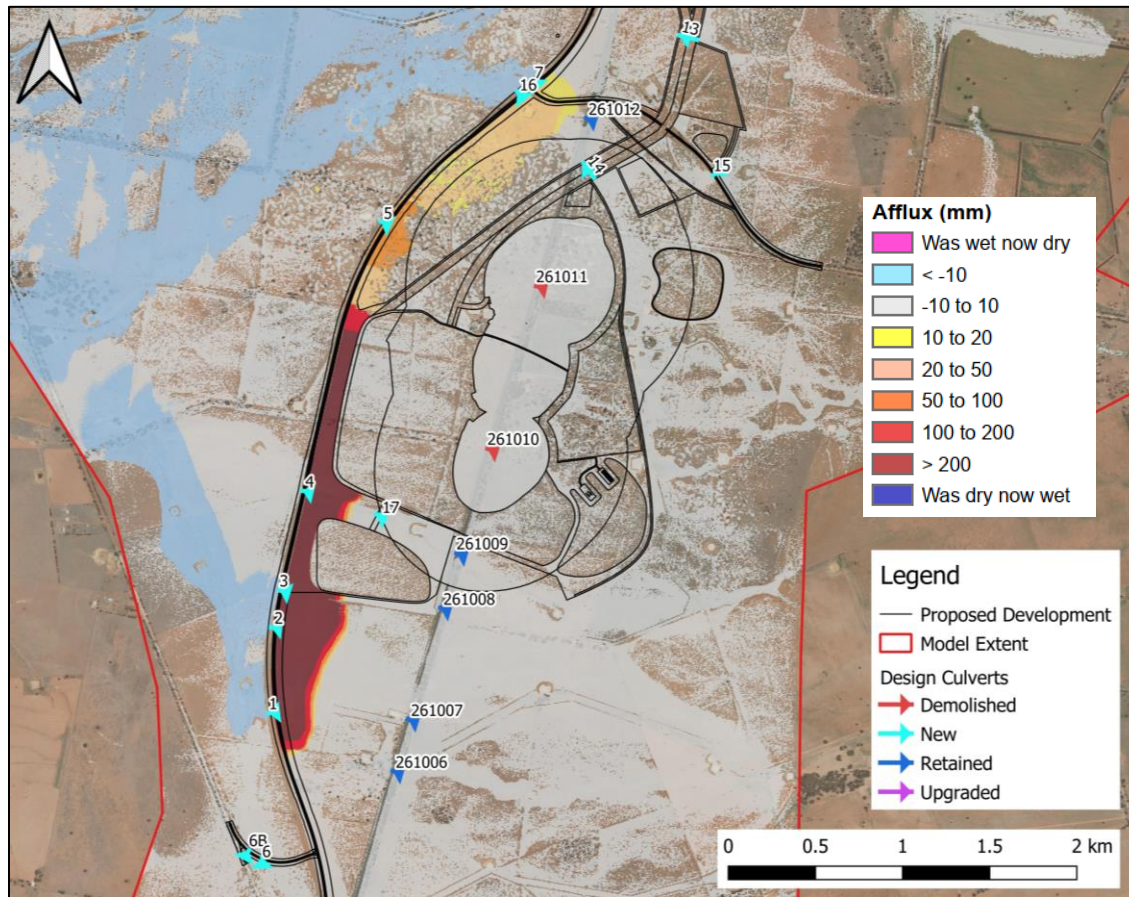


Figure 3-15: Difference in Flood level - Blocked vs Unblocked scenario 5% AEP event – Newell Highway

The blockage assessment was also undertaken for the culverts located under the local roads (Back Tomingley West Road, Kyalite Road, and Haul Road). Similar to the culverts under the proposed Newell Highway, a 25% blockage was adopted for all of the culverts and simulated for the 5% AEP event.

When compared to the design scenario with no blockage, the highest increase in flood levels would occur upstream of culverts 12 and 14 (culverts under Haul Road) being 370 mm and 210 mm respectively, as shown in **Figure 3-16**. 100 mm increase in flood level was observed upstream of Kyalite Road. Minor flood level increases (< 10 mm) were identified upstream of Back Tomingley West Road.

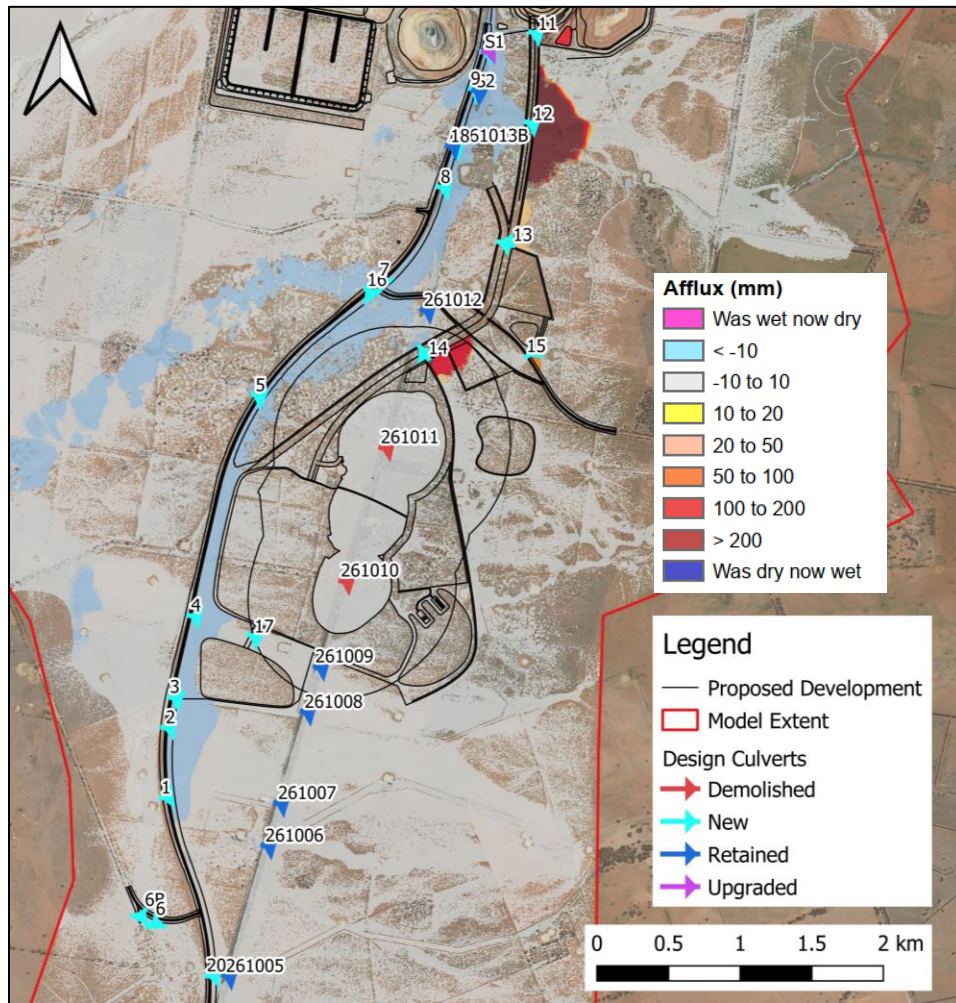


Figure 3-16: Difference in Flood level - Blocked vs Unblocked scenario 5% AEP event – Local Roads

3.4.7 Climate Change Sensitivity Analysis

A climate change scenario was modelled for the 5% AEP event based on RCP 6 and the year 2090. This equates to a 13.1% increase in design rainfall intensity.

Results suggest that the biggest increase in flood levels would occur upstream of culverts 4 and 12 being 230 mm and 280 mm respectively, as shown in **Figure 3-17**.

Along the proposed Newell Highway, flood immunity would still be achieved in the 5% AEP event. The road design, therefore, has sufficient freeboard to account for climate change.

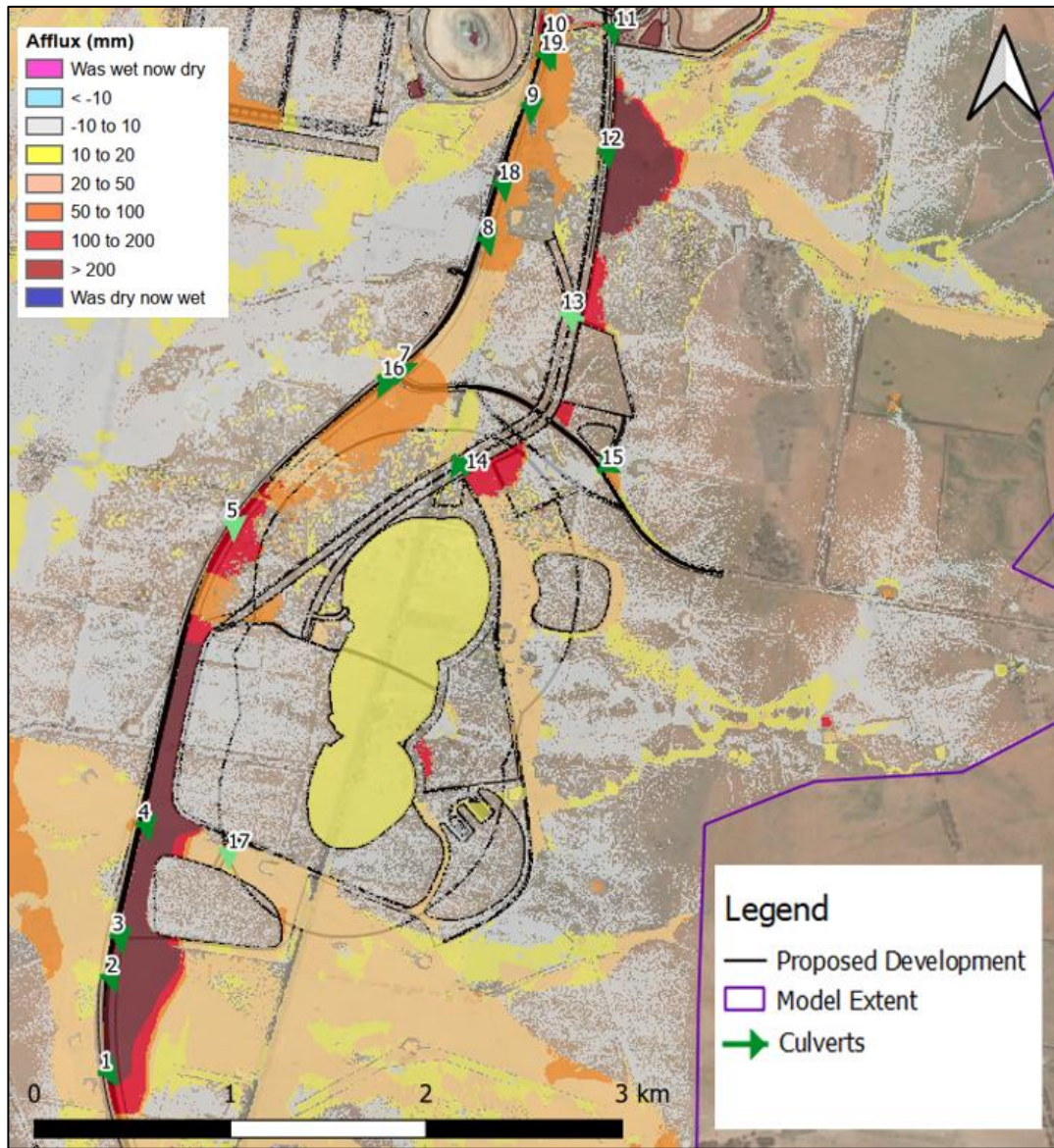


Figure 3-17: Difference in Flood level – 5% AEP event vs 5% AEP event with climate change

4. Limitations

The hydraulic modelling results presented in this report are based on the TGEP design received by Jacobs in August 2021. The hydraulic model was found to be sensitive to changes in the design and therefore the conclusions drawn in this report would not apply to any future design changes. Future design changes should be re-modelled.

Details of the surface water management plan such as drains, swales and sediment basins have not been included in the hydraulic model as they form a relatively small catchment area compared to the overall catchment. These features are not expected to impact the conclusions of this report.

The critical storms identified for the existing case have been adopted for the design case. Due to attenuation of flow upstream of the proposed new Newell Highway, these critical storms may have changed in the design case. The risk is considered low as there were minor differences in flood levels observed between the different storms. Additionally, the realigned Newell Highway has quite a large freeboard. It is recommended that critical storms be checked during detailed design.

No calibration to historic events has been performed for the hydrologic and hydraulic models due to the lack of available gauge data in the catchment. The hydrologic model has been validated to the RFFE, and an appropriately conservative flow has been adopted to provide a buffer for the lack of calibration.

Appendix A. Flood Maps Existing Situation

Figure A1: 20% AEP Peak Depth and Peak Water Level - Existing Case

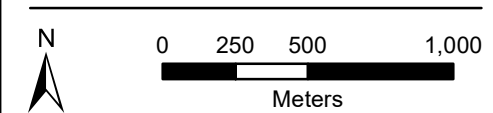


LEGEND

- Spot Flood Level (mAHD)
- Watercourse
- Existing Culverts
- Water Level (mAHD)
- Cadastre
- ▭ Model Extent

Depth (m)

- Light Blue: < 0.1
- Light Green: 0.1 - 0.2
- Yellow: 0.2 - 0.5
- Orange: 0.5 - 1.0
- Red: 1.0 - 1.5
- Dark Red: > 1.5

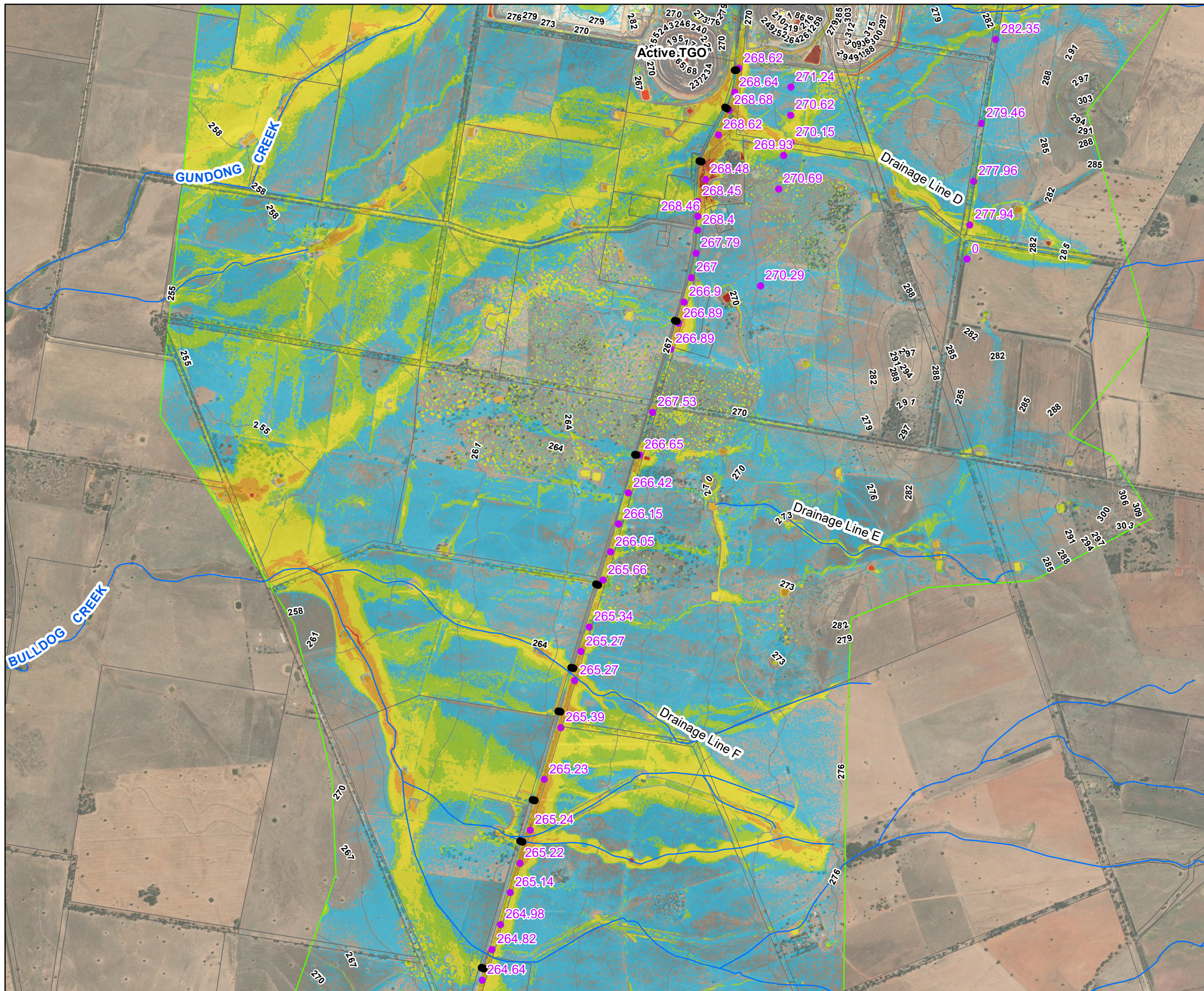


GDA 1994 MGA Zone 55 1:26,000
 Model Name: E009
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure A2: 10% AEP Peak Depth and Peak Water Level - Existing Case

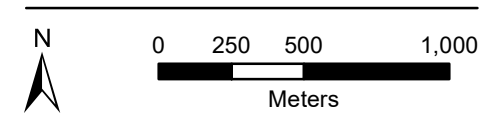


LEGEND

- Spot Flood Level (mAHD)
- Watercourse
- Existing Culverts
- Water Level (mAHD)
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

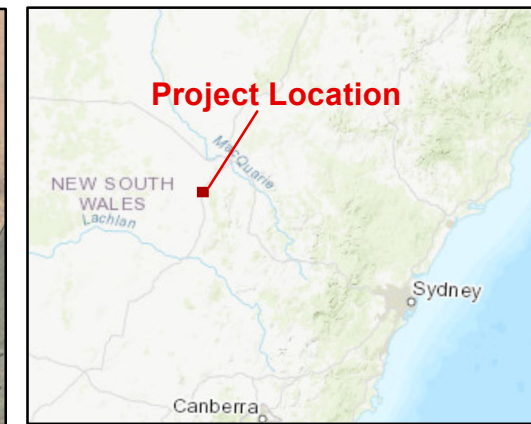
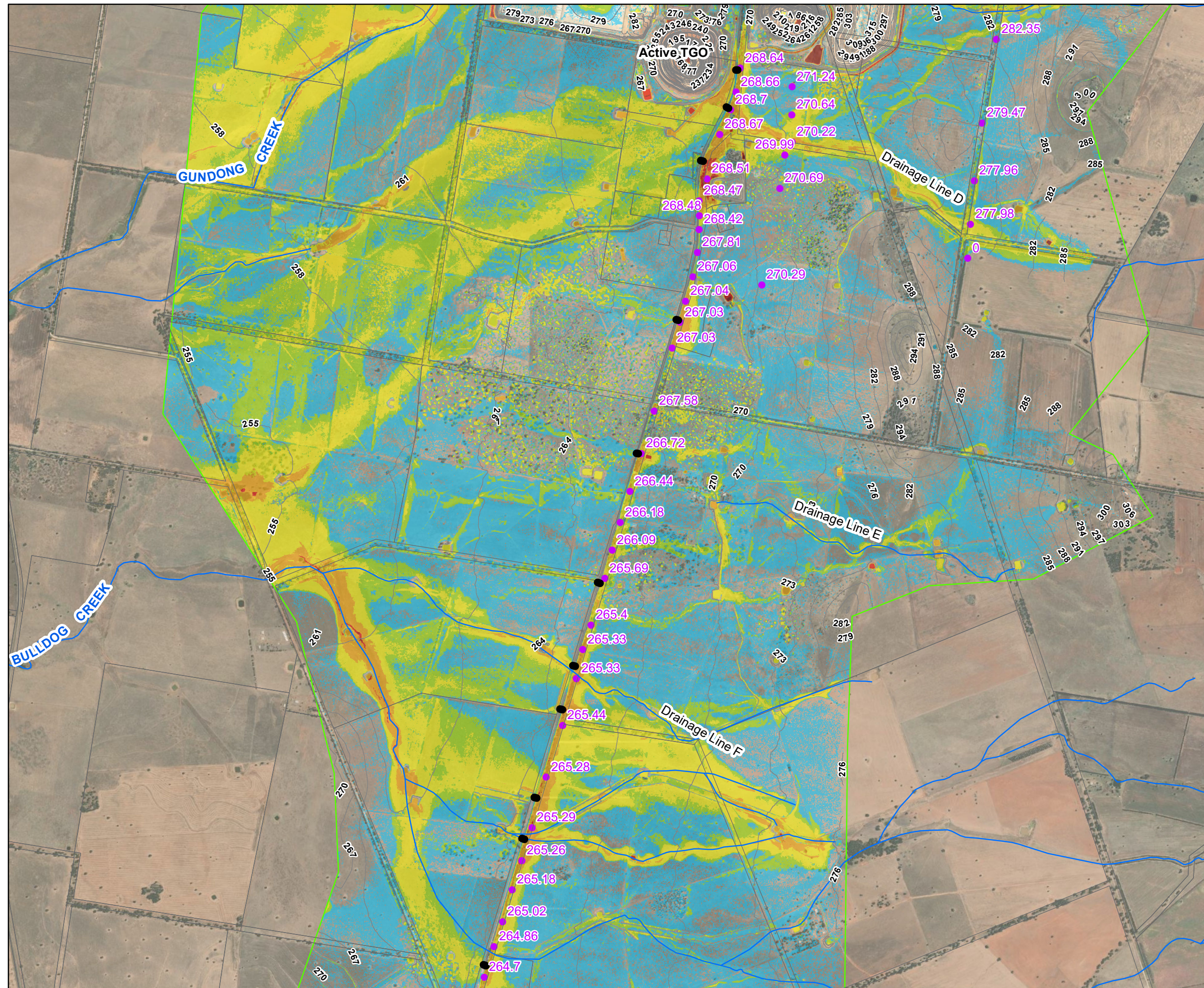


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Figure A3: 5% AEP Peak Depth and Peak Water Level - Existing Case

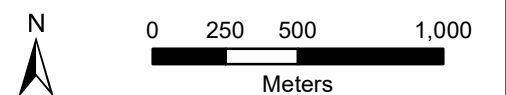


LEGEND

- Spot Flood Level (mAHD)
- Watercourse
- Existing Culverts
- Water Level (mAHD)
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

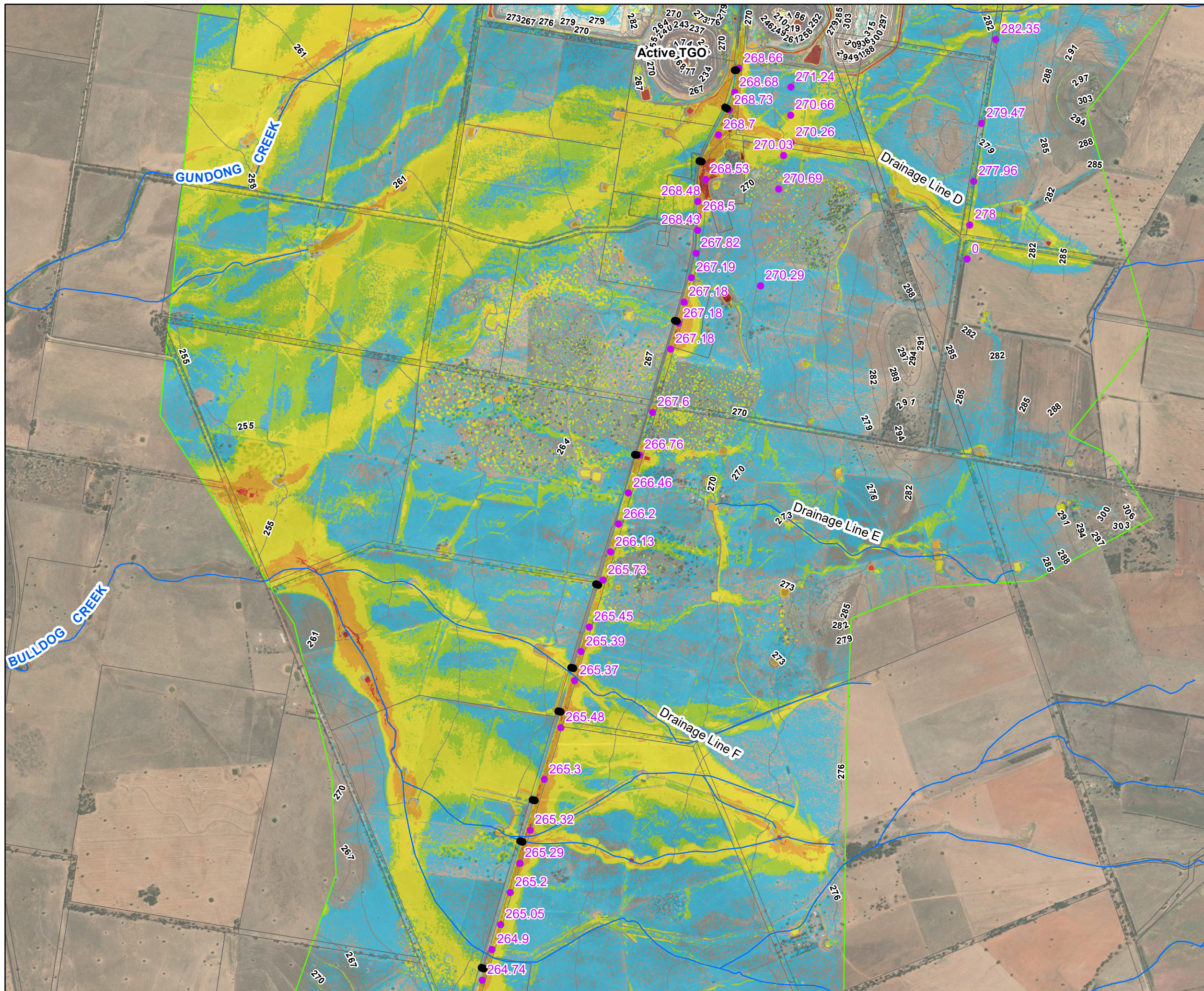


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Figure A4: 2% AEP Peak Depth and Peak Water Level - Existing Case

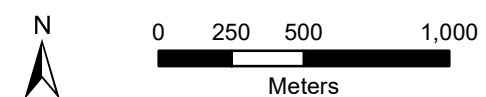


LEGEND

- Spot Flood Level (mAHD)
- Watercourse
- Existing Culverts
- Water Level (mAHD)
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

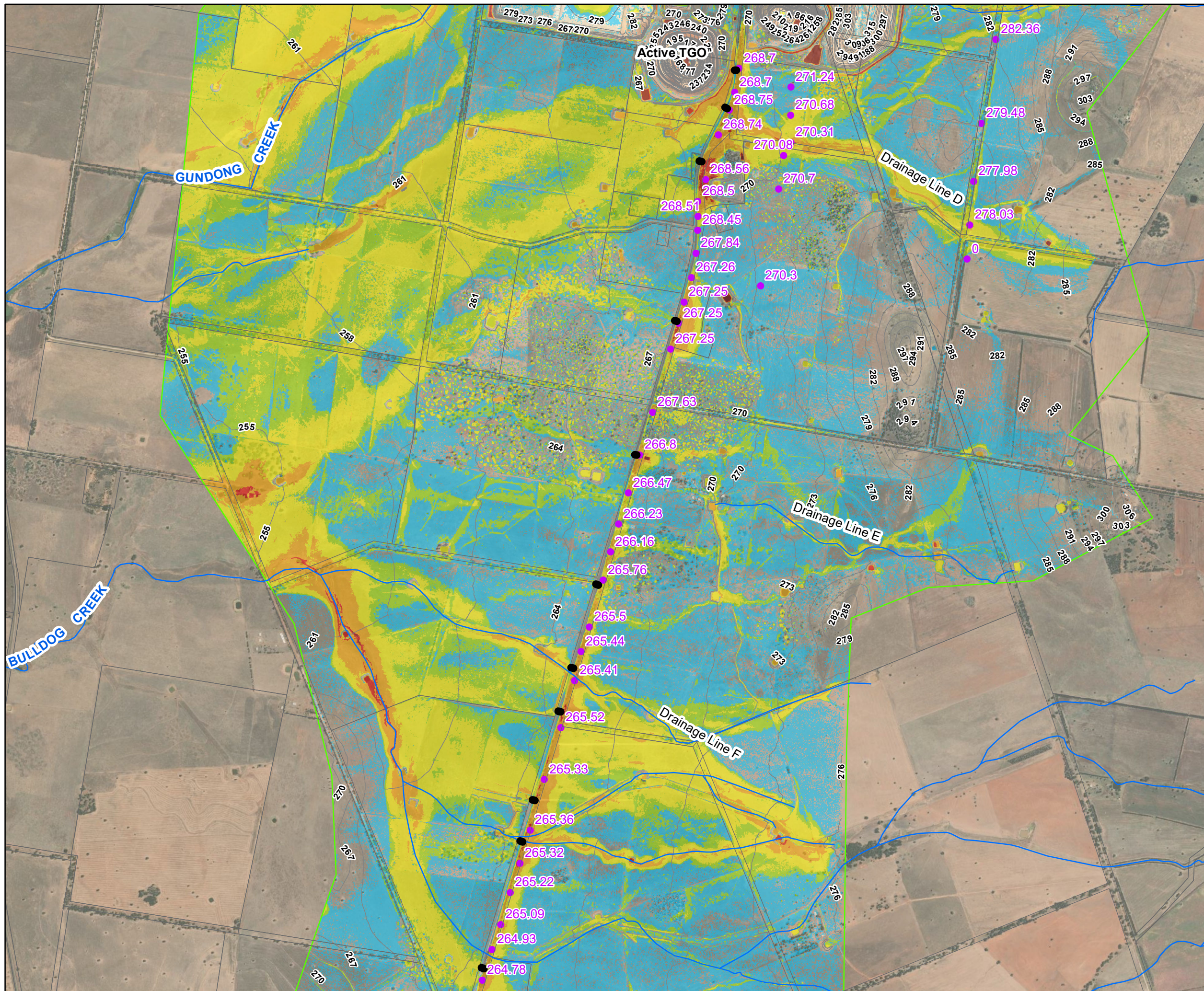


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Figure A5: 1% AEP Peak Depth and Peak Water Level - Existing Case

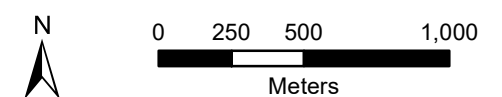


LEGEND

- Spot Flood Level (mAHD)
- Watercourse
- Existing Culverts
- Water Level (mAHD)
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

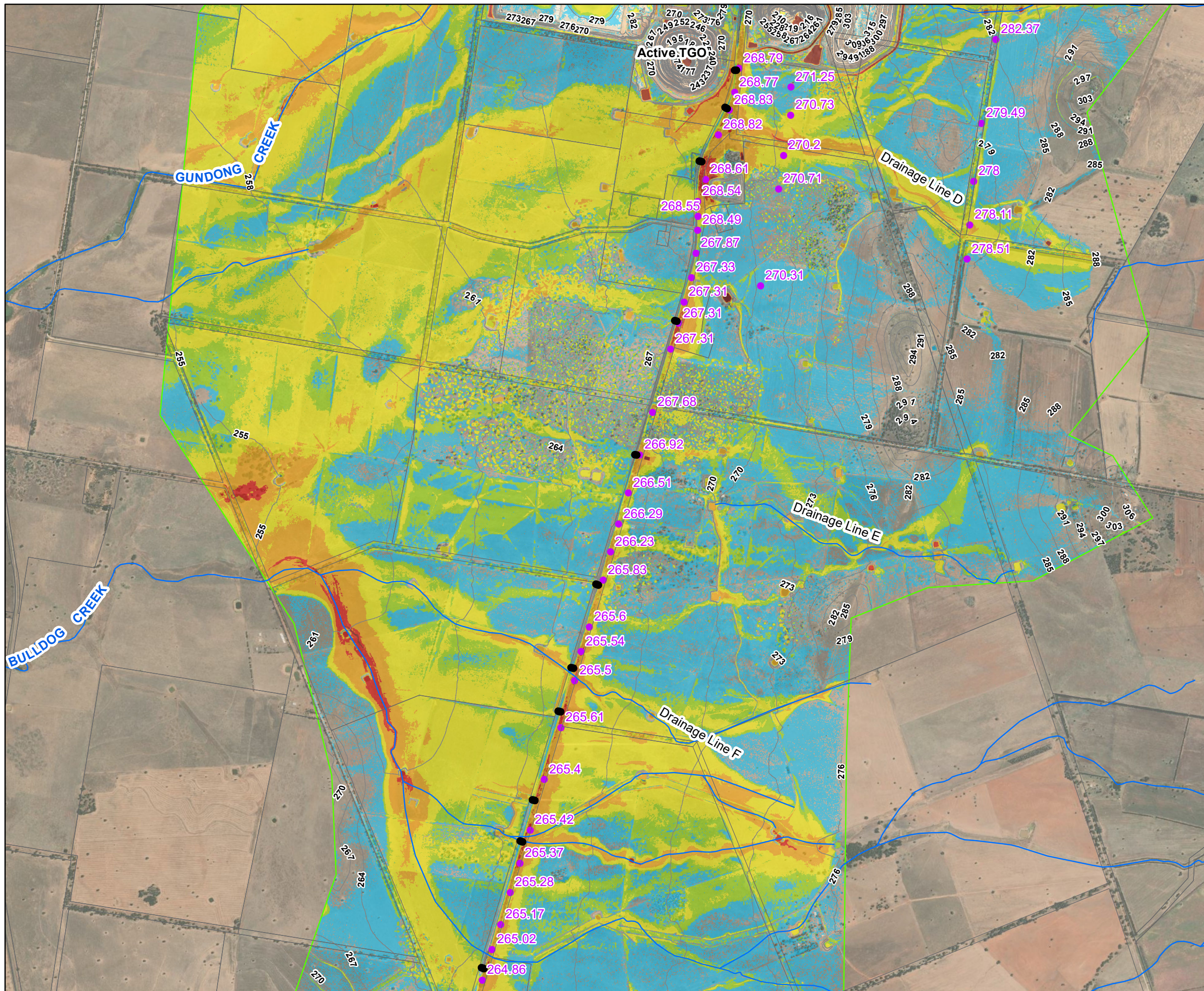


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Figure A6: 0.1% AEP Peak Depth and Peak Water Level - Existing Case



LEGEND

- Spot Flood Level (mAHD)
- Watercourse
- Existing Culverts
- Water Level (mAHD)
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

N

0 250 500 1,000
Meters

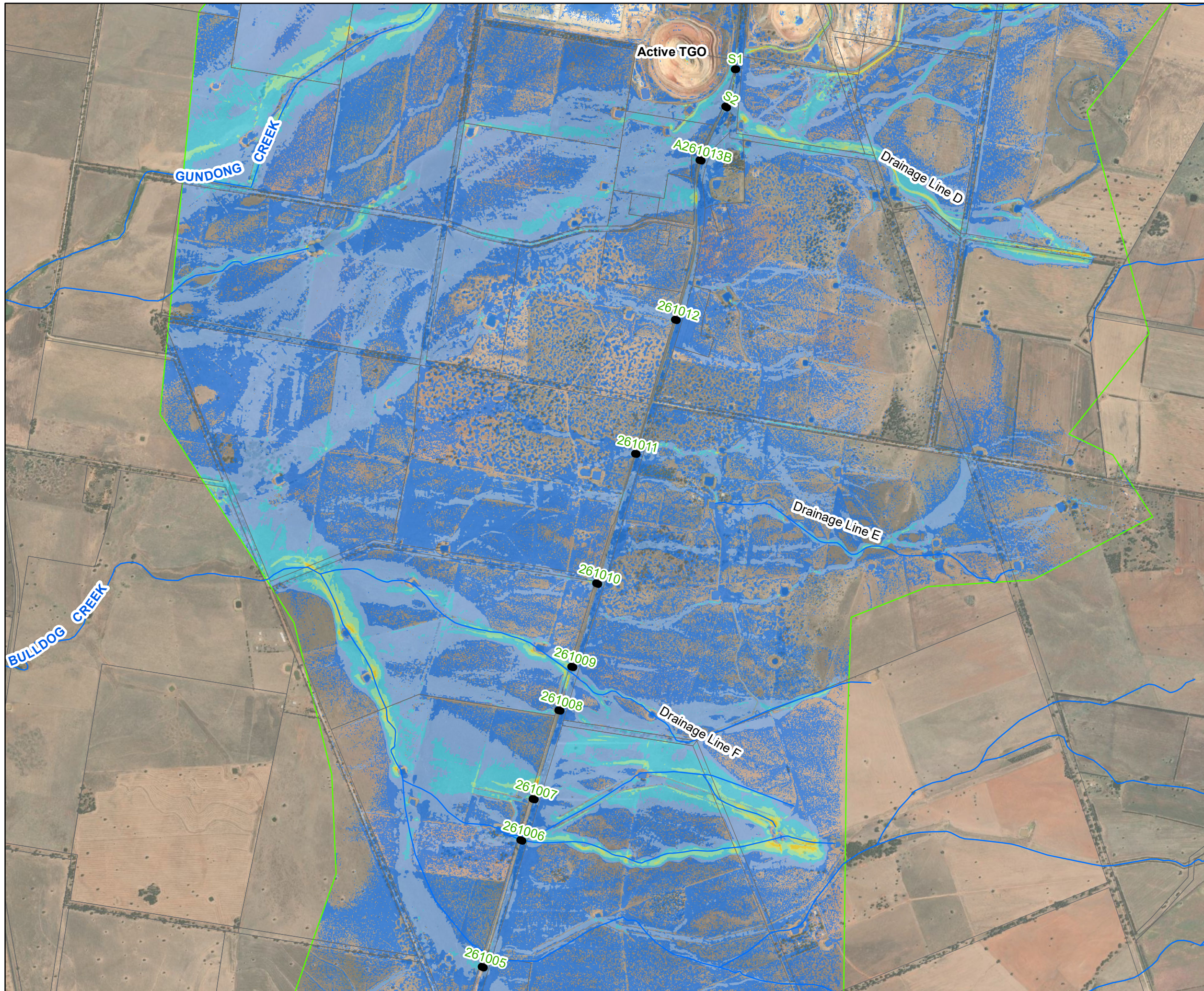
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Figure A7: 20% AEP Peak Velocity - Existing Case

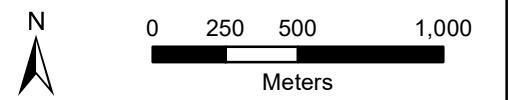


LEGEND

- Watercourse
- Existing Culverts
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

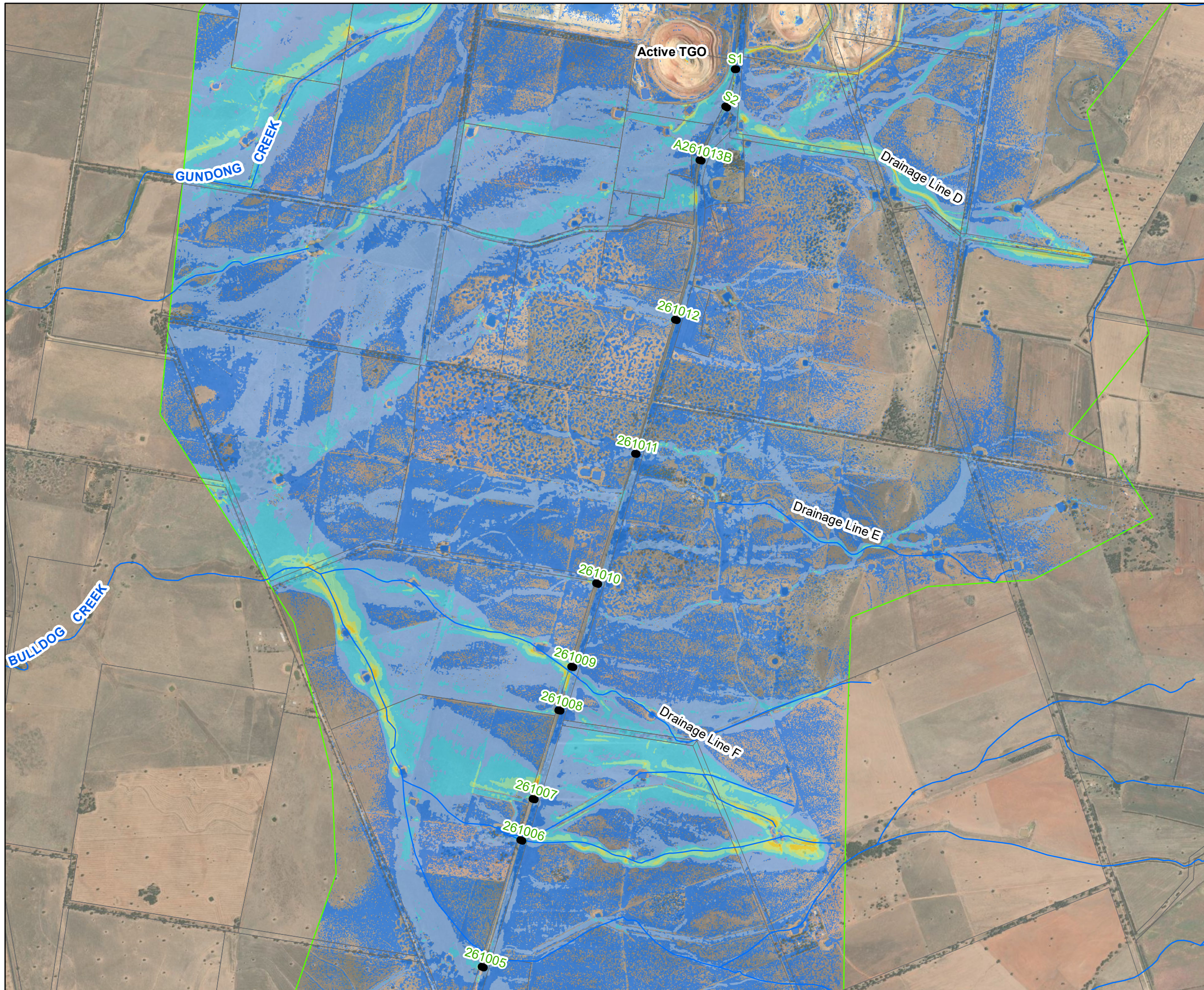


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 Originator: RK
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 Date: September 2021

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Figure A8: 10% AEP Peak Velocity - Existing Case

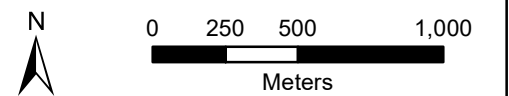


LEGEND

- Watercourse
- Existing Culverts
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

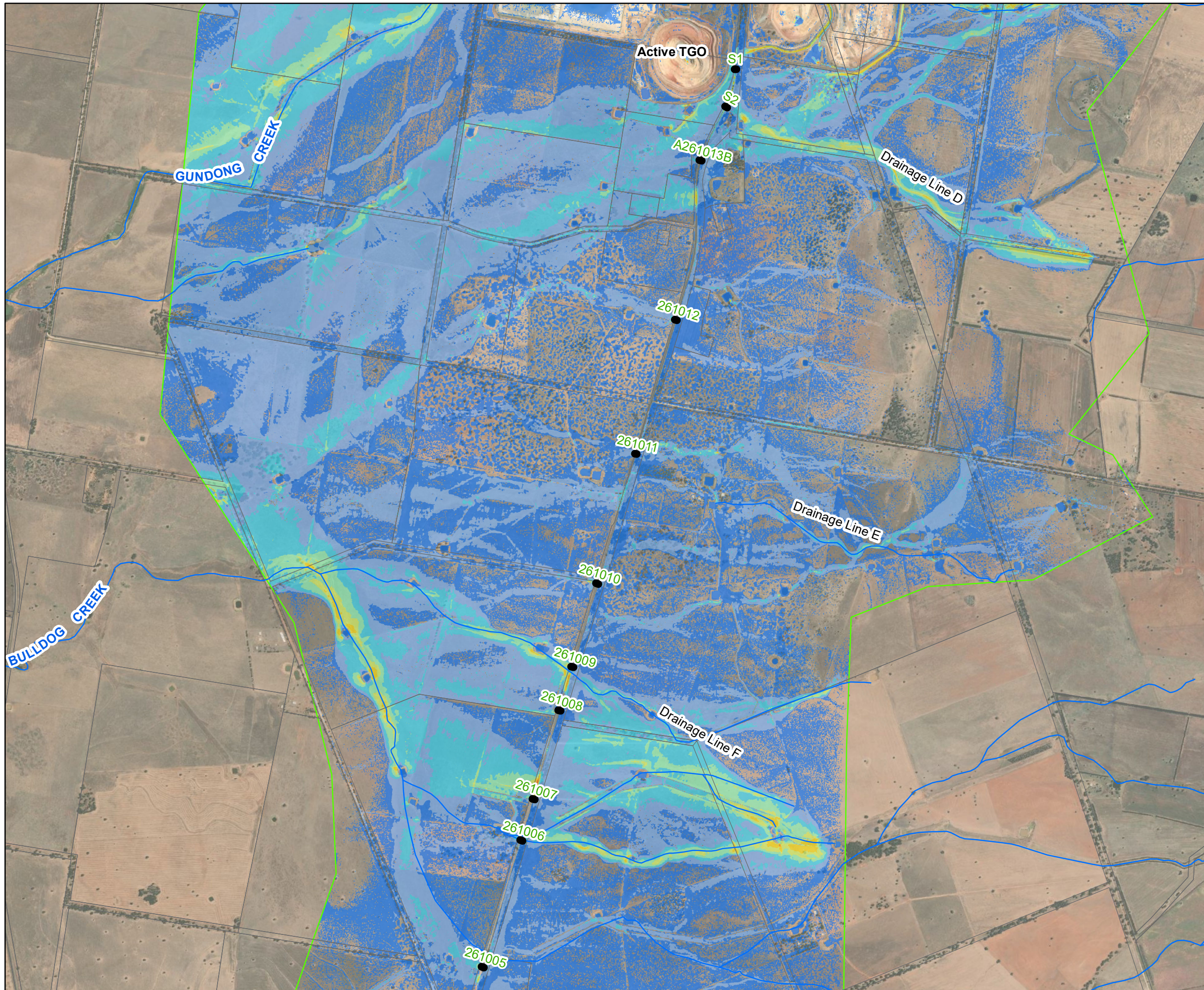


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Figure A9: 5% AEP Peak Velocity - Existing Case

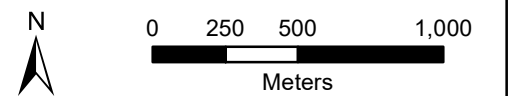


LEGEND

- Watercourse
- Existing Culverts
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

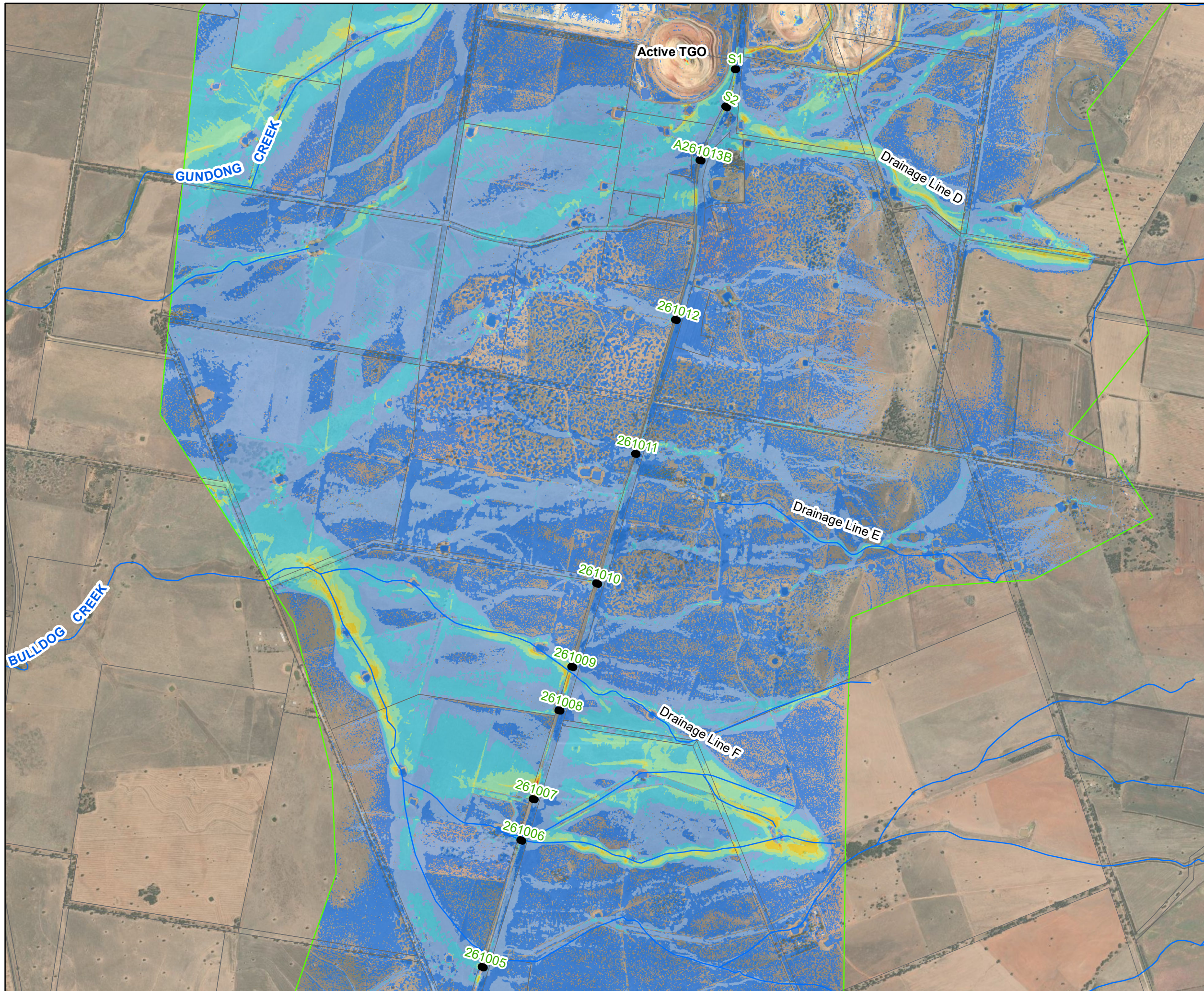


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Figure A10: 2% AEP Peak Velocity - Existing Case

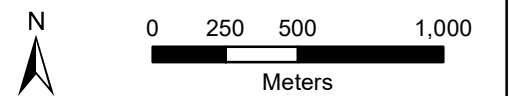


LEGEND

- Watercourse
- Existing Culverts
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

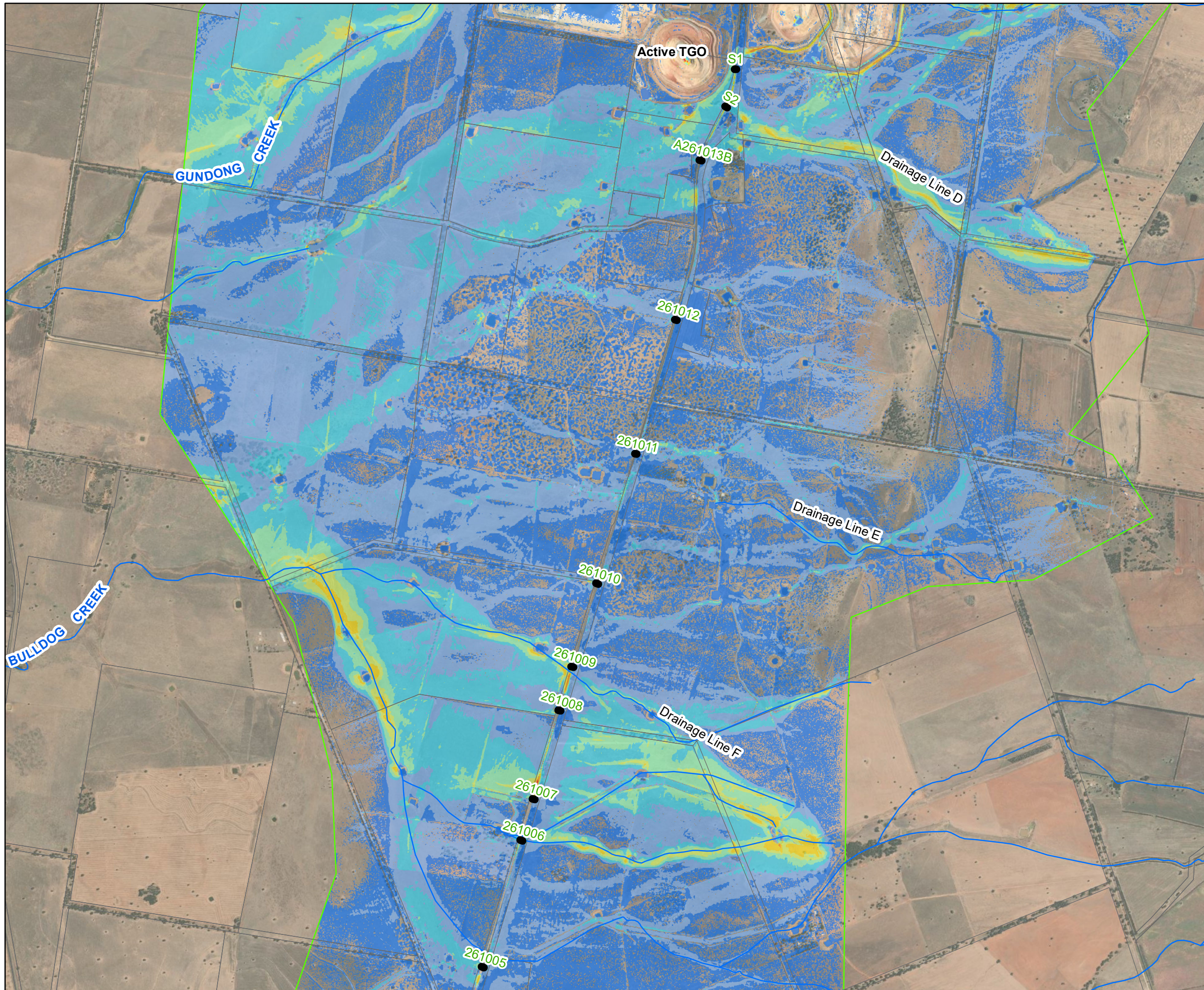


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Figure A11: 1% AEP Peak Velocity - Existing Case

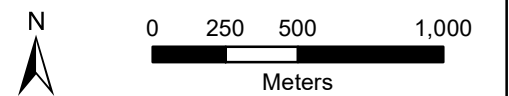


LEGEND

- Watercourse
- Existing Culverts
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

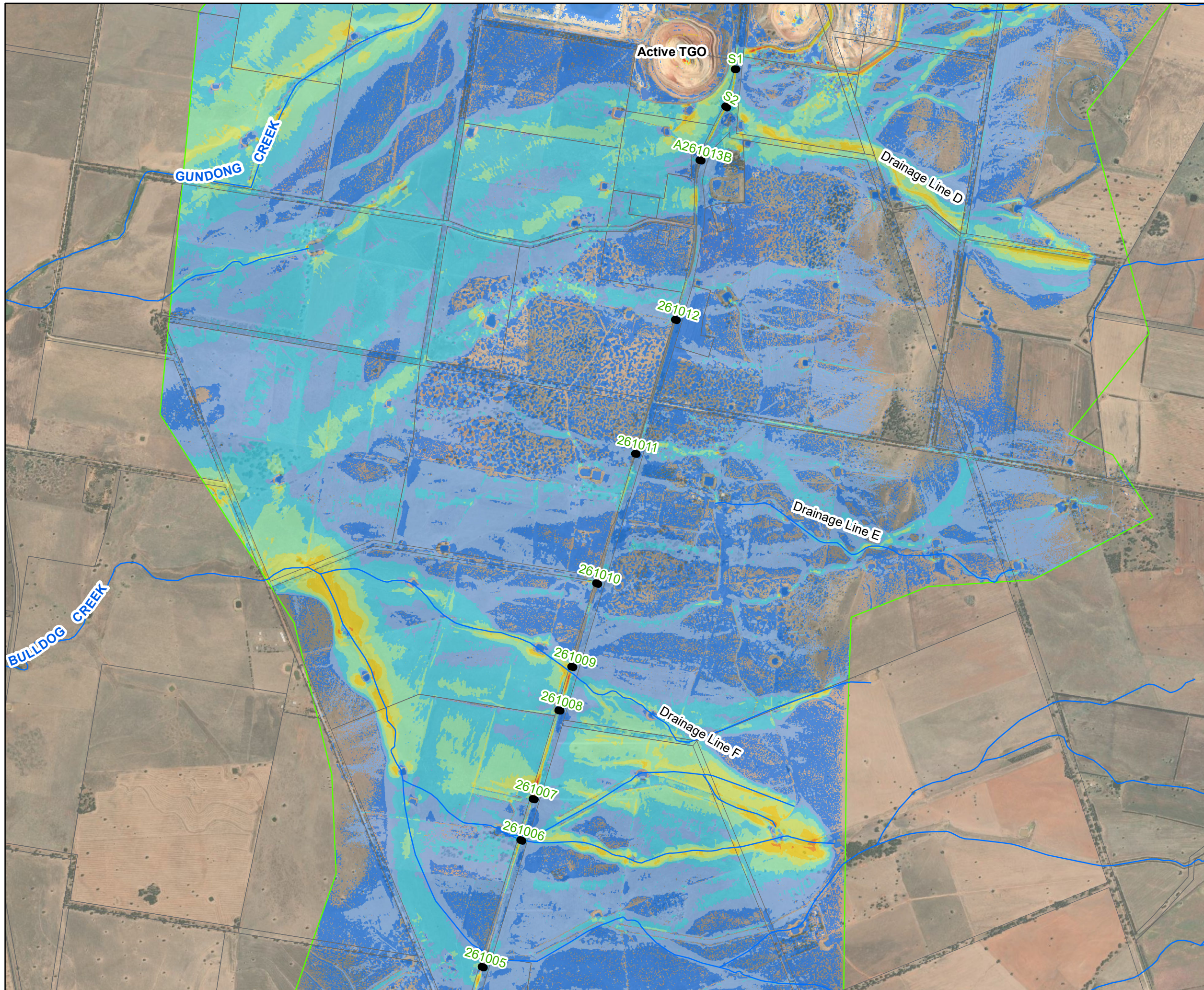


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Figure A12: 0.1% AEP Peak Velocity - Existing Case

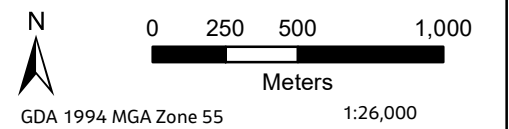


LEGEND

- Watercourse
- Existing Culverts
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0



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Appendix B. Flood Maps Design Situation

Figure B1: 20% AEP Peak Depth and Peak Water Level - Design Case



LEGEND

- Shed and House Location
- Spot Flood Level (mAHD)
- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- Water Level (mAHD)
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

N

0 250 500 1,000
Meters

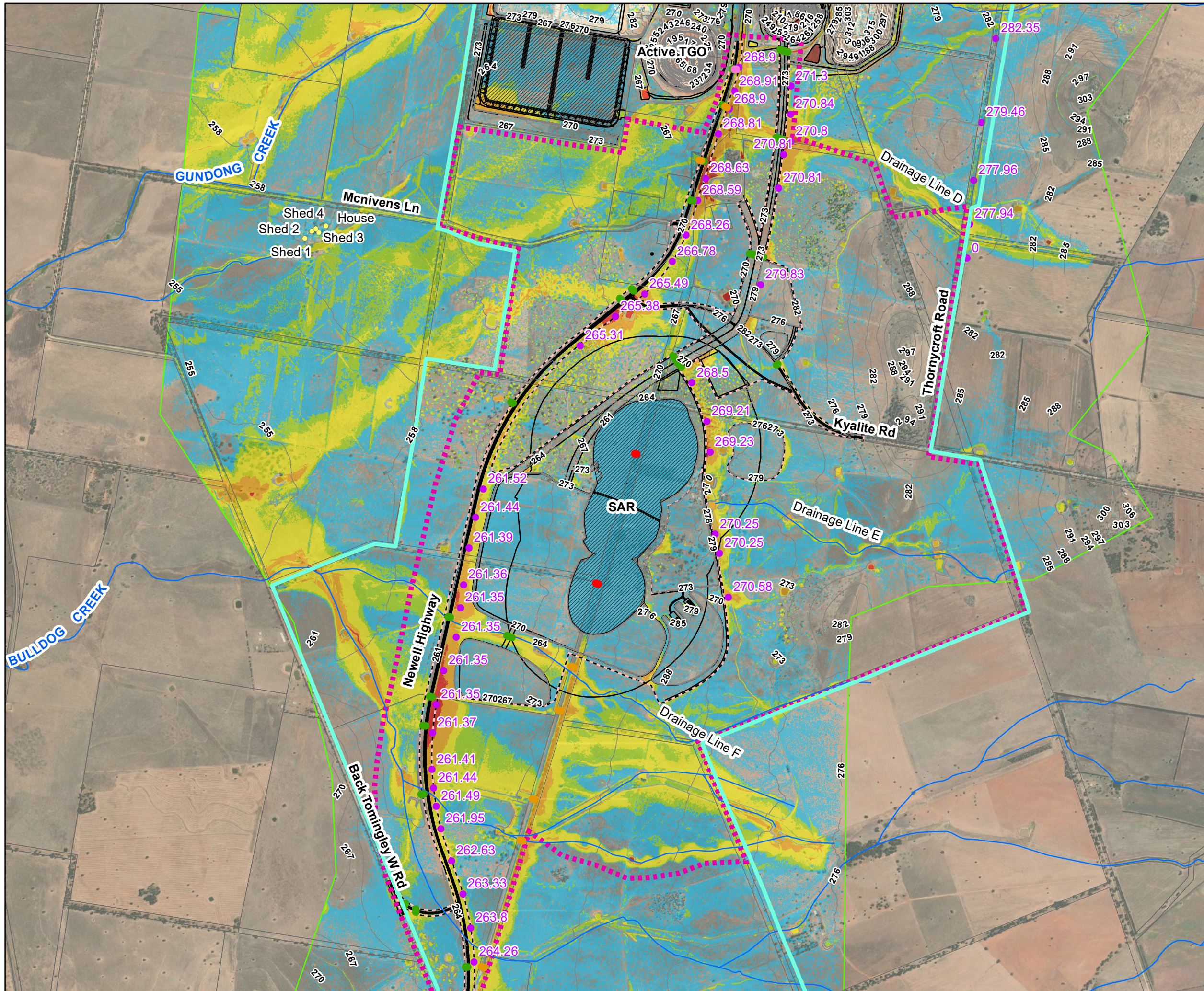
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
 Originator: RK
 Checker: SC
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Figure B2: 10% AEP Peak Depth and Peak Water Level - Design Case



LEGEND

- Shed and House Location
- Spot Flood Level (mAHD)
- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- Water Level (mAHD)
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

N

0 250 500 1,000
Meters

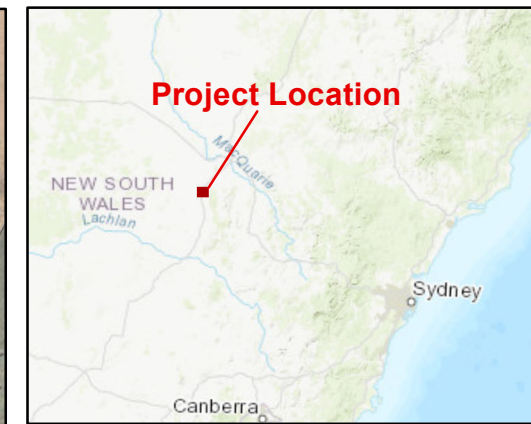
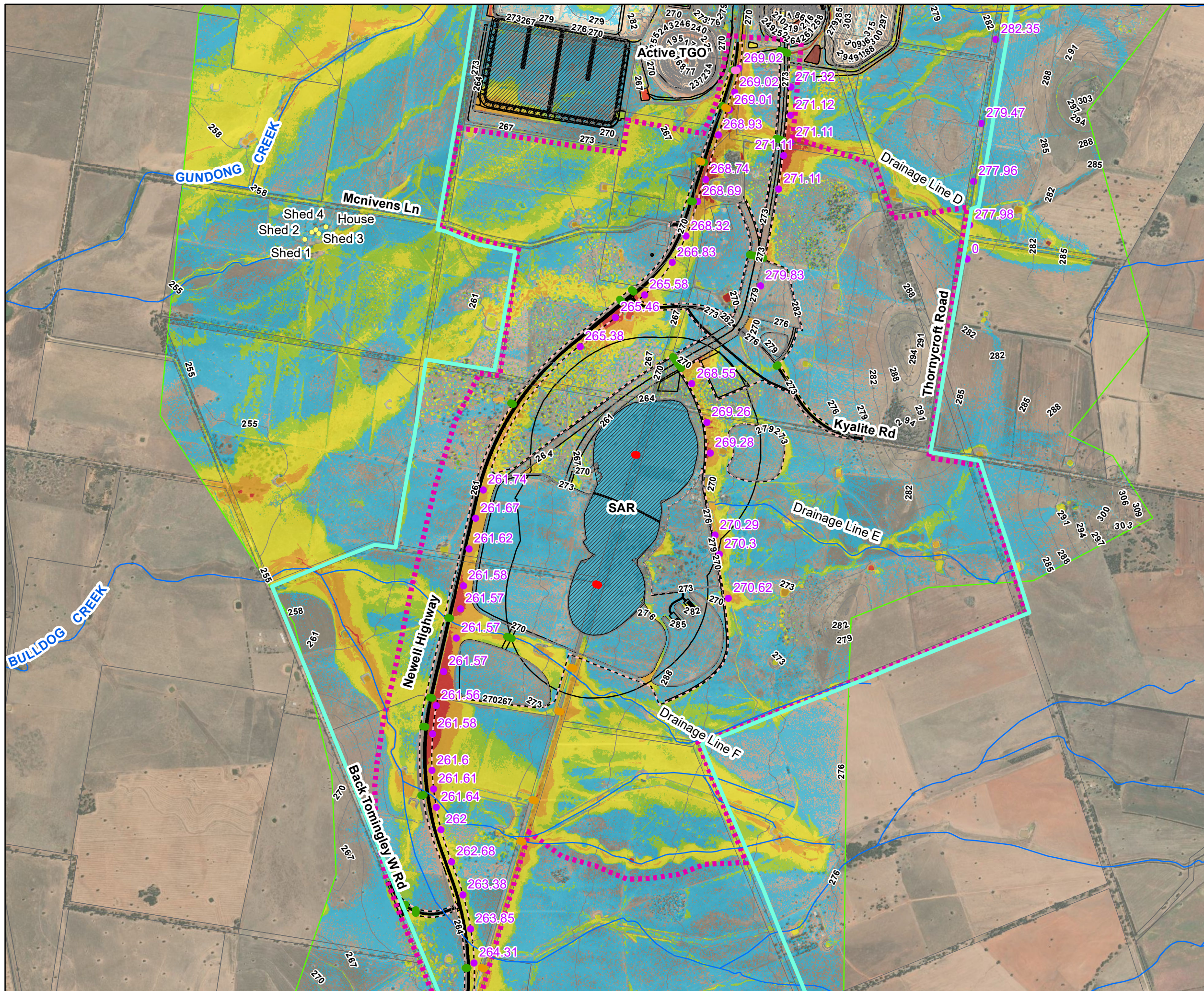
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B3: 5% AEP Peak Depth and Peak Water Level - Design Case



LEGEND

- Shed and House Location
- Spot Flood Level (mAHD)
- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- Water Level (mAHD)
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

N

0 250 500 1,000
Meters

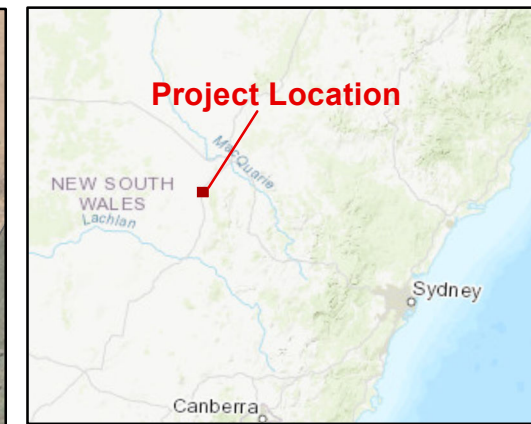
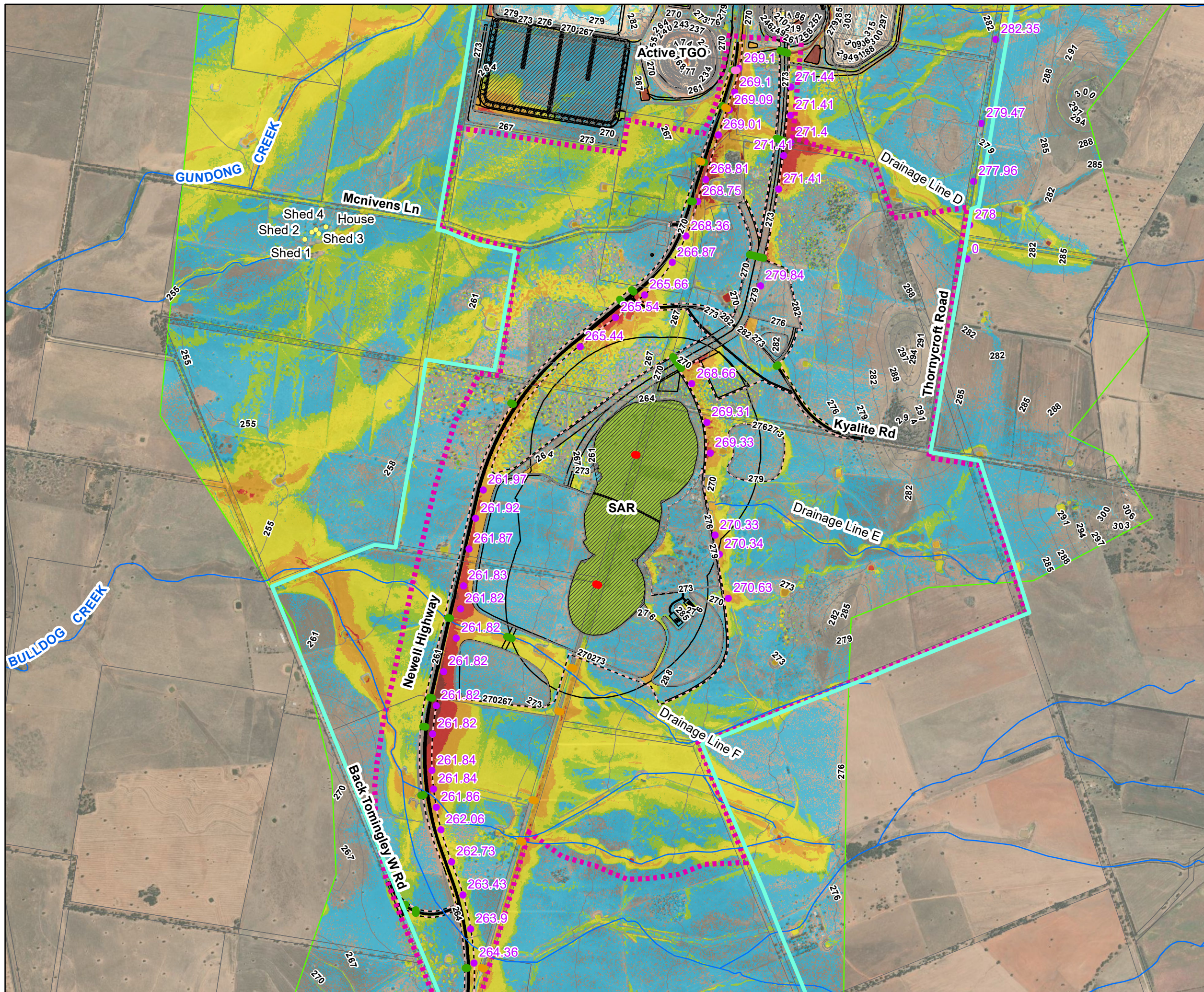
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B4: 2% AEP Peak Depth and Peak Water Level - Design Case



LEGEND

- Shed and House Location
- Spot Flood Level (mAHD)
- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- Water Level (mAHD)
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

N

0 250 500 1,000
Meters

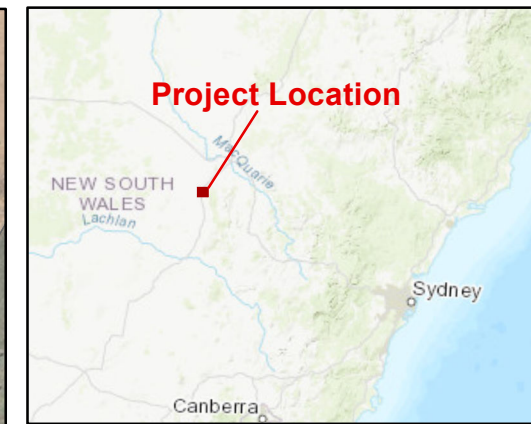
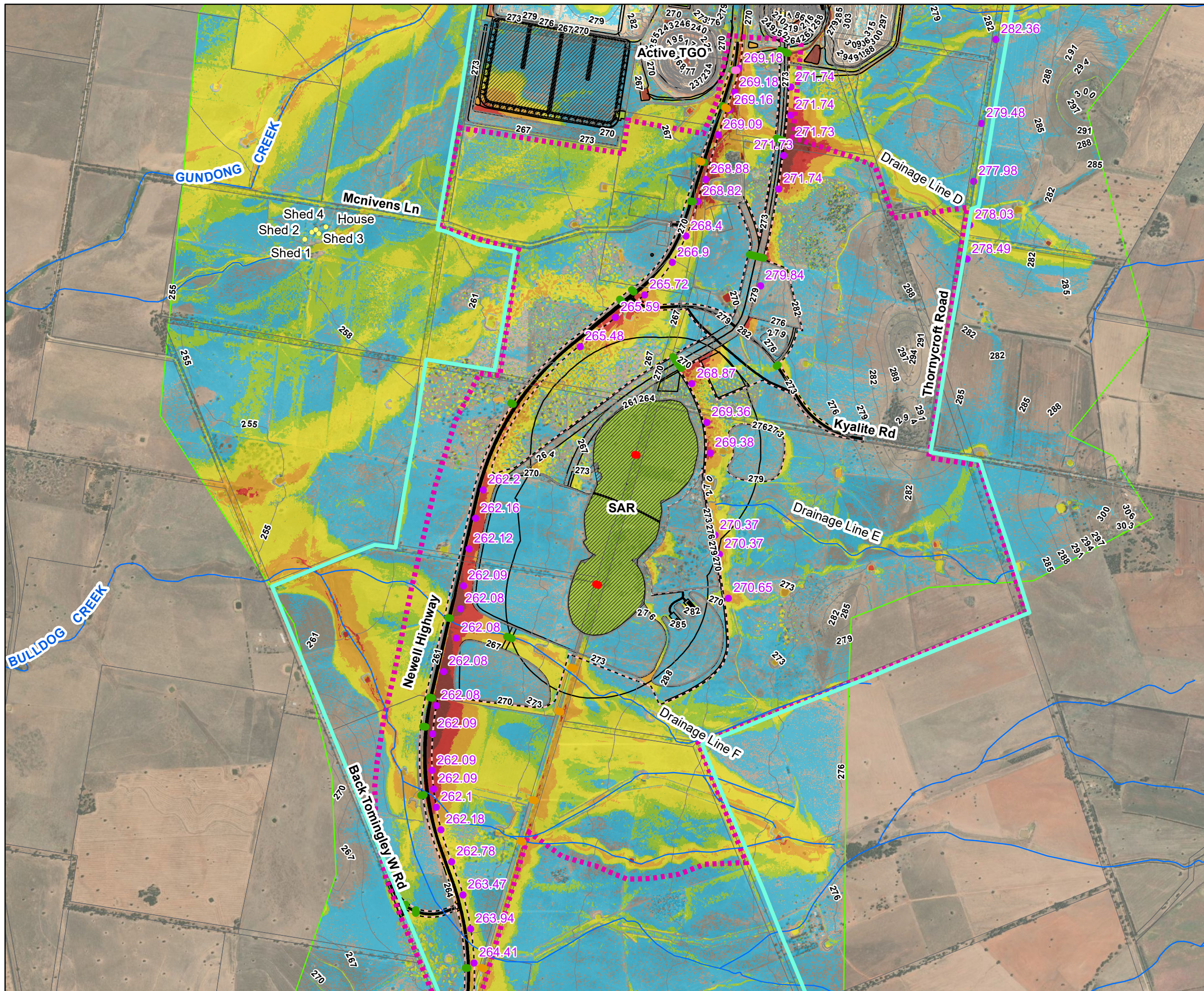
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B5: 1% AEP Peak Depth and Peak Water Level - Design Case



LEGEND

- Shed and House Location
- Spot Flood Level (mAHD)
- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- Water Level (mAHD)
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

N

0 250 500 1,000
Meters

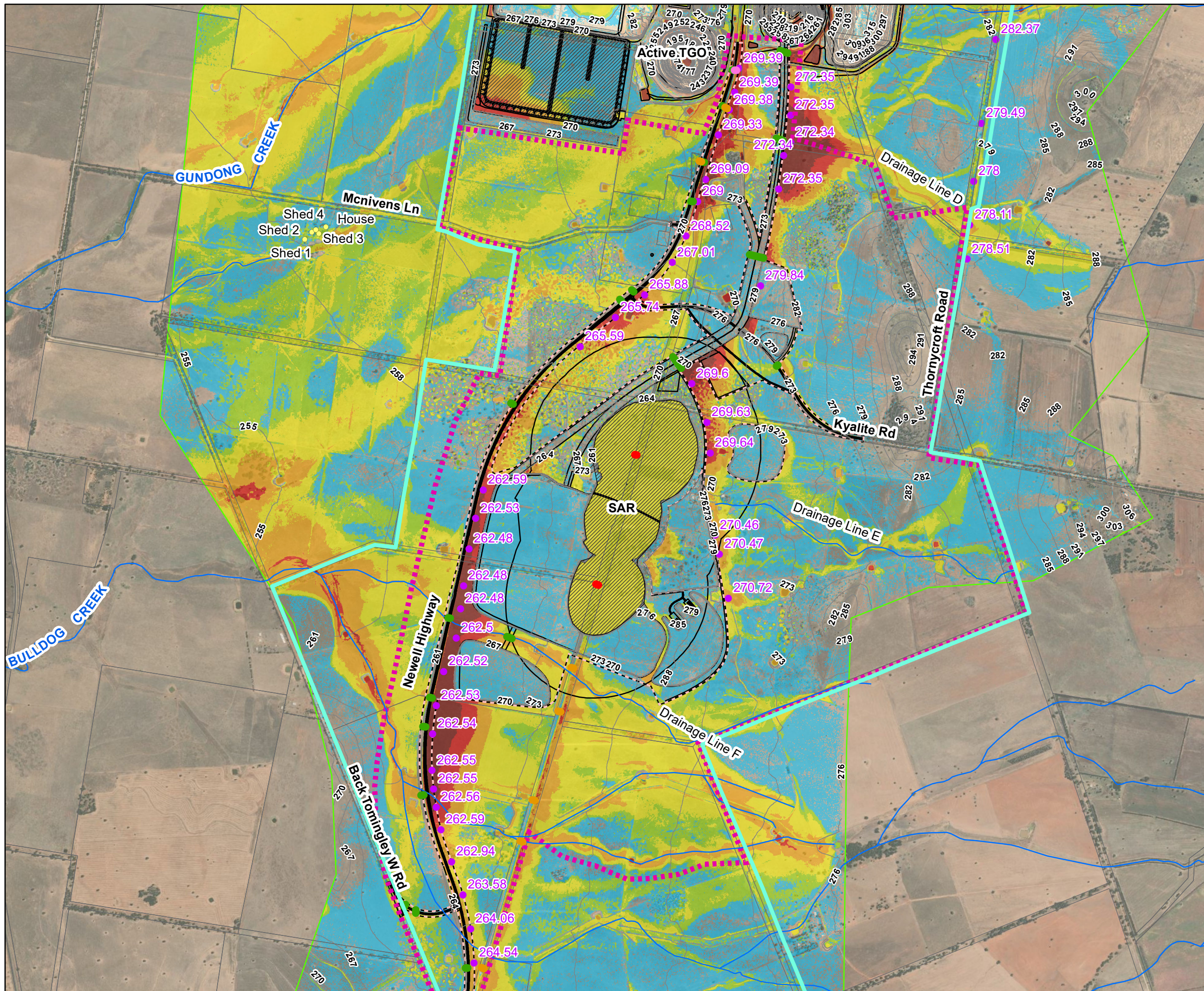
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B6: 0.1% AEP Peak Depth and Peak Water Level - Design Case

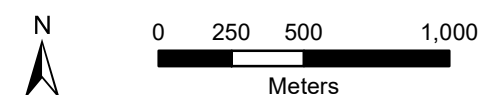


LEGEND

- Shed and House Location
- Spot Flood Level (mAHD)
- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- Water Level (mAHD)
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- 1.0 - 1.5
- > 1.5

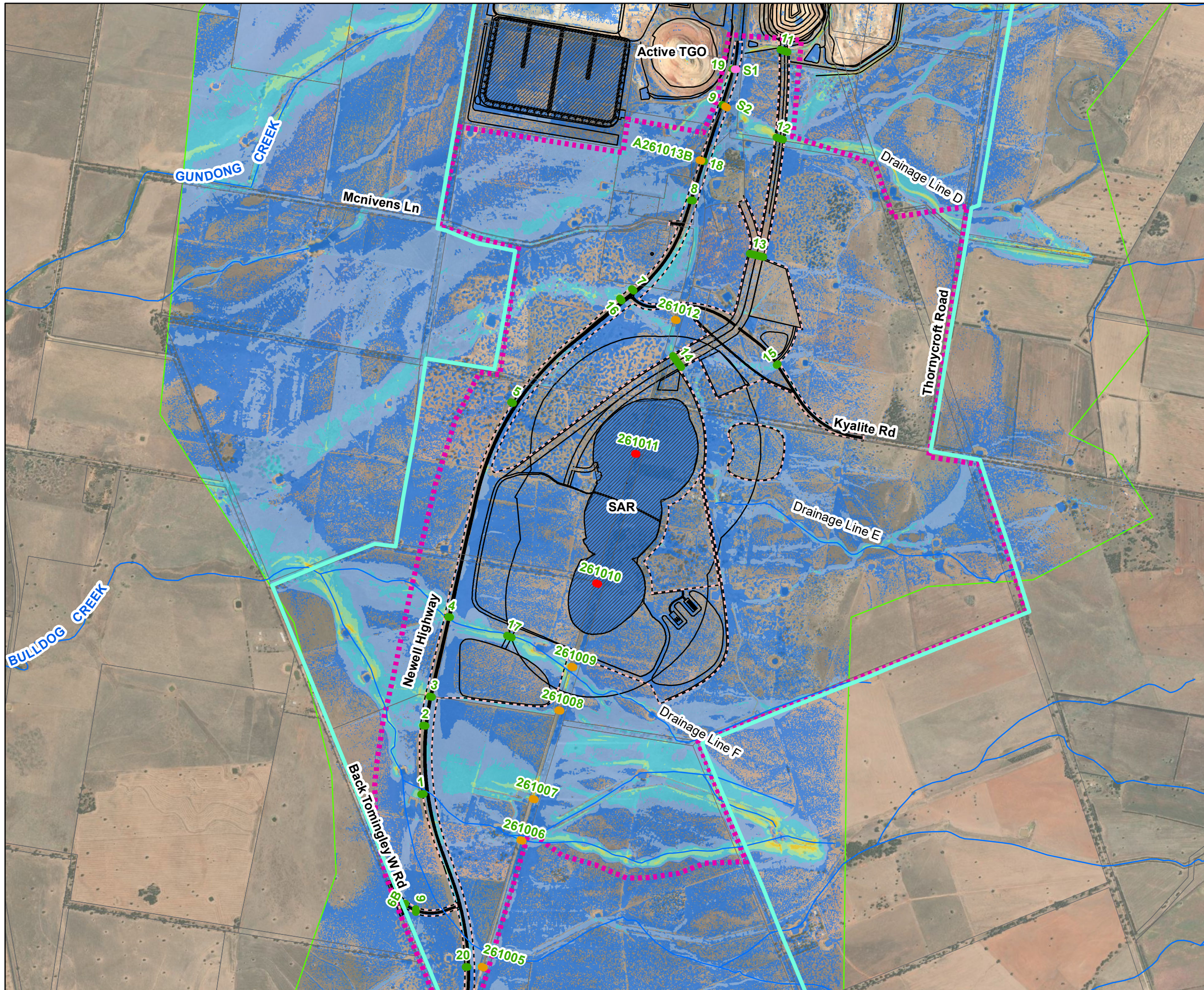


GDA 1994 MGA Zone 55 1:26,000
 Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B7: 20% AEP Peak Velocity - Design Case

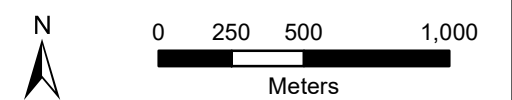


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastrate
- Model Extent

Velocity (m/s)

- <math>< 0.2</math>
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

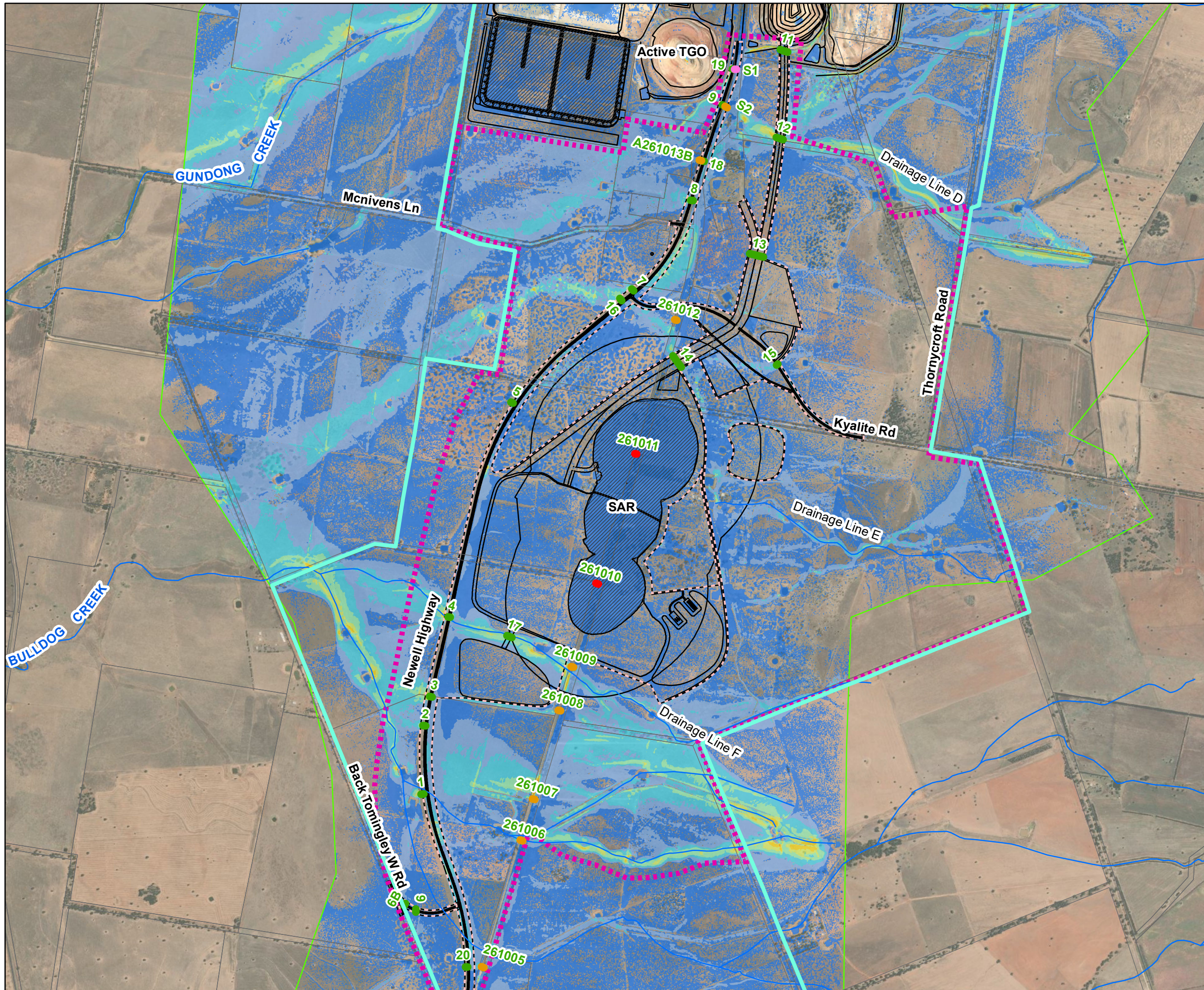


GDA 1994 MGA Zone 55 1:26,000
 Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B8: 10% AEP Peak Velocity - Design Case

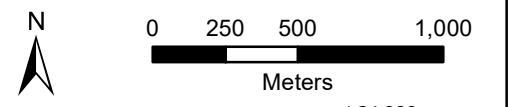


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- - - Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

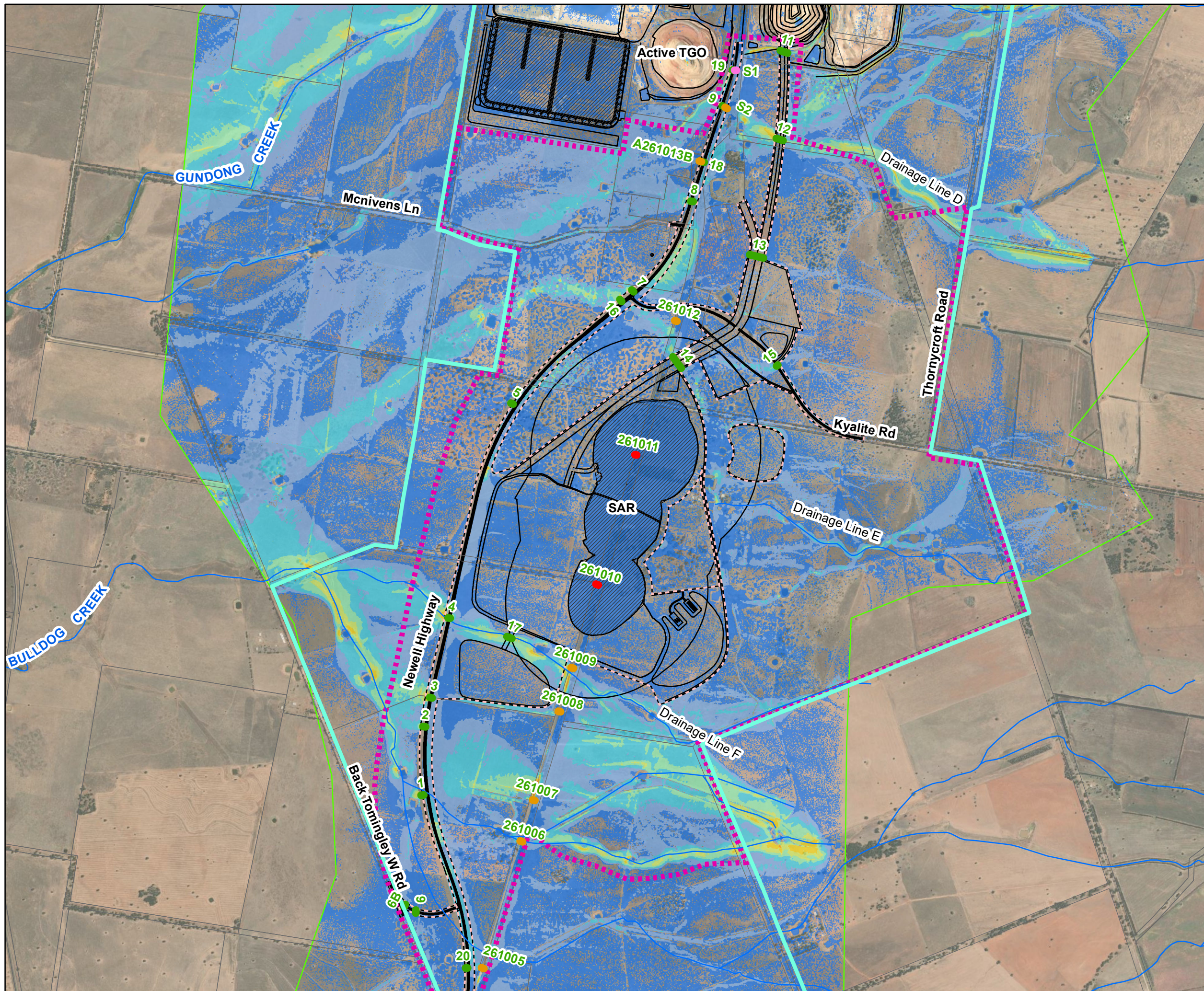


GDA 1994 MGA Zone 55
 Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B9: 5% AEP Peak Velocity - Design Case

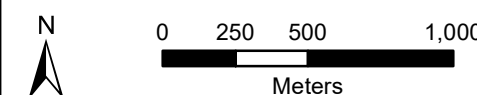


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

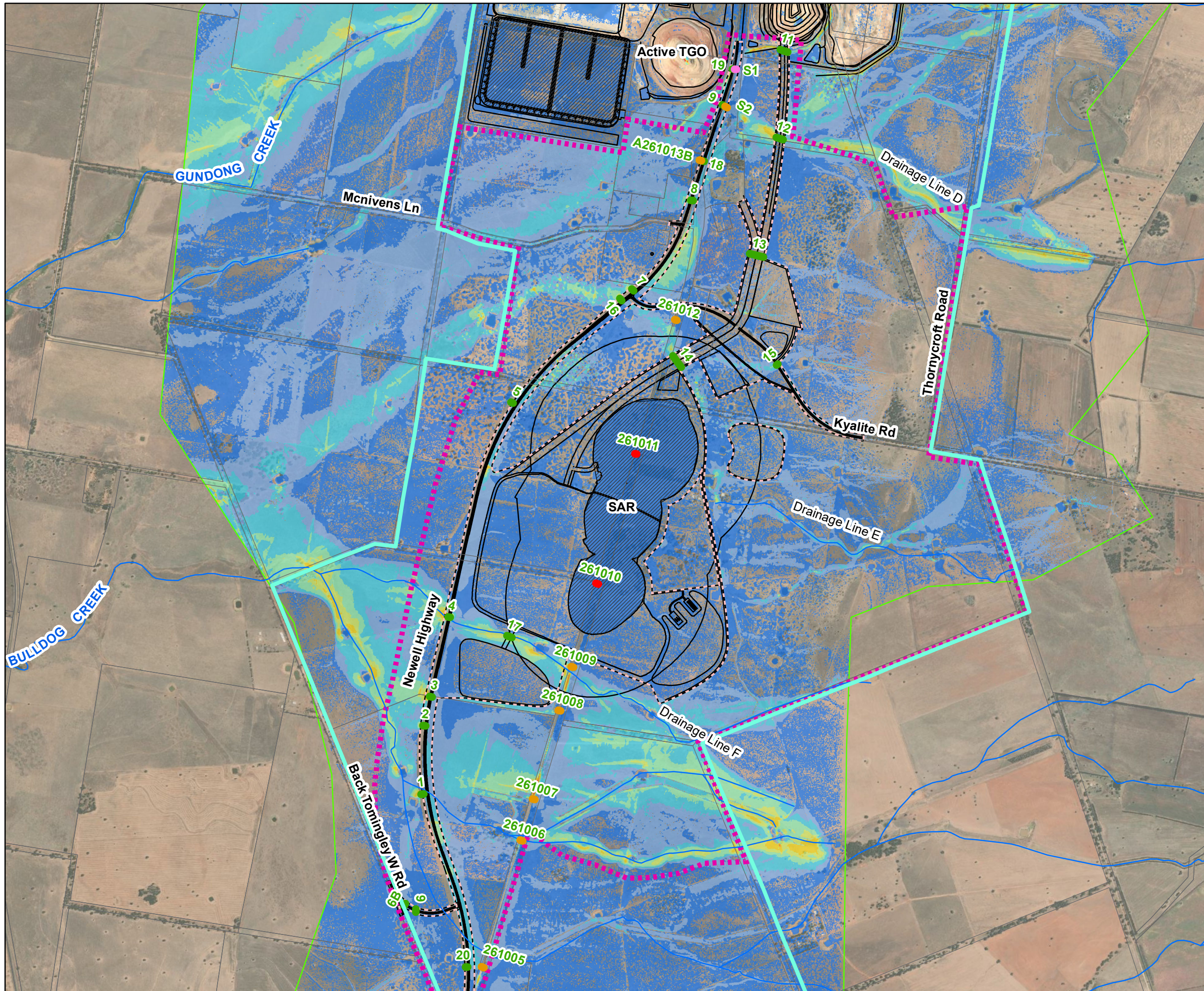


GDA 1994 MGA Zone 55 1:26,000
 Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B10: 2% AEP Peak Velocity - Design Case



LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 250 500 1,000
Meters

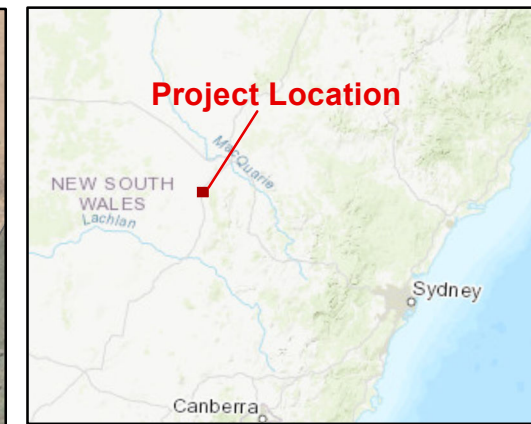
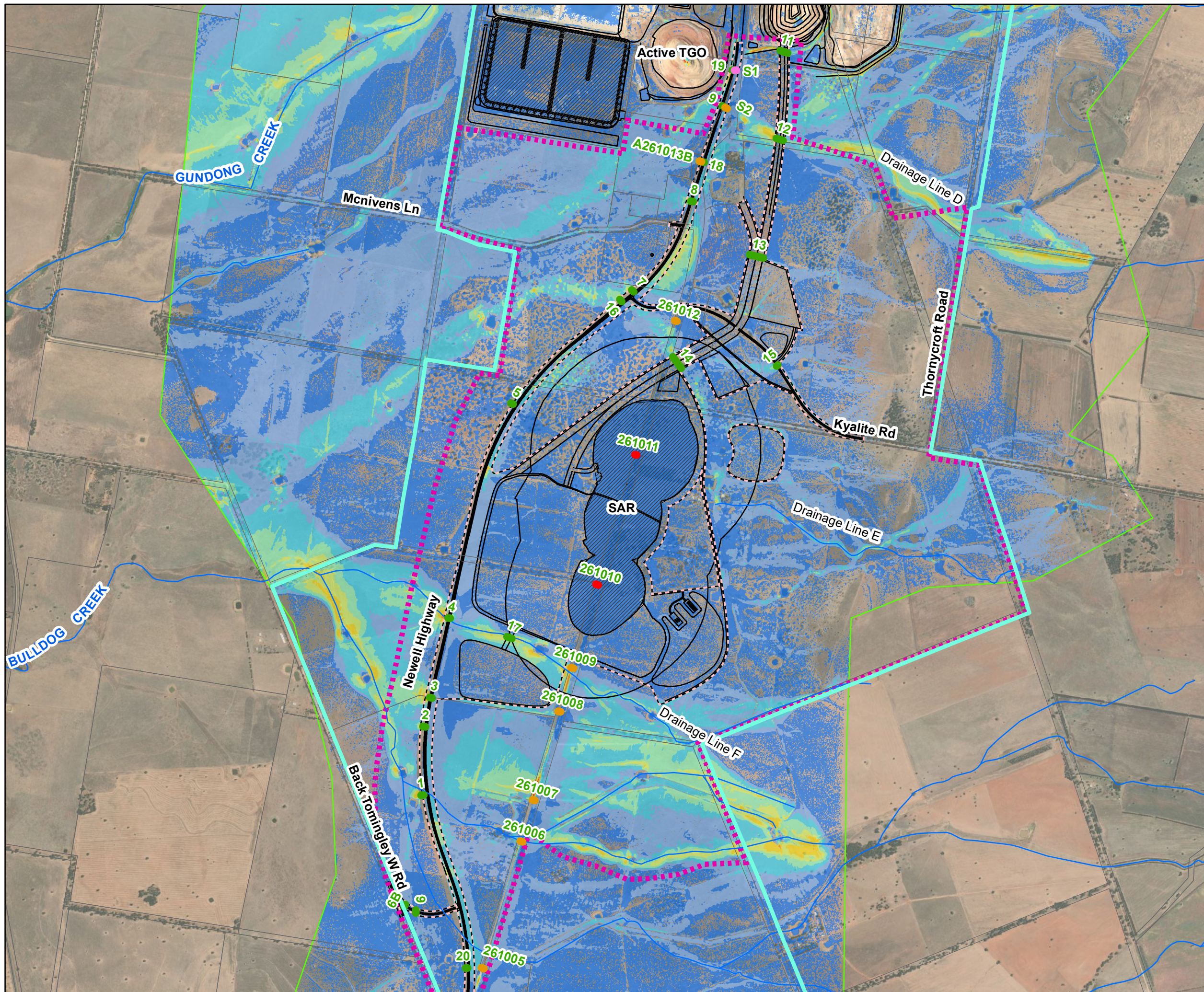
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
Originator: RK
Checker: SC
Date: September 2021

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Figure B11: 1% AEP Peak Velocity - Design Case



LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0

N

0 250 500 1,000
Meters

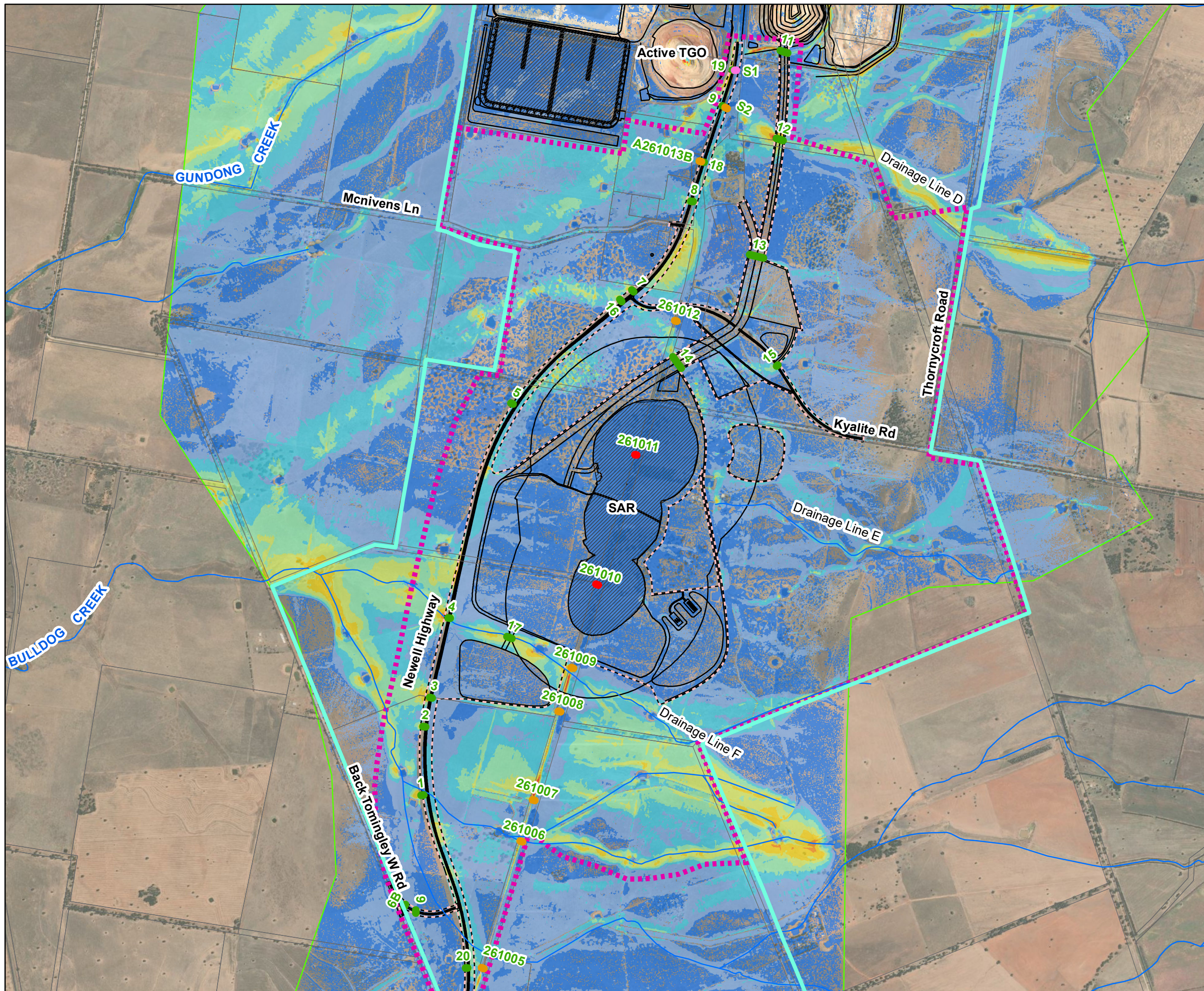
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure B12: 0.1% AEP Peak Velocity - Design Case

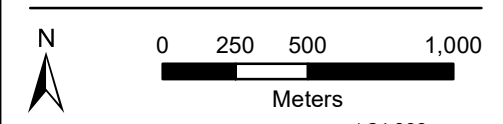


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- - - Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Velocity (m/s)

- < 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- > 2.0



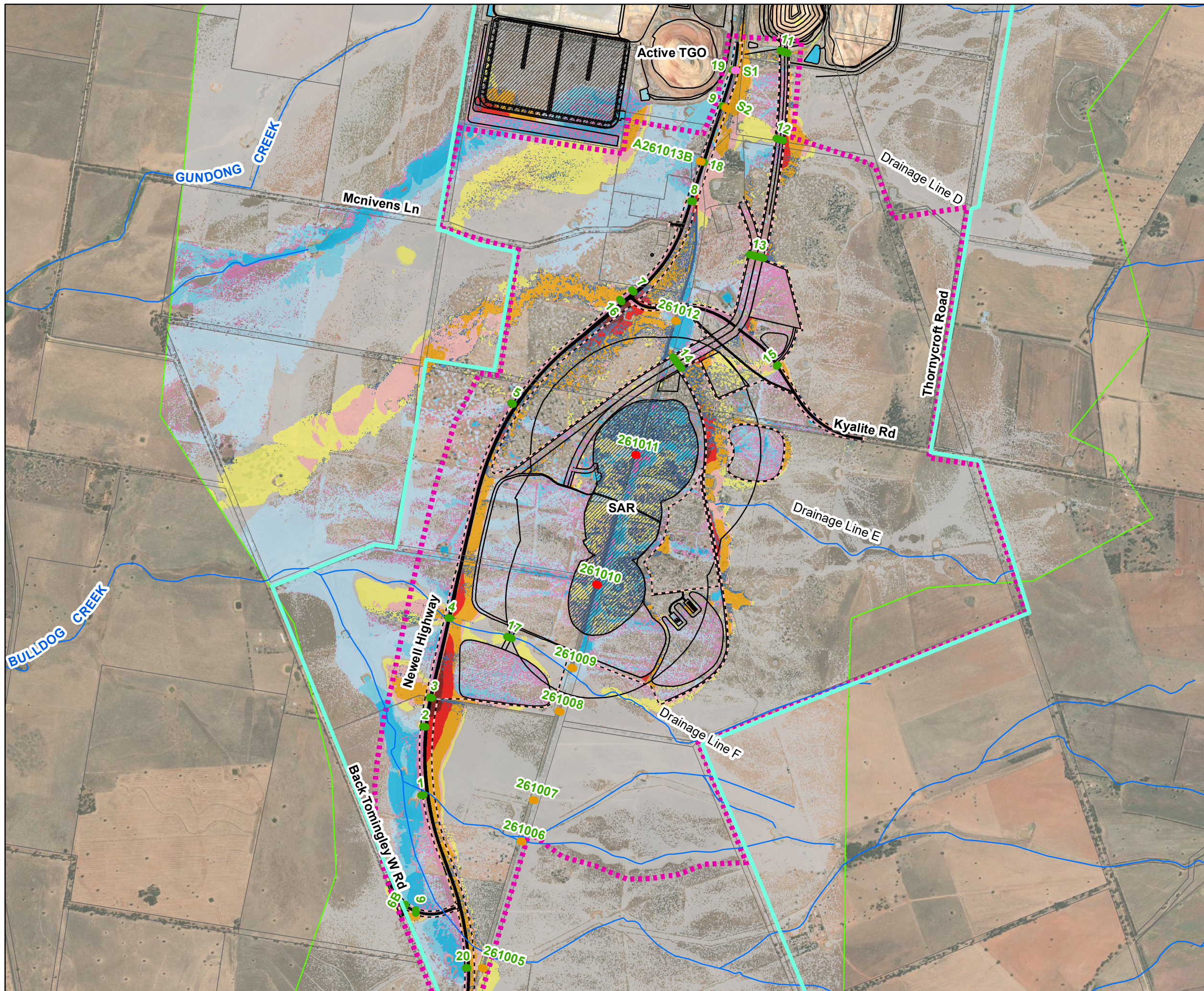
Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Appendix C. Flood Maps Difference in Flood level

Figure C1: 20% AEP Flood Level Difference - Design vs Existing

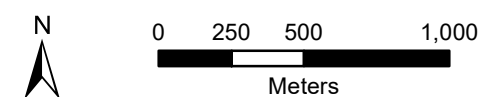


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

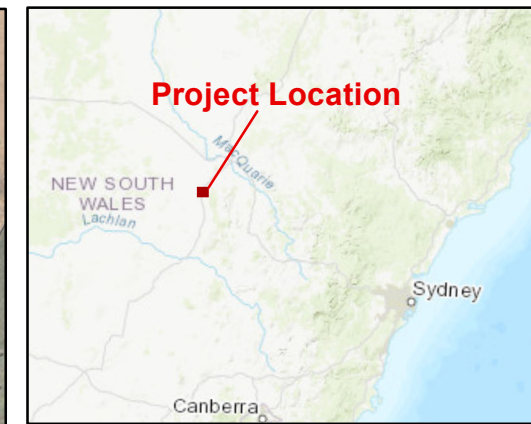
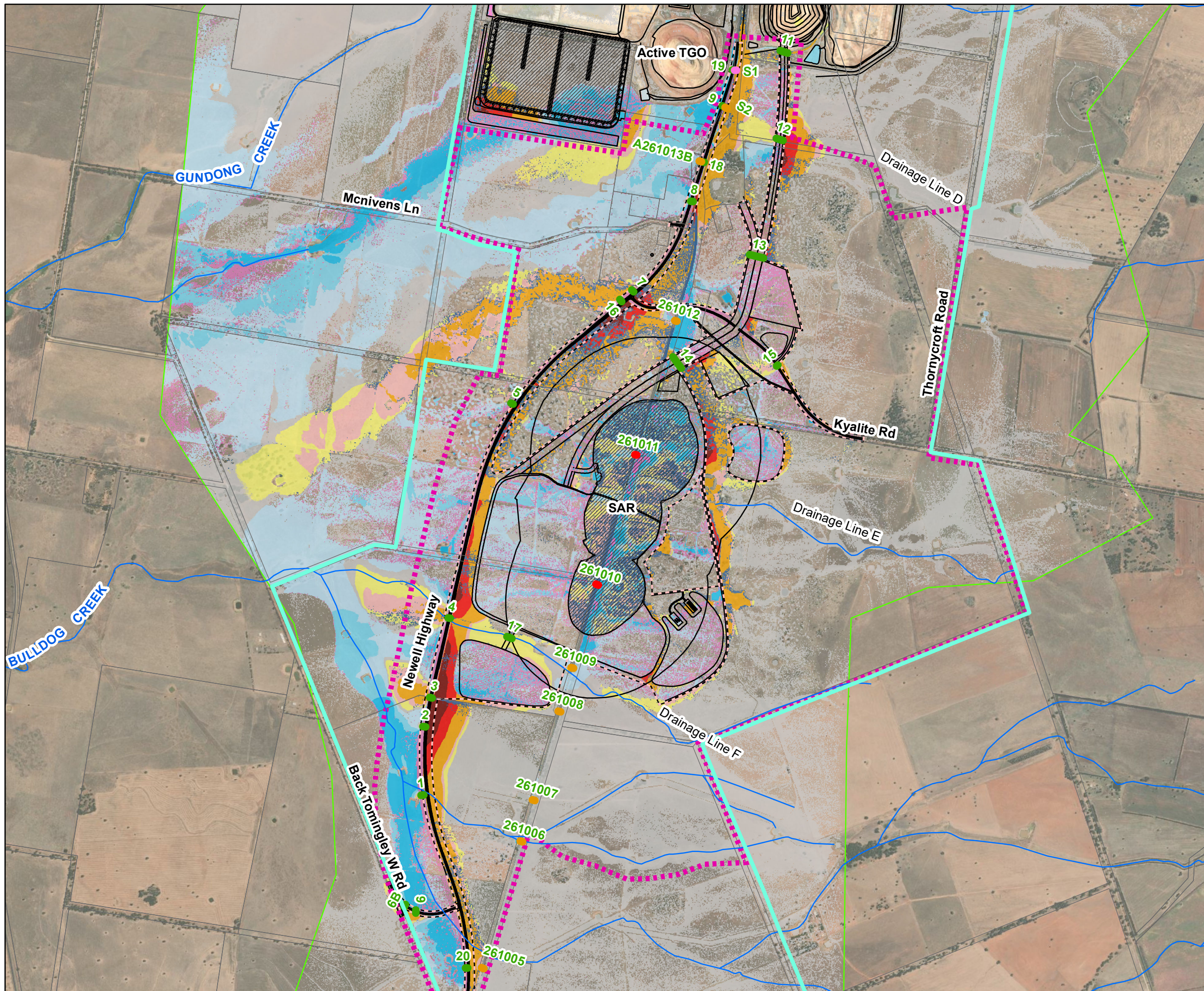


Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C2: 10% AEP Flood Level Difference - Design vs Existing



LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

N

0 250 500 1,000
Meters

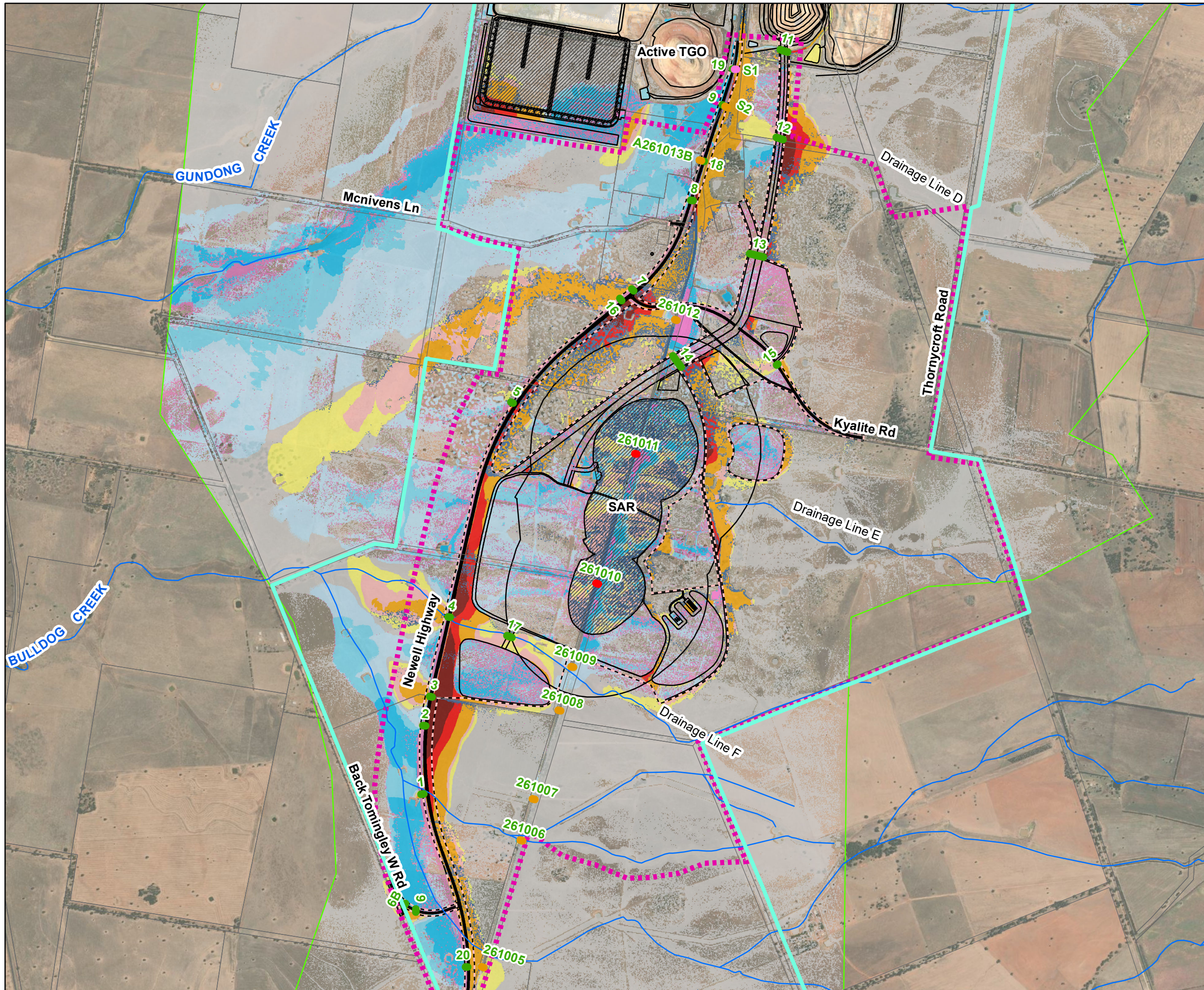
GDA 1994 MGA Zone 55 1:26,000

Model Name: D033
Originator: RK
Checker: SC
Date: September 2021

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Figure C3: 5% AEP Flood Level Difference - Design vs Existing

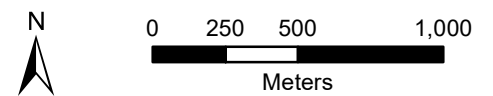


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

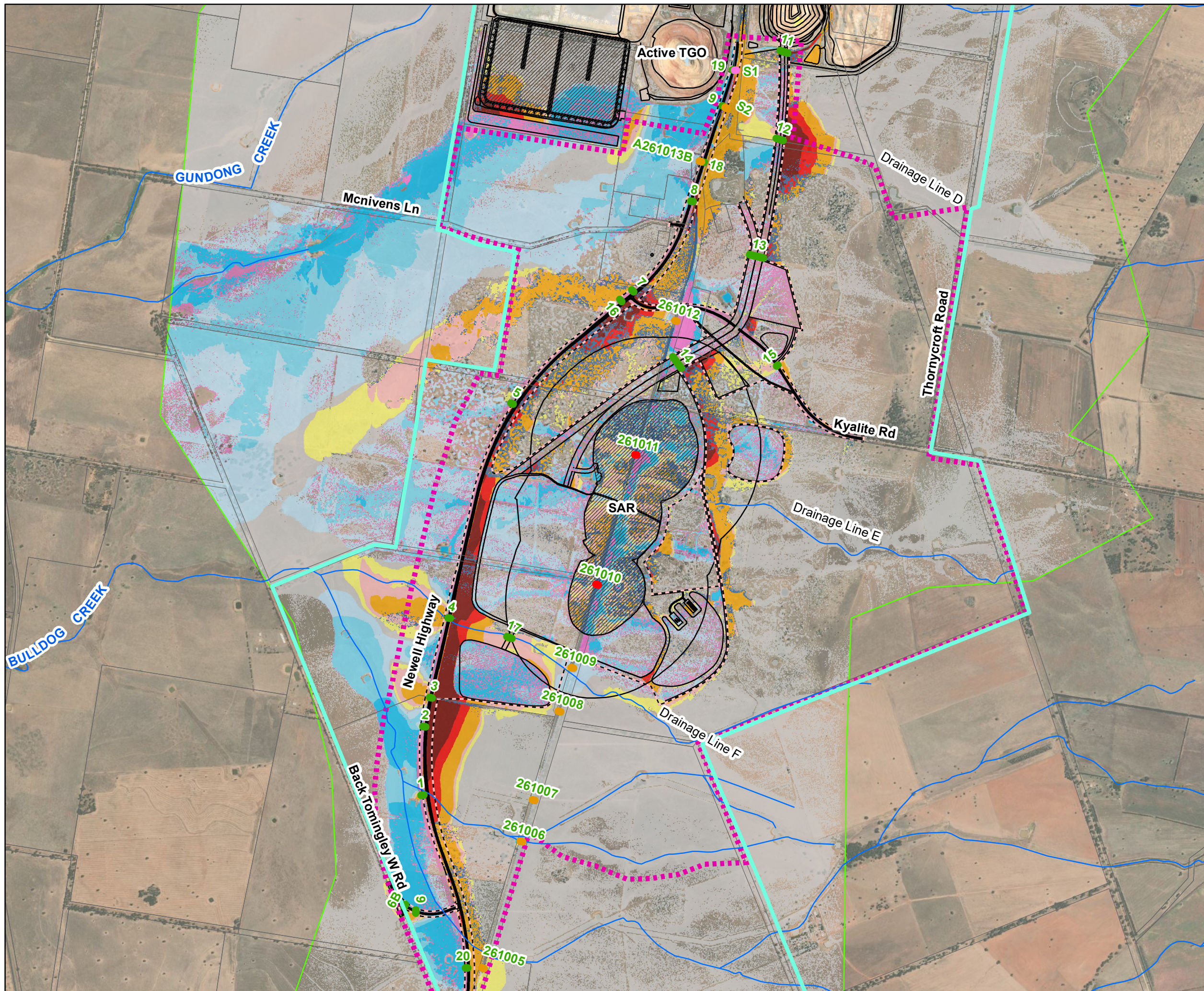


Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C4: 2% AEP Flood Level Difference - Design vs Existing

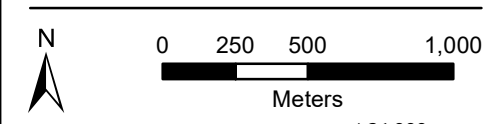


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- - - Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

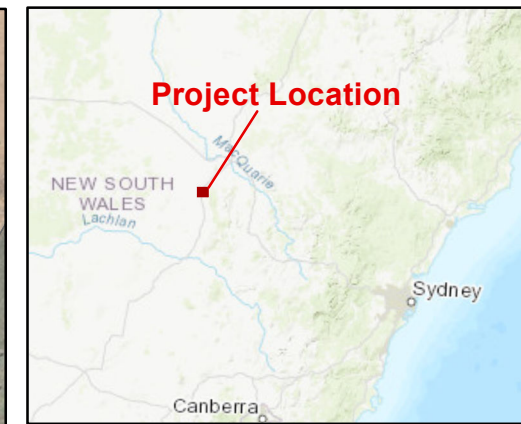
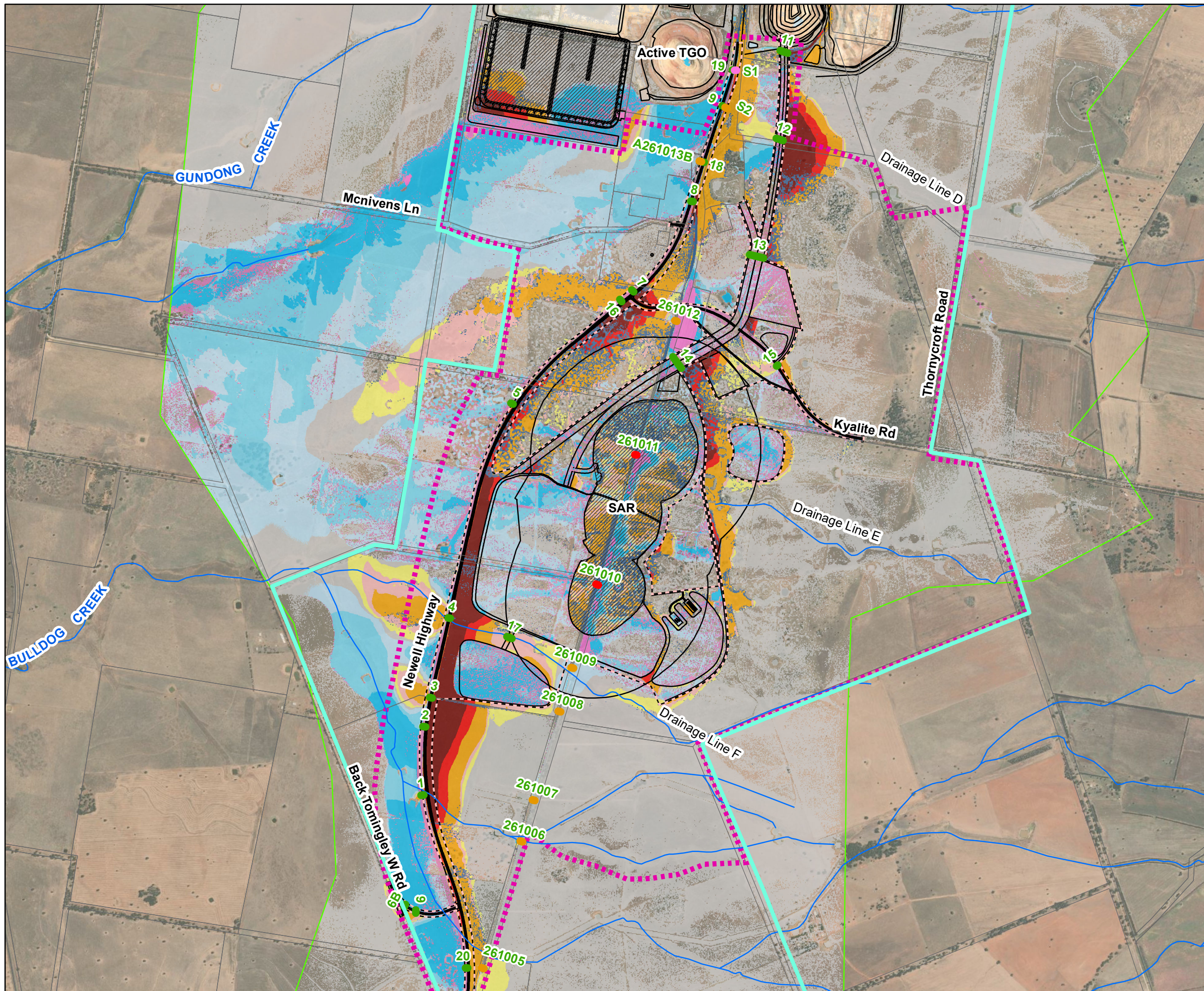


Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C5: 1% AEP Flood Level Difference - Design vs Existing

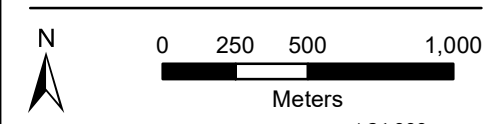


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- - - Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

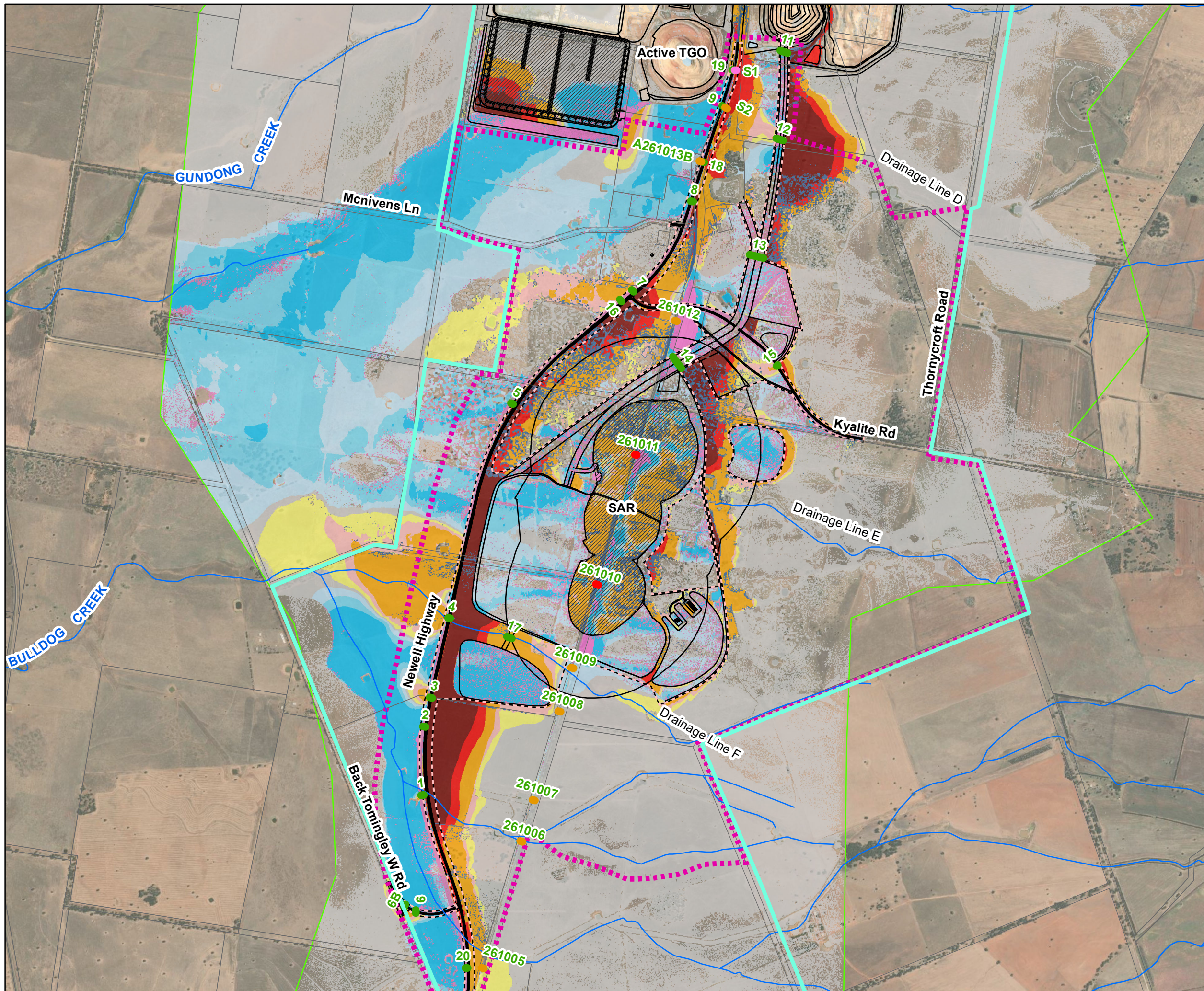


GDA 1994 MGA Zone 55 1:26,000
 Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C6: 0.1% AEP Flood Level Difference - Design vs Existing

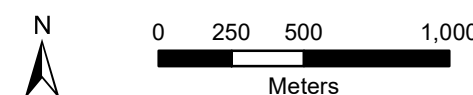


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

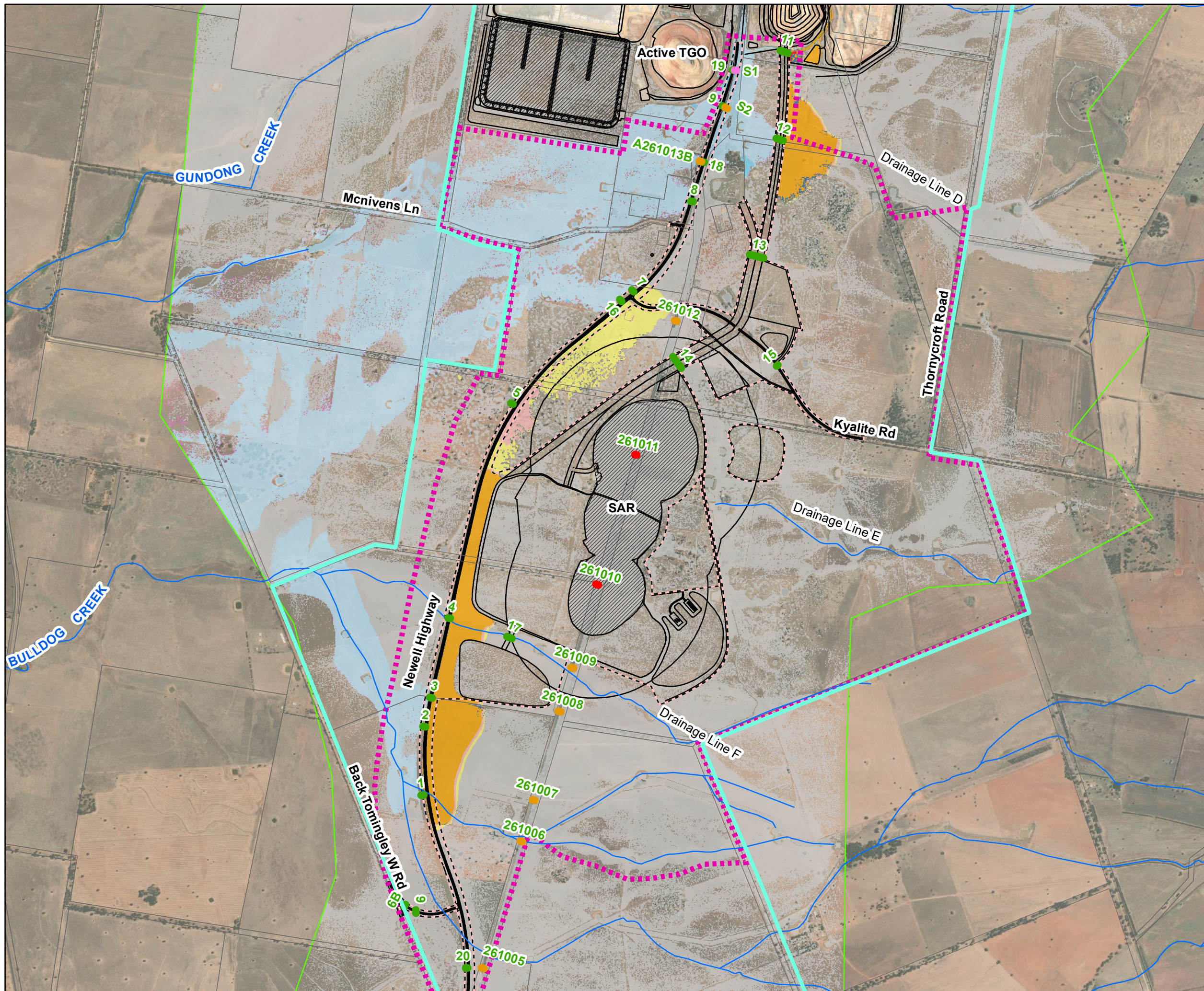


GDA 1994 MGA Zone 55 1:26,000
 Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C7: 5% AEP Flood Level Difference - Blockage vs No Blockage - Newell Highway

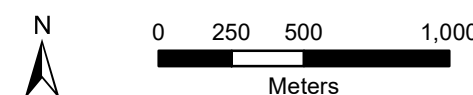


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

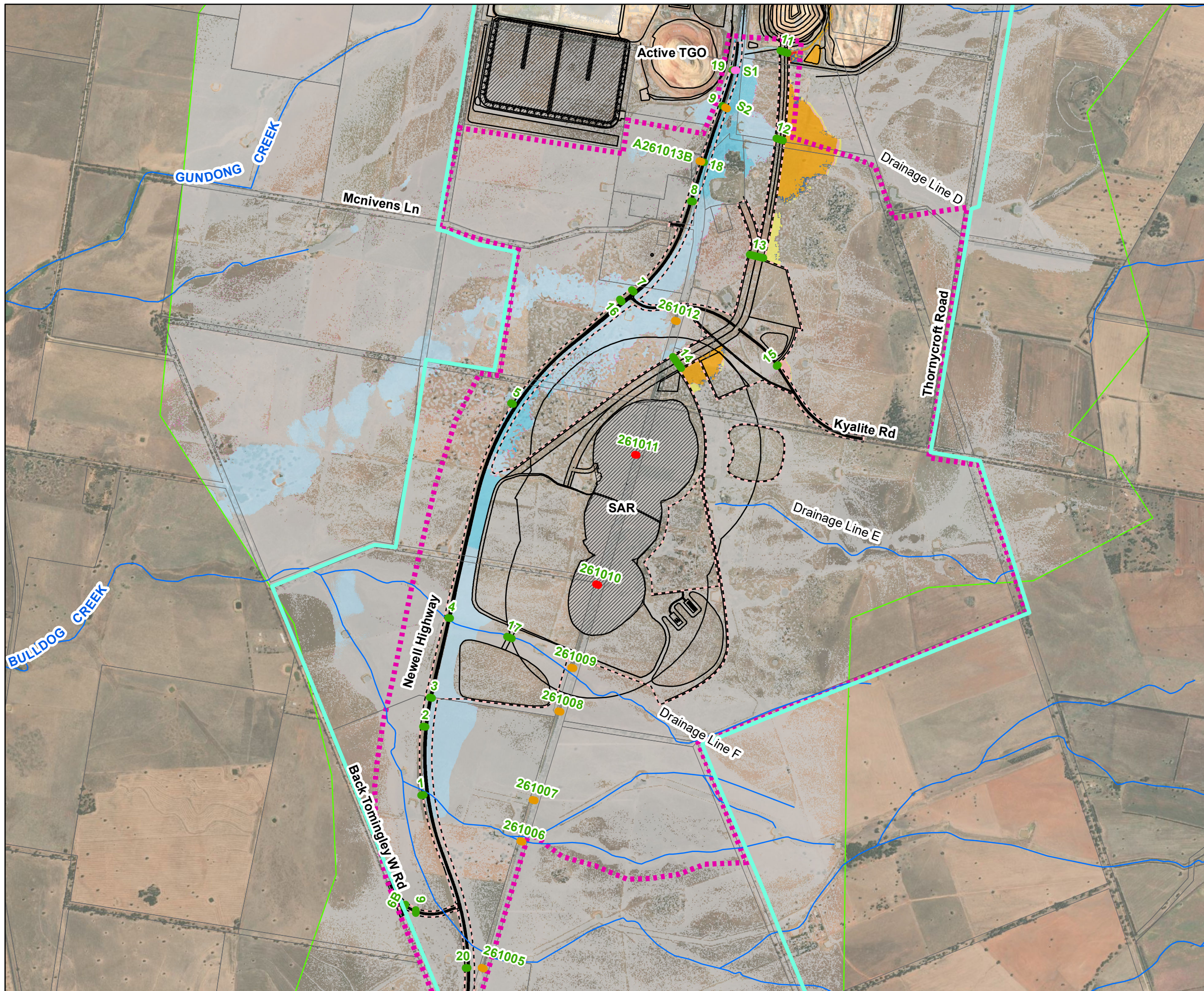


GDA 1994 MGA Zone 55
 Model Name: D031
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C8: 5% AEP Flood Level Difference - Blockage vs No Blockage - Local Roads

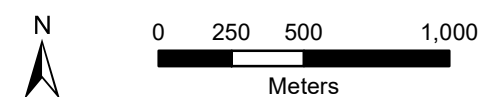


LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

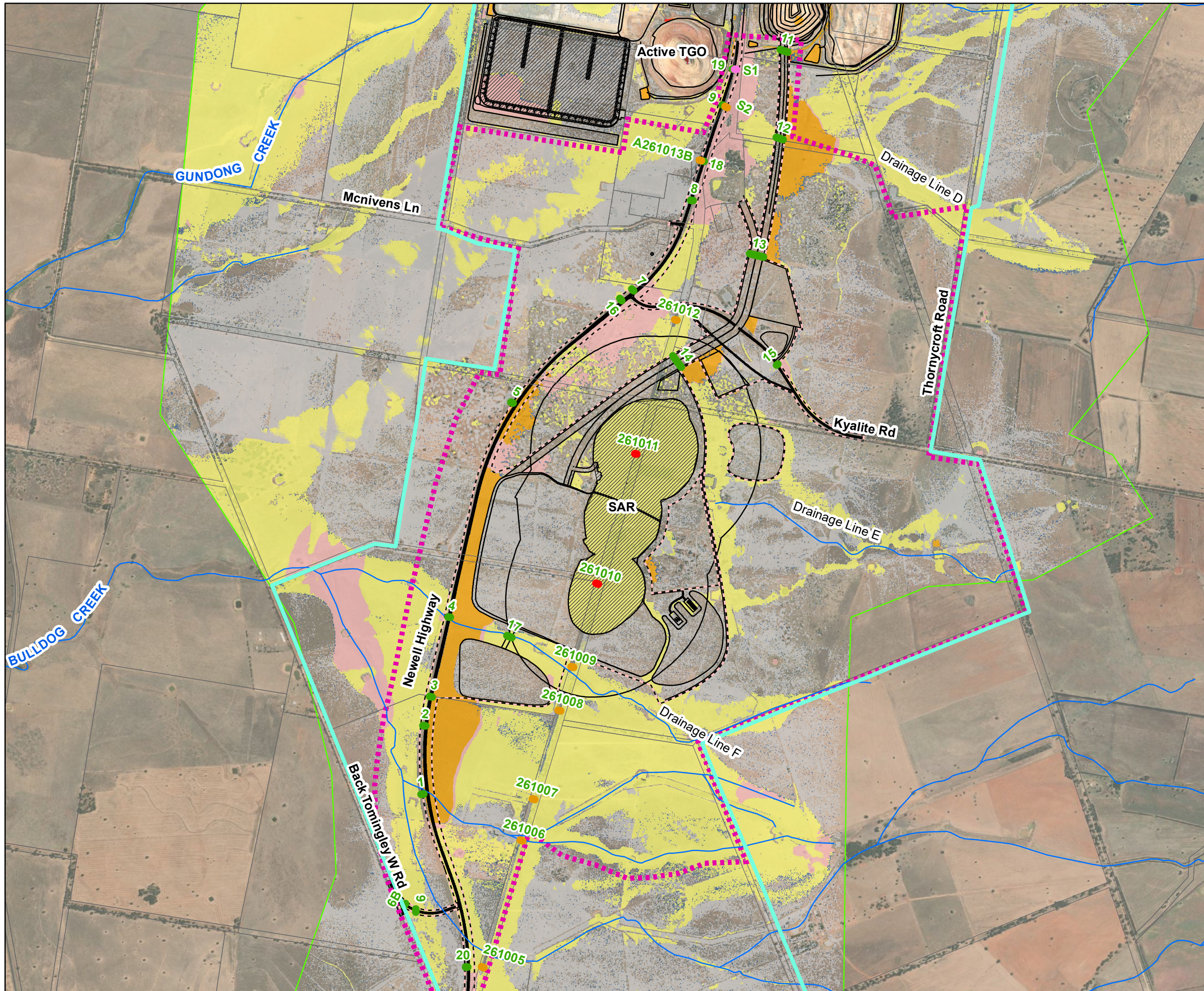


Model Name: D033
 Originator: RK
 Checker: SC
 Date: September 2021

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Figure C9: 5% AEP Flood Level Difference - Climate Change RCP 8.5 vs No Climate Change



LEGEND

- Limit of Alkane Controlled Land
- Watercourse
- Demolished Culverts
- New Culverts
- Retained Culverts
- Upgraded Culverts
- - - Limit of Disturbance
- Proposed Layout
- SAR Infrastructure Area
- Not Assessed
- Cadastre
- Model Extent

Afflux (mm)

- Was wet now dry
- < -100
- 100 to -50
- 50 to -10
- 10 to 10
- 10 to 50
- 50 to 100
- 100 to 500
- 500 to 800
- > 800
- Was dry now wet

N

0 250 500 1,000
Meters

GDA 1994 MGA Zone 55 1:26,000

Model Name: D031
Originator: RK
Checker: SC
Date: September 2021

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Appendix D. XP-RAFTS Inputs

Catchment Name	Area (ha)	Slope (%)
A-1	654.8	2.13
A-2	516.9	1.01
A-3	864.1	0.75
A-4	1046.4	0.33
A-5	920.4	1.67
A-6	243.0	0.51
B-1	1374.1	2.51
B-2	560.9	1.35
B-3	520.0	1.62
B-4	1154.4	1.90
B-5	574.0	0.59
B-6	651.4	0.32
B-7	432.8	0.25
G-1	1942.5	1.91
G-2	1543.8	1.80
G-3	724.0	2.97
G-4	1829.1	1.44
G-5	1304.6	0.75
G-6	64.1	0.44
G-7	733.5	1.16
G-8	83.3	0.77
G-9	267.1	0.76
G-10	103.2	0.12
G-11	770.7	0.41

Catchment Name	Area (ha)	Slope (%)
S-1	187.7	1.04
S-2	271.3	0.58
S-3	425.8	0.93
S-4	248.5	0.60
S-5	739.5	0.40
S-6	207.9	1.16

APPENDIX 5: Intersection Design Calculations

5.3 Stopping Sight Distance (SSD)

Stopping Sight Distance (SSD) is the distance to enable a normally alert driver, travelling at the design speed on wet pavement, to perceive, react and brake to a stop before reaching a hazard on the road ahead.

SSD is derived from two components:

1. the distance travelled during the total reaction time
2. the distance travelled during the braking time from the design speed to a stop and their relationship is shown in Equation 1.

$$SSD = \frac{R_T V}{3.6} + \frac{V^2}{254(d + 0.01a)} \quad 1$$

where

- R_T = reaction time (sec)
- V = operating speed (km/h)
- d = coefficient of deceleration (longitudinal friction factor)
- a = longitudinal grade (% , + for upgrades and – for downgrades)

Values of R_T and d must be assumed in order to compute the values of SSD appropriate to a specified initial speed; these can be obtained from Table 5.2 and Table 5.3 respectively.

Rt	2.5
V	120
d	0.29
a	0
SSD	278.8261

Table 5.3: Design domain for coefficient of deceleration

Vehicle type	Coefficient of deceleration (d)	Driver/road capability	Typical use
Cars	0.61 ⁽¹⁾	Braking on dry, sealed roads.	Specific applications where the normal stopping sight distance criteria applied to horizontal curves produce excessive lateral offsets to roadside barriers/structures – refer Section 5.5 (used in conjunction with supplementary manoeuvre capability).
	0.46 ⁽¹⁾	Mean value for braking on wet, sealed roads for a hazard. Maximum values when decelerating at an intersection.	Maximum value for calculating absolute minimum stopping sight distance. Only to be used in constrained locations, typically on: <ul style="list-style-type: none"> • lower volume roads • less important roads • mountainous roads • lower speed urban roads • sighting over or around barriers • tunnels.
	0.36	About a 90th percentile value for braking on wet, sealed roads. Maximum value allowed for deceleration lanes at intersections.	Desirable value for calculating minimum stopping sight distance for most urban and rural road types, and level crossings.
	0.26	Comfortable deceleration on sealed roads. Normal driving event.	Not to be used without the approval of the relevant road agency (refer to Section 5.3.1). This value may be adopted for stopping sight distance for major highways and freeways in flat terrain, and for deceleration in turn lanes at intersections. Its use can lead to an unnecessarily high standard and expensive design in undulating or hilly terrain. Maximum value for calculation of horizontal curve perception sight distance.
	0.27	Braking on unsealed roads.	Used to determine stopping sight distance on unsealed roads. This value is very dependent on the surface material and should be verified where possible.
Trucks	0.29 ⁽¹⁾	Braking by single unit trucks, semi-trailers and B-doubles on dry, sealed roads. Minimum value required by vehicle standards regulations.	Maximum value for calculating truck stopping sight distance for most urban and rural road types, and level crossings.
Buses	0.15		Desirable braking to ensure passenger comfort approaching a bus stop.

¹ For any horizontal curve with a side friction factor greater than the desirable maximum value, the coefficient of deceleration should be reduced by 0.05. For tunnels, a maximum coefficient of deceleration of 0.46 may be applied along the length of a tunnel with the exception of the 200 m length from the portal entries, where a coefficient of deceleration of 0.36 is used.

Table 5.2: Driver reaction times

Reaction time R_T (s)	Typical road conditions	Typical use
2.5	<ul style="list-style-type: none"> • Unalerted driving conditions due to the road only having isolated geometric features to maintain driver interest • Areas with high driver workload/complex decisions • High speed roads with long distances between towns. 	Absolute minimum value for high speed roads with unalerted driving conditions. General minimum value for: <ul style="list-style-type: none"> • high speed rural freeways • high speed rural intersections • isolated alignment features.
2.0	<ul style="list-style-type: none"> • Higher speed urban areas • Few intersections • Alerted driving situations in rural areas • High speed roads in urban areas comprising numerous intersections or interchanges where the majority of driver trips are of relatively short length. 	Absolute minimum value for the road conditions listed in this row. General minimum value for most road types, including those with alert driving conditions.
1.5 ⁽¹⁾	Alert driving conditions e.g.: <ul style="list-style-type: none"> • high expectancy of stopping due to traffic signals • consistently tight alignments for example, mountainous roads • restricted low speed urban areas • built-up areas – high traffic volumes • interchange ramps when sighting over or around barriers. 	Absolute minimum value. Only used in very constrained situations where drivers will be alert. Can be considered only where the maximum operating speed is ≤ 90 km/h. Should not be used where other design minima have been used.

¹ A reaction time of 1.5 s cannot be used in Western Australia. Designers should refer to road agency supplements to confirm local practice.

3.2.2 Safe Intersection Sight Distance (SISD)

SISD is the minimum sight distance which should be provided on the major road at any intersection. Designers should note that the object height for the application of SISD has been increased to 1.25 m (previously driver eye height was used i.e. 1.1 m) based on research by the Department of Main Roads (Lennie et al. 2008). The basis of the 1.25 m object height for cars is that this height is 0.2 m less than the 15th percentile height of passenger cars (1.45 m) as determined by the study.

Equation 2 provides the formula for SISD:

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)}$$

where

SISD = safe intersection sight distance (m)

D_T = decision time (sec) = observation time (3 sec) + reaction time (sec) – refer to *AGRD Part 3 (Austroads 2016b)* for a guide to values

V = operating (85th percentile) speed (km/h)

d = coefficient of deceleration – refer to Table 3.3 and *AGRD Part 3* for a guide to values

a = longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade)

Dt	5.5
V	120
d	0.29
a	0
SISD	378.8261

Table 5.3: Design domain for coefficient of deceleration

Vehicle type	Coefficient of deceleration (d)	Driver/road capability	Typical use
Cars	0.61 ⁽¹⁾	Braking on dry, sealed roads.	Specific applications where the normal stopping sight distance criteria applied to horizontal curves produce excessive lateral offsets to roadside barriers/structures – refer Section 5.5 (used in conjunction with supplementary manoeuvre capability).
	0.46 ⁽¹⁾	Mean value for braking on wet, sealed roads for a hazard. Maximum values when decelerating at an intersection.	Maximum value for calculating absolute minimum stopping sight distance. Only to be used in constrained locations, typically on: <ul style="list-style-type: none"> • lower volume roads • less important roads • mountainous roads • lower speed urban roads • sighting over or around barriers • tunnels.
	0.36	About a 90th percentile value for braking on wet, sealed roads. Maximum value allowed for deceleration lanes at intersections.	Desirable value for calculating minimum stopping sight distance for most urban and rural road types, and level crossings.
	0.26	Comfortable deceleration on sealed roads. Normal driving event.	Not to be used without the approval of the relevant road agency (refer to Section 5.3.1). This value may be adopted for stopping sight distance for major highways and freeways in flat terrain, and for deceleration in turn lanes at intersections. Its use can lead to an unnecessarily high standard and expensive design in undulating or hilly terrain. Maximum value for calculation of horizontal curve perception sight distance.
	0.27	Braking on unsealed roads.	Used to determine stopping sight distance on unsealed roads. This value is very dependent on the surface material and should be verified where possible.
Trucks	0.29 ⁽¹⁾	Braking by single unit trucks, semi-trailers and B-doubles on dry, sealed roads. Minimum value required by vehicle standards regulations.	Maximum value for calculating truck stopping sight distance for most urban and rural road types, and level crossings.
Buses	0.15		Desirable braking to ensure passenger comfort approaching a bus stop.

¹ For any horizontal curve with a side friction factor greater than the desirable maximum value, the coefficient of deceleration should be reduced by 0.05. For tunnels, a maximum coefficient of deceleration of 0.46 may be applied along the length of a tunnel with the exception of the 200 m length from the portal entries, where a coefficient of deceleration of 0.36 is used.

Table 5.2: Driver reaction times

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2.5	<ul style="list-style-type: none"> • Unalerted driving conditions due to the road only having isolated geometric features to maintain driver interest • Areas with high driver workload/complex decisions • High speed roads with long distances between towns. 	<p>Absolute minimum value for high speed roads with unalerted driving conditions.</p> <p>General minimum value for:</p> <ul style="list-style-type: none"> • high speed rural freeways • high speed rural intersections • isolated alignment features.
2.0	<ul style="list-style-type: none"> • Higher speed urban areas • Few intersections • Alerted driving situations in rural areas • High speed roads in urban areas comprising numerous intersections or interchanges where the majority of driver trips are of relatively short length. 	<p>Absolute minimum value for the road conditions listed in this row.</p> <p>General minimum value for most road types, including those with alert driving conditions.</p>
1.5 ⁽¹⁾	<p>Alert driving conditions e.g.:</p> <ul style="list-style-type: none"> • high expectancy of stopping due to traffic signals • consistently tight alignments for example, mountainous roads • restricted low speed urban areas • built-up areas – high traffic volumes • interchange ramps when sighting over or around barriers. 	<p>Absolute minimum value. Only used in very constrained situations where drivers will be alert.</p> <p>Can be considered only where the maximum operating speed is ≤ 90 km/h.</p> <p>Should not be used where other design minima have been used.</p>

¹ A reaction time of 1.5 s cannot be used in Western Australia. Designers should refer to road agency supplements to confirm local practice.

CHR Upgrade Design Data

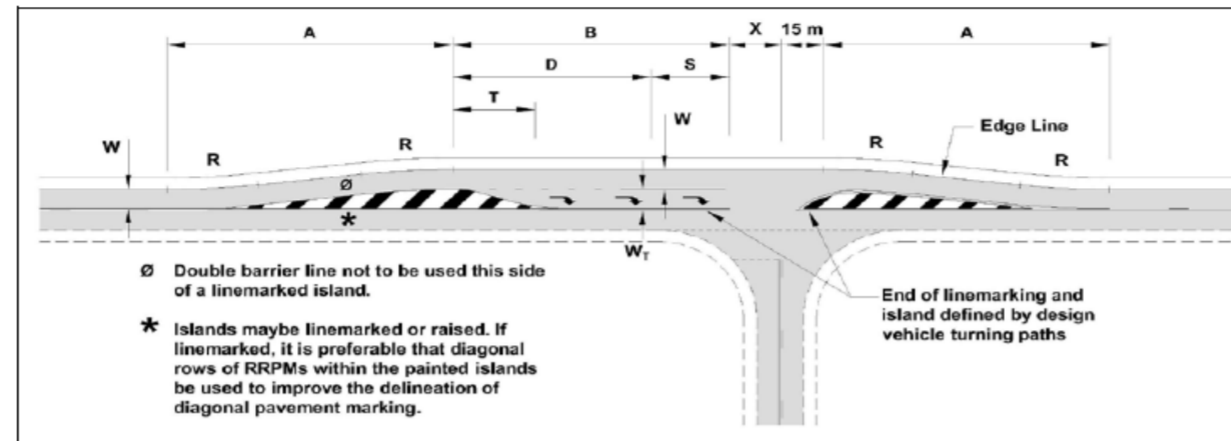
Guide to Road Design – Part 4A: Unsignalised and Signalised Intersections

Speed (V)	120
Lateral Movement Length (A)	120
exit curve speed	0
Diverge/Deceleration Length (D)	200
Desirable Radius (R)	600
Lane Width (W)	3.5
Turn Lane Width (W _t)	3.5
Correction to D (Table 5.3)	1
Storage (S)	36.5
Distance Based on Turn Path (X)	15

Total length of Aux Lane (B)	236.5
Distance from Start of Taper 2.0m Width of Chevron	68.57143
Taper Length (T)	38.50

Table 5.3: Correction to deceleration distance D for grade

Grade	Ratio of 'length on grade' to 'length on level'	
	Upgrade	Downgrade
0 – 2%	1.0	1.0
3 – 4%	0.9	1.2
5 – 6%	0.8	1.35



Notes:

1. An alternative to the double white line on the outside edge of the right-turn slot is a 1.0 m painted median. The 1.0 m median is particularly useful when the major road is on a tight horizontal curve and oncoming vehicles track across the centreline. Provision of this median will require the dimension 'A' to be increased.
2. A raised concrete median on the minor road may be used with this treatment to minimise 'corner cutting', particularly for higher turning volumes.
3. The dimensions of the treatment are defined below and values of A, D, R and T are shown in Table 7.2:

W = Nominal through lane width (m) (including widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.

W_t = Nominal width of turn lane (m), including widening for curves based on the design turning vehicle. Desirable minimum = W, absolute minimum = 3.0 m.

B = Total length of auxiliary lane including taper, diverge/deceleration and storage (m).

D = Diverge/deceleration length including taper. Adjust for grade using the 'correction to grade' factor (Section 5)

T = Physical taper length (m) and is given by:

$$T = \frac{0.33W_t}{3.6}$$

S = Storage length (m) should be the greater of:

1. the length of one design turning vehicle or
2. (calculated car spaces - 1) x 8 m (Guide to Traffic Management – Part 3: Traffic Studies and Analysis (Austroads 2009h), or use computer program e.g. aaSIDRA).

V = Design speed of major road approach (km/h)

X = Distance based on design vehicle turning path, typically 10–15 m

Source: Based on QDMR (2006).

Figure 7.7: Channelised right turn (CHR) on a two-lane rural road

Design Speed of approach road (km/h)	Design speed of exit curve D (km/h)									Diverge Length T for lane width	
	0	20	30	40	50	60	70	80	90	3.5	3
50	40	30	25	15						33	27
60	55	50	40	30	15					40	33
70	75	70	60	50	40	20				47	40
80	100	95	85	75	60	45	25			54	44
90	125	120	110	100	85	70	50	25		60	50
100	155	150	140	130	115	100	80	55	30	67	57
110	185	180	175	160	150	130	110	90	60	74	62

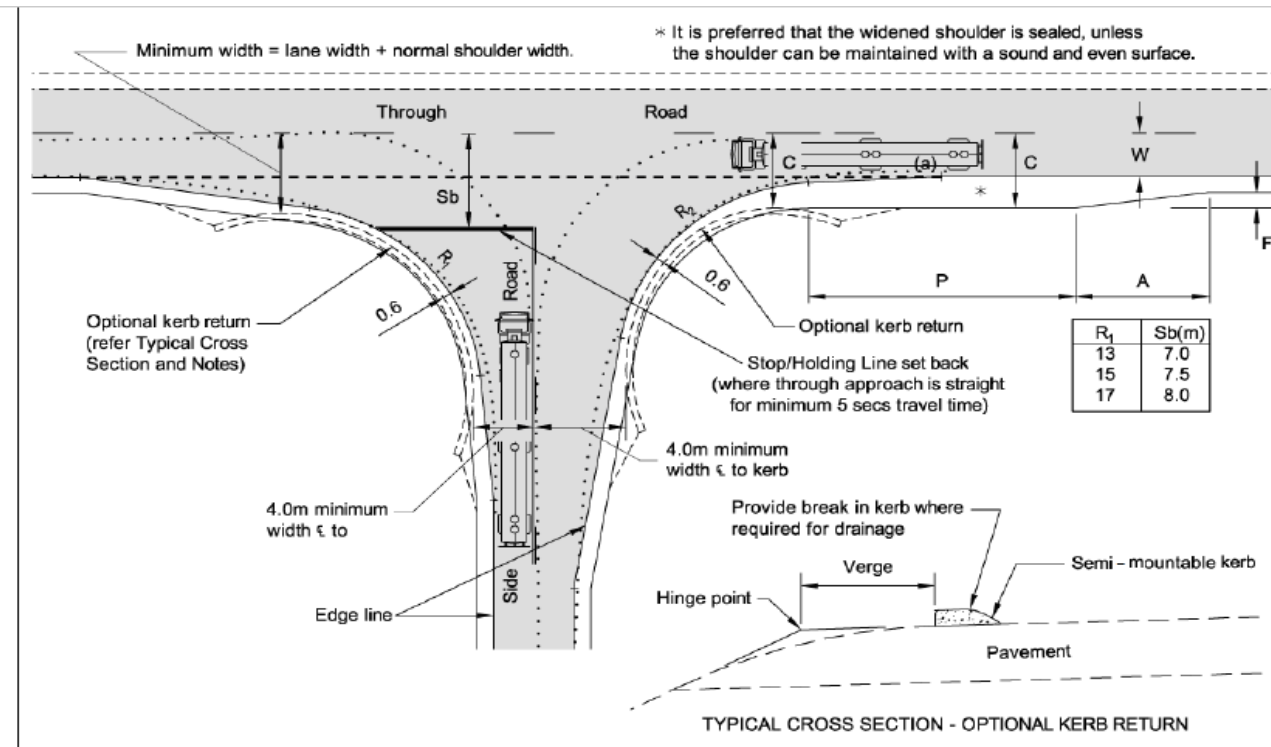
Design speed of major road approach (km/h)	Lateral movement length A (W _t =3.5m)	Desirable Radius R (m)
50	50	110
60	60	175
70	70	240
80	80	280
90	90	350
100	100	425
110	110	500
120	120	600

BAL Upgrade Design Data

V	120
Lane Width (Wr)	3.5
Total BAL Widening (C)	7
Formation/Carageway Widening (F)	1.5
Min. Parrallel Widen Shoulder (P)	45
Taper (A)	25
Adopted Taper	50 m
Total Length	95

Table 8.1: Minimum length of widened parallel shoulder

Design speed of major road approach (km/h)	Minimum length of parallel widened shoulder P (m)
50	0
60	5
70	10
80	15
90	20
100	25
110	35
120	45



Notes:

1. R1 and R2 are determined by the swept path of the design vehicle.

2. The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves).

C = On straights – 6.0 m minimum.

On curves – 6.0 m plus curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

$$A = \frac{0.5VF}{3.6}$$

V = Design speed of major road approach (km/h).

F = Formation/carrageway widening (m).

P = Minimum length of parallel widened shoulder (Table 8.1).

Source: QDMR (2006).

Figure 8.2: Rural basic left-turn treatment (BAL)

AUL Upgrade Design Data

V	120
Lane Width (W)	3.5
Turning Lane (W _T)	3.5
Design Speed of exit curve	0
Correction to D (Table 5.3)	1
Diverge/Deceleration Length (D)	220
Taper Length (T)	80

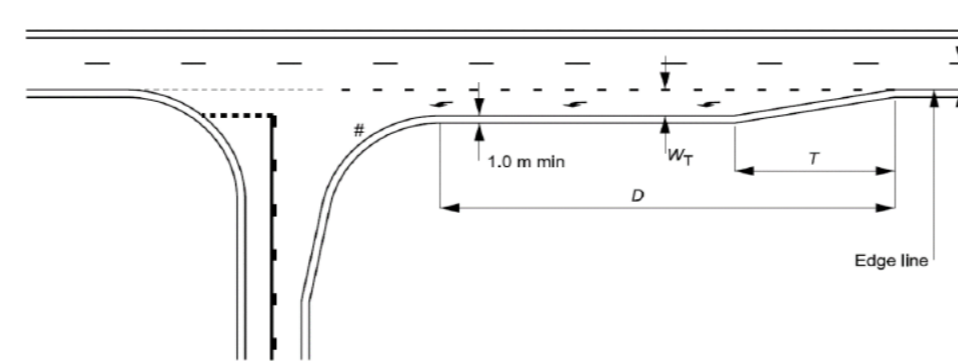
Total Length **220**

140

Table 5.3: Correction to deceleration distance D for grade

Grade	Ratio of 'length on grade' to 'length on level'	
	Upgrade	Downgrade
0 – 2%	1.0	1.0
3 – 4%	0.9	1.2
5 – 6%	0.8	1.35

Figure 8.4: Auxiliary left-turn treatment (AUL) on a rural road



Notes:

- # For setting out details of the left-turn geometry, use vehicle turning path software or templates.
- Approaches to left-turn slip lanes can create hazardous situations between cyclists and left-turning motor vehicles. Treatments to reduce the number of potential conflicts at left-turn slip lanes are given in AGRD Part 4 (Austroads 2017).
- The dimensions of the treatment are defined thus:
 - W = Nominal through lane width (m) (incl. widening for curves). For a new intersection on an existing road, the width is to be in accordance with the current link strategy.
 - W_T = Nominal width of turn lane (m) (incl. widening for curves based on the design turning vehicle) = 3.0 m minimum.
 - D = Diverge/deceleration length including taper – Table 5.2. (Adjust for grade using the 'correction to grade' in Table 5.3).
 - T = Physical taper length (m) given by Equation 5 being: $T = \frac{0.33VW_T}{3.6}$
 - V = Design speed of major road approach (km/h).

Source: Department of Main Roads (2006)³⁹.

Table 5.2 - Deceleration Distances Required for Cars on a Level Grade

Design Speed of approach road (km/h)	Design speed of exit curve D (km/h)									Diverge Length T for lane width	
	0	20	30	40	50	60	70	80	90	3.5	3
50	40	30	25	15						33	27
60	55	50	40	30	15					40	33
70	75	70	60	50	40	20				47	40
80	100	95	85	75	60	45	25			54	44
90	125	120	110	100	85	70	50	25		60	50
100	155	150	140	130	115	100	80	55	30	67	57
110	185	180	175	160	150	130	110	90	60	74	62

APPENDIX 6: Road Safety Audit



Preconstruction Road Safety Audit

Concept Design

Tomingley Gold Project - Newell Highway (HW17) Deviation

Prepared for
Constructive Solutions Pty Ltd (Brisbane Office)

September 2021

Report prepared by Constructive Solutions Pty Ltd

PO Box 1498
TAMWORTH NSW 2340

Phone: 02 6762 1969
Fax: 02 6762 1969
Email: admin@constructivesolutions.com.au

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DOCUMENT HISTORY AND STATUS

Issue	Rev	Issued To	Date	Reviewed	Approved
1	A	Internal	2/9/2021	B. Rossiter D. Greentree	
1	0	S. O'Rourke	3/9/2021		
1	1	S. O'Rourke	6/9/2021	M. Bloem	M. Bloem

Author: Michael Bloem / Ben Rossiter / Danielle Greentree
Project Manager: Steve O'Rourke
Project Name: Tomingley Gold Project - Newell Highway (HW17) Deviation
Project Number: 2019116
Name of Client: Constructive Solutions Pty Ltd (Brisbane Office)



Template: Rev 6 (February 2021)

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AUDIT REPORT

CLIENT:	Constructive Solutions Pty Ltd (Brisbane Office)
ADDRESS:	Benson House, Toowong, QLD 4066
TELEPHONE:	0427 011 143
PROJECT MANAGER	Steve O'Rourke Project Manager
DESIGNER:	Constructive Solutions Pty Ltd (Brisbane Office)
PROJECT:	Tomingley Gold Project - Newell Highway (HW17) Deviation
DRAWINGS:	Refer to Section 3 of this report.
TYPE OF AUDIT:	Preconstruction – Concept Design
DATE OF AUDIT:	2 September 2021
AUDIT TEAM:	
Accredited Level 3 Road Safety Auditor in NSW	Michael Bloem
Accredited Level 3 Road Safety Auditor in NSW	Ben Rossiter
Accredited Level 2 Road Safety Auditor in NSW	Danielle Greentree
COMMENCEMENT MEETING:	No commencement meeting was required.
COMPLETION MEETING:	6 September 2021
PREVIOUS AUDIT:	Nil

Executive Summary

Constructive Solutions Pty Ltd (CSPL) has been engaged by Alkane Resources Ltd to provide professional design services for the proposed deviation of approximately 8.3km of the Newell Highway (HW17) which is required for the proposed expansion of the Tomingley Gold Mine.

The proposed highway deviation is located immediately south of the village of Tomingley, approximately 7.5km north of Peak Hill and approximately 38km south of Narromine. The deviation will be located approximately 1km to the west of the existing HW17 alignment. The design will also require modification to existing intersecting local roads namely McNivens Lane, Kyalite Road and Back Tomingley West Road. The design of the highway deviation is to be completed in accordance with the Transport for NSW (TfNSW) Works Authorisation Deed and be approved by TfNSW whilst the modification to the existing local roads requires approval from Narromine Shire Council (NSC).

CSPL designers and engineers based in the Brisbane office are responsible for the design.

This audit of the 100% concept designs consisted of an independent road safety audit (RSA) completed by CSPL personnel based in the Tamworth office that are not directly involved with the design.

The purpose of this RSA is to report on the potential safety deficiencies and areas of risk associated with the concept designs completed for the HW17 deviation and NSC local roads.

The audit consisted of a desktop examination only of the concept designs on 2 September 2021. **NIL** Corrective Action Requests (CAR) were raised for the HW17 deviation concept design and the NSC local roads concept design.

The comments listed under the heading 'General Observations' are observations noted whilst carrying out the audit and do not necessarily relate to safety issues. This list is not comprehensive, it is simply a record of some of the additional observations made by the auditors and has been provided purely as an item for additional information for the Client. Some of these issues may have already been addressed by the Client. For the HW17 deviation concept design, **fifteen (15)** items have been listed and for the NSC local roads concept design, **nine (9)** items have listed.

The risk ratings provided in this audit are the assessment of the auditors. Ultimately, it is the Client's responsibility to determine the response to risk for each road safety risk identified.

This report does not provide recommendations with regards to addressing the corrective actions or general observations identified from this audit.

1 Introduction

1.1 Project Description

The proposed expansion of the Tomingley Gold Mine has identified gold deposits which are located under the Newell Highway (HW17) south of Kyalite Road. In order to mine the gold via open cut operations, HW17 will require a deviation from its current route.

The Tomingley Gold Mine is located immediately south of the village of Tomingley and approximately 38km south of Narromine. The gold mine is located to the west of the current alignment of HW17. Alkane Resources Ltd has engaged CSPL to complete the required design of the HW17 deviation and associated local road modifications which include as follows:

- 8.3km (approx.) deviation of HW17, to be located approximately 1km to the west of the existing HW17 alignment, including new intersections with Kyalite Road, McNivens Lane and Back Tomingley West Road;
- 2.08km (approx.) realignment of Kyalite Road, including an overpass over the mine site haul road; and
- A modification of Back Tomingley West Road such that its new intersection with the HW17 realignment meets minimum sight distance requirements.

The location and approximate extent of the design work is shown in **Figure 1**.

New intersections on HW17 will be required for Kyalite Road, McNivens Lane and Back Tomingley West Road. Where these local roads meet HW17 they shall be designed in accordance with NSC requirements and will be located such that minimum sight distance requirements on HW17 are met.

A realignment of Kyalite Road is also required to facilitate the proposed gold mine expansion. The realignment will also include an overpass of the mine site to allow for the movement of mine haulage vehicles and will form the main access point from HW17 to the new mine administration area.

1.2 Design Criteria

The design of the HW17 deviation will require approval from TfNSW and the modifications to intersecting local roads will require the approval of NSC.

The scope of the design for the HW17 deviation is as follows:

- Provision of an 80m wide road corridor.
- Minimum sealed carriageway width of 12m.
- Provision for 3.5m wide travel lanes, 2m wide shoulders and a 1.0m wide centre line.
- Design speed of 120km/h.
- Pavement design with a 20 year pavement life.
- Provision for centre line and edge line markings, retroreflective raised pavement markers and guide posts.
- Allowance for a minimum 1500m long overtaking lane in both the northbound and southbound travelling lanes.
- Provision of Channelised Right (CHR) and Auxiliary Left (AUL) treatments at the new intersections with Kyalite Road, McNivens Lane and Back Tomingley West Road. Intersections to be designed to cater for the B-triple design vehicle.
- Provision of drainage structures necessary to achieve a flood immunity of 1 in 20 year average recurrence interval (ARI).
- Provision for regulatory, warning and guide signage.
- Provision for safety barrier along the verges, as required.
- Provision of new rural property access locations to the new alignment, as required.

The scope of the design for the NSC local roads is as follows:

- Provision of an 20m wide road corridor.
- Minimum carriageway width of 9m for the Back Tomingley West Road realignment and McNivens Lane, inclusive of a bitumen seal of approximately 30m in length from the edge line of HW17.
- Minimum sealed carriageway width of 9m for the 1.3km length of the Kyalite Road realignment from HW17 to the new mine site access.
- Provision for 2 x 3.5m wide travel lanes, 1m wide shoulders.
- Design speed of 110km/hr.
- Pavement design with a 20 year pavement life.
- Provision for centre line and edge line markings on sealed sections.
- Provision of guide posts.
- Provision of drainage structures necessary to achieve a flood immunity of 1 in 20 year average recurrence interval (ARI).
- Provision for regulatory, warning and guide signage, as required.
- Provision for safety barrier along the verges, as required.

1.3 Current Status of the Audited Road(s)

HW17 forms part of a major transport link between Melbourne and Brisbane with TfNSW as the road authority. The AADT (2020) of HW17 adjacent to the mine site is approximately 4,450 vehicles per day of which approximately 45% are heavy vehicles. The speed limit of HW17 at this location is 110km/h.

Kyalite Road, McNivens Lane and Back Tomingley West Road are unsealed local roads with NSC as the road authority. The speed limit for these unsealed roads is the default 100km/h speed limit and the AADT (2020) for each road is less than 50 vehicles per day.

2 Audit Scope and Objectives

This report is for the 100% Concept Design of the proposed HW17 deviation and 50% Concept Design for the intersecting local roads namely, Kyalite Road, McNivens Lane and Back Tomingley West Road.

The audit consisted of an independent RSA completed by CSPL personnel not directly involved with the design.

Positive aspects of the design have not been recorded. This road safety audit is not a design check although some design issues may be raised during the audit process. The auditors do not take responsibility for any suggested design changes made in this report.

The objective of this RSA is to identify any potential safety issues/deficiencies associated with the concept design. No site inspection was undertaken as part of this RSA and it should be noted that the findings of this RSA are limited to the review of the provided designs.

This report does not provide recommendations with regards to addressing the corrective actions identified from this audit. A separate Recommendations Report would need to be prepared as a guide to possible treatments available to address the CARs.



Figure 1 – Proposed Road Realignments and Upgrades

3 Information Provided by the Client

Information provided by Constructive Solutions Pty Ltd (Brisbane Office) for the audit included as follows:

- 100% concept design drawings for HW17 – Newell Highway Deviation 56.3km to 64.1km North of Parkes as detailed in **Table 1**.
- 50% Concept Design Report for the HW17 Deviation.
- 50% Concept Design for the NSC Roads that intersect with the HW17 Deviation as detailed in **Table 2**.

Table 1 – 100% Concept Design for the HW17 Deviation

Code	Description	Drawing No.	Revision	Date
GE	General	GE-100 to GE-108	B	27/8/2021
RA	Road Alignment	RA-100 to RA-115	B	27/8/2021
RD	Road Detail	RD-101 to RD-133	B	27/8/2021
PV	Pavement	PV-100 to PV-101	B	27/8/2021
RF	Roadside Furniture, Signposting and Line Marking	No drawings included in the current drawing set		
RC	Road Cross Sections	RC-101 to RC-153	B	27/8/2021
SM	Soil and Stormwater Management	No drawings included in the current drawing set		
ST	Structural	No drawings included in the current drawing set		
TP	Turning Paths	No drawings included in the current drawing set		
PW	Property Works	RC-101 to RC-153	B	27/8/2021

Table 2 – 50% Concept Design for the Intersecting NSC Local Roads

Description	Drawing No.	Revision	Date
Cover Sheet	2019116-0001	F	21/6/2021
Sheet Index	2019116-0002	F	21/6/2021
Council Roads Plan Overview	2019116-0003	F	21/6/2021
Back Tomingley West Road (MC10) – Plan Overview and Alignment Table	2019116-1001	F	21/6/2021
Back Tomingley West Road (MC10) – Typical Section and Pavement Details	2019116-1010 to 1011	F	21/6/2021
Back Tomingley West Road (MC10) – Plan View and Longitudinal Sections	2019116-1101 to 1103	F	21/6/2021
Back Tomingley West Road (MC10) – Cross Section View	2019116-1201 to 1205	F	21/6/2021
Back Tomingley West Road (MC10) – Intersection Detail	2019116-1001 to 1500	F	21/6/2021
Kyalite Road (MC20) – Plan Overview and Alignment Table	2019116-2001	F	21/6/2021
Kyalite Road (MC20) – Typical Section and Pavement Details	2019116-2010	F	21/6/2021

Description	Drawing No.	Revision	Date
Kyalite Road (MC20) – Plan View and Longitudinal Sections	2019116-2101 to 2107	F	21/6/2021
Kyalite Road (MC20) – Cross Section View	2019116-2201 to 2242	F	21/6/2021
Kyalite Road (MC20) – Intersection Detail	2019116-2700	F	21/6/2021
McNivens Lane (MC30) – Plan Overview and Alignment Table	2019116-3001	F	21/6/2021
McNivens Lane (MC30) – Typical Section and Pavement Details	2019116-3010	F	21/6/2021
McNivens Lane (MC30) – Plan View and Longitudinal Sections	2019116-3101	F	21/6/2021
McNivens Lane (MC30) – Cross Section View	2019116-3201	F	21/6/2021

4 Road Safety Audit Program

4.1 Commencement Meeting

No commencement meeting was required by the Client however the following information was provided based on the design review completed by TfNSW on the 50% concept design for the HW17 deviation:

- No acceleration lanes are required for the new intersections as some road users treat these as quasi overtaking lanes given the required length for a 120km/h design speed.
- The new intersections for McNivens Lane, Kyalite Road and Back Tomingley West Road are to have a CHR/AUL configurations.
- Intersections have been designed to cater for the B-triple design vehicle.

4.2 Site Inspection

No inspection was required for this RSA as indicated by the Client.

4.3 Completion Meeting

The completion meeting was held on 6 September 2021 and included Steve O'Rourke (Project Manager), Lachlan Baynham (Project Designer), Ben Rossiter (Level 3 Auditor), Danielle Greentree (Level 2 Auditor) and Michael Bloem (Lead Auditor) with the findings discussed prior to finalising the audit report.

5 Road Safety Audit

5.1 Audit Findings

The audit findings have been documented in **Table 3** which includes the following information:

- Specific details of the nature of the audit findings;
- A risk rating of high, medium or low (refer **APPENDIX 1** for Risk Assessment Tools).

Table 3 – Audit Findings

CAR No.	Audit Findings
NIL	No CARs raised for this audit. Refer to Section 6 regarding General Observations.

6 General Observations

The following general observations have been included in **Table 4** for the HW17 Deviation 100% Concept Design.

Table 4 – Observations for the HW17 Deviation 100% Concept Design

Item	Description
4-1	<p>Delineation</p> <p>It is noted that proposed line marking has been shown on the Road Alignment (RA) and Road Detail (RD) drawings. Consideration may need to be given for the provision of audio tactile line marking (ATLM) to address fatigue and/or lane departures. It is expected that the proposed line marking and pavement markings will be appropriately dimensioned in subsequent detailed design submissions.</p>
4-2	<p>Delineation</p> <p>It is noted that no delineation has been included with the concept design. Consideration will need to be given in future detailed design submissions with regards to the location of guideposts and retro-reflective raised pavement markers in accordance with Austroads, Australian Standards and relevant guidelines.</p>
4-3	<p>Delineation</p> <p>Show transition of standard centreline to wide centreline at either end to prevent incorrect installation and abrupt changes.</p>
4-4	<p>Traffic Signs</p> <p>It is noted that no signage has been included with the concept design. Consideration will need to be given in subsequent detailed design submissions to the following in accordance with Austroads, Australian Standards and relevant guidelines:</p> <ul style="list-style-type: none"> • Advanced warning signs for side road junctions. • Regulatory signage (e.g.: Give Way signs) on the side roads. • Sight boards (and finger boards, if required) opposite the intersections.
4-5	<p>Landscaping</p> <p>Consideration may need to be given in future detailed design submissions with regards to landscaped bunds for example at each end where the HW17 deviations begin such that road users are not distracted by the existing straight HW17 alignment.</p>
4-6	<p>Roadside Hazards</p> <p>Whilst the designs for overhead power lines (OHPL) have not yet been completed, these designs will need to be integrated with the subsequent detailed designs to ensure that the location of power poles are beyond the clear zone and the clear distance between the new road surface level and the OHPL meets the minimum requirements of the electricity authority, particularly for any road crossings.</p>
4-7	<p>Road Pavement</p> <p>Section 3.3 of the design report indicates that aquaplaning issues will need to be considered and addressed. There may be risk during heavy rainfall events for sheet flow across the highway given the wide sealed surface, particularly where there is one way crossfall of the road surface. It is unclear if these issues have been investigated and addressed as part of the 100% concept design.</p>

Item	Description
4-8	<p>Road Alignment and Cross Section</p> <p>Whilst it is noted from the 50% concept design report that there are “Nil” departures from the design standards, it has been assumed that the independent design reviewer will check that the geometric design elements for the 100% concept design meet the required design standards.</p>
4-9	<p>Safety Barriers</p> <p>It is noted that the locations for safety barrier have been included with this concept design. Consideration will need to be given for subsequent detailed design submissions with regards to the point of need, extents in terms of the transition from the 6:1 batters, and the most appropriate type of safety barrier and end terminals in accordance with the TfNSW approved products.</p>
4-10	<p>Safety Barriers</p> <p>Where safety barrier is not proposed adjacent to culvert crossings (it is assumed these are located outside of the clear zone), consideration should be given to ensuring that trafficable headwalls are provided at these locations.</p> <p>The need for safety barrier should be assessed on a case by case basis dependant on the extent of the drop off and its perpendicular distance from the edge line.</p>
4-11	<p>Safety Barriers</p> <p>It is noted that 6:1 batters have been adopted in lieu of full containment with safety barrier, particularly where the batters are over 2m in height.</p> <p>It is understood from the Safe Systems Approach that full containment is more desirable given the known outcome of an errant vehicle coming into contact with a barrier as opposed to the errant vehicle leaving the carriageway.</p> <p>From a design perspective, it may actually be cheaper to install safety barrier with steeper embankments as opposed to the additional cost to provide the 6:1 batters with the extended pavement profiles.</p>
4-12	<p>Network Effects</p> <p>Vehicles need to be prevented from accessing HW17 from the old alignment of Back Tomingley West Road</p>
4-13	<p>Intersections</p> <p>Whilst proposed new rural property access points are not detailed on the 100% concept design, swept analysis for the design vehicle, appropriate sight distance requirements and storage will need to be considered for any proposed new rural property access points as a result of the HW17 deviation.</p>
4-14	<p>Intersections and Network Effects</p> <p>Has adequate storage been allowed for the CHR to maintain deceleration distance, particularly at shift commencement for vehicles using the new alignment of Kyalite Road?</p>
4-15	<p>Intersections and Heavy Vehicle Infrastructure</p> <p>During the closing meeting it was discussed that the truck rest area located between ch7400 and ch7700 is for southbound heavy vehicles (HV) only. Subsequent detailed design submissions will need take into consideration modifications to the ingress and egress, inclusive of signage, to prevent northbound HV from entering this truck rest area. It was further noted that rest area provisions for northbound HV vehicles are available within the village of Tomingley located approximately 1km north.</p>

The following general observations have been included in **Table 5** for the NSC Local Roads 50% Concept Design.

Table 5 – Observations for the NSC Local Road 50% Concept Design

Item	Description
5-1	<p>Delineation</p> <p>It is noted that no line marking has been prepared for the concept design. Consideration may need to be given in the detailed design submissions for the provision of edge line and centre line markings, particularly for the proposed sealed section of Kyalite Road.</p>
5-2	<p>Delineation</p> <p>It is noted that no delineation has been included with the concept design. Consideration will need to be given to the location of guideposts in accordance with Austroads, Australian Standards and relevant guidelines for the detailed design submissions.</p>
5-3	<p>Traffic Signs</p> <p>It is noted that no signage has been included with the concept design. Consideration will need to be given to the following in accordance with Austroads, Australian Standards and relevant guidelines:</p> <ul style="list-style-type: none"> • Advanced warning signs for approaching intersections. • Regulatory signage (e.g.: Give Way signs) for McNivens Lane, Back Tomingley West and Kyalite Road. • Sight boards opposite the intersections.
5-4	<p>Safety Barriers</p> <p>It is noted that the locations for safety barrier have been included with this concept design. Consideration will need to be given for subsequent detailed design submissions with regards to the point of need, extents in terms of the transition from the 6:1 batters, and the most appropriate type of safety barrier and end terminals in accordance with the TfNSW approved products.</p>
5-5	<p>Safety Barriers</p> <p>The location of safety barrier should be shown on the relevant cross sections along Kyalite Road for the subsequent detailed design submissions to show the width of the shoulder and the offset of the safety barrier.</p>
5-6	<p>Safety Barrier</p> <p>Where safety barrier is not proposed adjacent to culvert crossings (it is assumed these are located outside of the clear zone), consideration should be given to ensuring that trafficable headwalls are provided at these locations.</p> <p>The need for safety barrier should be assessed on a case by case basis dependant on the extent of the drop off and its perpendicular distance from the edge line.</p>
5-7	<p>Road Alignment and Cross Section</p> <p>Where table drains are proposed along Kyalite Road, need to ensure that the invert of the table drains is lower than the pavement layers.</p>
5-8	<p>Road Alignment and Cross Section</p> <p>Vehicles turning right from the old alignment of Back Tomingley West Road would cross the centre line and cut the corner given the approach alignment is significantly less than 90 degrees.</p>
5-9	<p>Bridge Structures</p> <p>Consideration may need to be given for the provision of screen protection on the overpass to prevent spillages from vehicles conveying any type of product from falling off the side of the overpass onto vehicles using the mine site haul road.</p>

7 Formal Statement

We, the undersigned, declare that we have reviewed the material listed in this report and identified the potential safety and operational deficiencies.

It should be noted that while every effort has been made to identify potential safety hazards, no guarantee could be made that every deficiency has been identified.

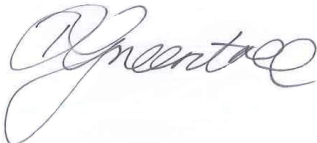
It is recommended that audit findings be investigated with satisfactory corrective actions identified and implemented.



Name: Michael Bloem
Position: Road Safety Auditor Level 3
Auditor ID: RSA-02-0466
Date: 6 September 2021



Name: Ben Rossiter
Position: Road Safety Auditor Level 3
Auditor ID: RSA-02-0464
Date: 6 September 2021



Name: Danielle Greentree
Position: Road Safety Auditor Level 2
Auditor ID: RSA-02-1169
Date: 6 September 2021

8 References

- Austroads 2019, 'Guide to Road Safety Part 6: Managing Road Safety Audits';
- Austroads 2019, 'Guide to Road Safety Part 6A: Implementing Road Safety Audits';
- RTA 2011, 'Road Safety Audit Practices Information Sheet – Road Safety Categories', August 2011 RTA/Pub 11.348
- RMS Delineation Guide – Section 16: Guide Posts and Delineation for Safety Barrier, Version1, February 2010.
- Australian Standard, AS 1742.2 (2009) Manual for uniform traffic control devices. Part 2: Traffic control devices for general use

Appendix 1: Risk Assessment Tools

Table 1 - Frequency – How often is the problem likely to lead to a crash?

Frequency	Description
Frequent	One or more per week
Probable	One or more per year (but less than once a week)
Occasional	Once every five or ten years
Improbable	Less often than once every ten years

Table 2 - Severity – What is the likely severity of the resulting accident type?

Severity	Description	Examples
Catastrophic	Likely multiple deaths	High-speed multi vehicle crash on a freeway. Car runs into crowded bus stop. Bus and petrol tanker collide. Collapse of a bridge or tunnel.
Serious	Likely death or serious injury	High or medium speed vehicle/ vehicle collision. High or medium speed collision with a fixed roadside object. Pedestrian struck at high speed. A car hits cyclist.
Minor	Likely minor injury	Some low speed vehicle collisions. Cyclist falls from bicycle at low speed. Left turn rear end crash in a turn lane.
Limited	Likely trivial injury or property damage only	Some low speed vehicle collisions. Pedestrian walks into object (no head injury). Car reverses into post.

Table 3 - Risk – The resulting level of risk

Severity	Risk Level			
	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

Table 4 - Treatment

Risk	Suggested Treatment Approach
Intolerable	Must be corrected
High	Should be corrected or the risk significantly reduced, even if the treatment cost is high.
Medium	Should be corrected or the risk significantly reduced, if the treatment cost is moderate, but not high.
Low	Should be corrected or the risk reduced if the treatment cost is low.

Constructive Solutions Pty Ltd

www.constructivesolutions.com.au

Tamworth Office:

PO Box 1498

Tamworth NSW 2340

Phone: 02 6762 1969

Email: admin@constructivesolutions.com.au

Brisbane Office

PO Box 133

Paddington QLD 4064

Phone: 0427 011 143

Email: admin@constructivesolutions.com.au



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APPENDIX 7: Design Comments Register

Road Name - HW17 Newell Highway



Road Name - Newell Highway Proposed Deviation 56.3km To 64.1km North Of Parkes

Drawing Registration Number: TBC

RMS Project No: TBC

Reviewers WBS: TBC

Comments Notes

Comments should give a clear & concise view of the issue raised identifying change, reference, feature or geographic point.
All comments should be identified as either:
- Observations; or
- Non-Compliances.

Observation
Comments regarding the design development, potential future compliance issue or other questions should be identified as Observations and should be raised in the preliminary (Draft 20%, 50%, 80%) phases only. Non-compliances during the 100% Pre AFC / AFC phases

Non-Compliance
Comments regarding non-compliances must refer to the relevant standards or reference documents and include the relevant clause that the issue is non-compliant with. Non-Compliances can be made at all stages. However, during the 100% Pre AFC / AFC phases comments should be limited to actual non-compliances, ONLY.

Close Out Status Legend

Open
Unaddressed or inadequate response to the reviewer comment / issue item

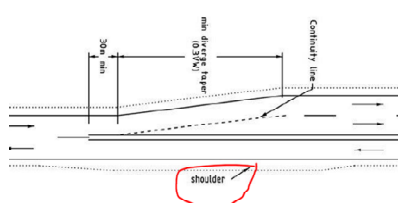
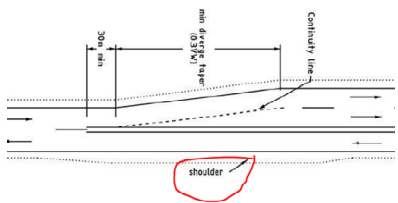
Closed
Adequate response given to the reviewer comment where no change is required or the design documents have updated to reflect the required change. Comment is considered closed.

Conditional
Adequate response given to the reviewer comment, to be used where:
1. comment is minor and the design documents have not been updated to reflect the required change and can be addressed in the following design phase. Can only be used where there is agreement between the reviewer and the project manager.
2. A design departure is required to close the comment which is yet to be approved/signed.
All Conditional comments must be closed prior to Pre-AFC of Delivery Readiness.

Close out columns to be completed by Reviewer Only.
Comments entered from other sources will be ignored and deleted from the Reviewers Closure column.

All Departures from Standards will require sign off so that the Design Review Comments can be officially closed.

Background				Review						Response			Close Out		
Issue No	Gateway	Issue Phase %	Document / Reference	Rev	Discipline / Aspect	Name / Reviewer	Review Issue Date	Comment Type	Reviewer's Comment Reviewer's additional comment inc date and feedback	Designer's Response / Action Designer's additional response inc date and feedback	Name	Response Date	Reviewer's Closure	Status	Closure Date
50% CONCEPT DESIGN, 100% CONCEPT DESIGN, 50% DETAILED DESIGN, 80% DETAILED DESIGN, 100% DETAIL DESIGN & IFC															
1	Concept	50%	All	A	Drafting	D. Woods / Evan Ralph	11/06/2021		ROADLOC system should be applied.	Proposed disposition raised in Meeting 1 (050721) Item 1.5. Awaiting response	L.Baynham	05/07/21	NO - tfnsw to provide Road Loc reference details for future iterations	Conditional	
2	Concept	50%	GE-101 - GE-105; RD-101 - RD-113	A	Drafting	D. Woods / Evan Ralph	11/06/2021		Add curve Radii. Not on key plan.	Added Radii to sheets GE-103 to GE-106	L.Baynham	16/07/21	Agree	Closed	10/08/21
3	Concept	50%	GE-102; RD-102 - RD-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Add notes to terminate existing Back Tomingley West Road before existing intersection.	Added note to GE-102 and a solid hatched area	L.Baynham	16/07/21	Agree	Closed	10/08/21
4	Concept	50%	GE-105; RD-114	A	Alignment	D. Woods / Evan Ralph	11/06/2021		Arc length for curve should be checked to ensure it meets minimum.	The last curve on the alignment was not standard. I have added in an additional curve with a radius of 6000m and increased the radius of the last curve to bring the arc length to standard	L.Baynham	16/07/21	Agree - But add Notation of Curve size to plan GE-106. We not the wobble in alignment ?? Why not provide a straight alignment?	Conditional	
5	Concept	50%	RA-100	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Top soil to be provided on batters. Verge rounding should be 2m on a 1m wide verge. Adjust note on verge rounding detail. Typical should give range for typical sections. Typical should detail super elevation range for curves ?.	Changed note to reflect a 2m verge rounding. Sheets GE-107 and GE108 show typical sections, showing full width of passing lanes and areas of full superelevation.	L.Baynham	16/07/21	Agree - future iterations should show seal widths with call outs to pavement design ?	Closed	10/08/21
6	Concept	50%	RA-100	A	Road Design	D. Woods / Evan Ralph	11/06/2021		6:1 batters are required for the Newell Highway due to high percentage of heavy vehicles	Design now showing 6:1 Batters along the length of the job, pending finalisation of discussions TfNSW/Alkane	L.Baynham	16/07/21	Agree	Closed	10/08/21
7	Concept	50%	RA-101 - RA-107	A	Drafting	D. Woods / Evan Ralph	11/06/2021		Add survey marks / alignment bearings.	Survey marks have been included on the overall plan of Newell Highway and alignment bearing table has been added to all RA sheets.	L.Baynham	16/07/21	Agree - add to alignment and plan long sheets for future iterations of plans	Closed	10/08/21
8	Concept	50%	GE-104; RA-106; RD-111	A	Alignment	D. Woods / Evan Ralph	11/06/2021		Curve at 6200 to 6500 has an unnecessary lateral movement in curve.	TS label have been used to flag to the designer and the construction contractor that at the TS point is where the pavement crossfall is level through the superelevation transition. There are no spirals or lateral shifts on the Newell Highway over the project length	L.Baynham	16/07/21	Agree - we note intersection moved , excellent	Closed	10/08/21
9	Concept	50%	GE-102; RA-102 - RD-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Adjust location of New Back Tomingley West Road to the south to improve vehicle manoeuvre distance from southbound overtaking lane merge (i.e. manoeuvre distance to pass a standing vehicle at Back Tomingley West Road intersection). Current design arrangement is not desirable.	Location and the diverge tapers of the passing lanes adjusted to obtain the distance required between the southbound passing lane and the start of the CHR treatment for Back Tomingley West Road	L.Baynham	16/07/21	Agreed - refer to email response William Prell dated Mon 9/08/2021 12:16 PM, advising slight adjustment	Conditional	

10	Concept	50%	RD-101	A	Alignment	D. Woods / Evan Ralph	11/06/2021	Vertical alignment should tie-in with reverse curves to ease the vertical grading into the existing road level.	Reverse vertical curves have been added to each tie-in	L.Baynham	16/07/21	Agree	Closed	10/08/21
11	Concept	50%	RD-101 - RD-114	A	Drafting	D. Woods / Evan Ralph	11/06/2021	HW39 referenced instead of HW17	Changed to show HW17	L.Baynham	16/07/21	Agree	Closed	10/08/21
12	Concept	50%	RA-102	A	Road Design	D. Woods / Evan Ralph	11/06/2021	No provision for protected right turn at McNivens Road or Back Tomingley West Road. Noting that traffic volumes on side road are low, it is desirable to provide CHR and AUL treatments on basis of safety not volume. Consider situation where a vehicle is stopped to make a right turn. Is there enough manoeuvring distance for a vehicle from the overtaking lane merge to pass a standing vehicle at new Back Tomingley West Road? Wide shoulder required.	All 3 council road intersection with the Newell Highway are now designed as a CHR treatment. In order to achieve this curves 1,2 & 3 from Radius reduced from 2000m to 1500m	L.Baynham	16/07/21	Agree - But reference to plans set dated 14/07/21 RA-102	Closed	10/08/21
13	Concept	50%	RD-105 - RD-106; RD-110 - RD-111	A	Drainage	D. Woods / Evan Ralph	11/06/2021	No details provided on headwall locations or proposed safety barriers for culverts. Ensure clear zone is met to Austroads for 110km/h.	Guardrails will be required where culverts are located. Need final culvert sizes	L.Baynham	16/07/21	Agree - Take issue forward for future reference	Conditional	
14	Concept	50%	All	A	Drainage	D. Woods / Evan Ralph	11/06/2021	No detail provided on drainage design apart from notation on plans.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - Take issue forward for future reference	Conditional	
15	Concept	50%	RD-105 - RD-106; RD-110 - RD-111	A	Drainage	D. Woods / Evan Ralph	11/06/2021	Maintenance access to culvert structures will be required, particularly at large culverts.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - Take issue forward for future reference	Conditional	
16	Concept	50%	RA-102	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Check and adjust shoulder widths and treatments at merges and diverges per Austroads requirements for runoff.	Designed runoff provided for both passing lane merge tapers - See sheets RD-108 & RD-120	L.Baynham	16/07/21	Agree	Closed	10/08/21
17	Concept	50%	RA-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Adjust adjacent opposing shoulder width at north bound overtaking lane diverge per Austroads requirements. Refer to image below: 	Shoulder in this area have been extended to 3m - See sheets RD-108	L.Baynham	16/07/21	Agree	Closed	10/08/21
18	Concept	50%	RA-102 - RD-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Adjust adjacent opposing shoulder width at south bound overtaking lane diverge per Austroads requirements. Refer to image below: 	Shoulder in this area have been extended to 3m - See sheets RD-120	L.Baynham	16/07/21	Agree	Closed	10/08/21
19	Concept	50%	RA-104	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Remove note end taper for Kyalite Road acceleration lane.	Kyalite Road Acceleration lane has been removed and replaced with left turn out shoulder treatment	L.Baynham	16/07/21	Agree	Closed	10/08/21
20	Concept	50%	RA-106; RD-111	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Intersection tapers merge against the LHS Horizontal curve. This manoeuvre is not desirable. Relocate intersection taper clear of curve. Ideally there should be 3 - 5 seconds travel time separation between curve and intersection.	Newell and Kyalite Road Alignment shifted to move the intersection taper off the horizontal curve. There is now approximately 1.5 seconds of travel time between the end of the CHR and the 1000m Radius Curve	L.Baynham	16/07/21	Agree	Closed	10/08/21
21	Concept	50%	GE-104; RA-106; RD-112	A	Road Design	D. Woods / Evan Ralph	11/06/2021	McNiven Lane has been located within a horizontal curve with diminishing line of sight to the south. Additionally the alignment of McNiven Lane is on a slight skew exacerbating the line sight across a drivers shoulder to Right. Desirable treatment is to relocate intersection out of curve, or otherwise square up intersection.	McNivens Lane squared up with The Newell Highway	L.Baynham	16/07/21	Agree	Closed	10/08/21
22	Concept	50%	RD-104	A	Drainage	D. Woods / Evan Ralph	11/06/2021	Low point in terrain, provide additional culverts.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
23	Concept	50%	RD-109	A	Drainage	D. Woods / Evan Ralph	11/06/2021	Low point in terrain, provide additional culverts.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	

24	Concept	50%	GE-102; GE-104; RD-103; RD-111 RD-112	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Acceleration lanes are not the preferred left turn treatment on the Newell Highway as large heavy vehicles are typically not able to reach within 20km/h of the through traffic speed, leading to accidents.	Kyalite Road Acceleration lane has been removed and replaced with left turn out shoulder treatment	L.Baynham	16/07/21	Agree	Closed	10/08/21
25	Concept	50%	RD-115	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Leading taper required Left turn in and out.	BAL has been designed for all intersections and have added a left turn out shoulder treatment - See sheet RD-106	L.Baynham	16/07/21	Agree	Closed	10/08/21
26	Concept	50%	RD-116	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Leading taper required Left turn in and out.	BAL has been designed for all intersections and have added a left turn out shoulder treatment - See sheet RD-122	L.Baynham	16/07/21	Agree	Closed	10/08/21
27	Concept	50%	RD-117	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Leading taper required Left turn in and out.	BAL has been designed for all intersections and have added a left turn out shoulder treatment - See sheet RD-125	L.Baynham	16/07/21	Agree	Closed	10/08/21
28	Concept	50%	Pg 4, Pg10,	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Tables for intersection treatments conflict with each other. CHR and AUL proposed for Back Tomingley West Road in Table 3 but not in Table 10.	Tables in the design report will be updated for the 100% Concept Design	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
29	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Acceleration Lane design speed in table is 110km/h not 120km/h. Posted speed is 110km/h. Truck acceleration should be to a speed no less than 20km/h below, therefore acceleration lane length should be adopted to reach 90km/h not 80km/h.	Kyalite Road Acceleration lane has been removed	L.Baynham	16/07/21	Agree - note doesnt apply	Closed	10/08/21
30	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021	AUL design speed should be 120km/h.	AUL has been designed to 120km/h	L.Baynham	16/07/21	Agree	Conditional	
31	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021	Standard BAR length as per Austroads does not allow enough length for a B-triple to pass a standing B-Double. BAR length should be determined by the vehicle turn paths.	All 3 council road intersection with the Newell Highway are now designed as a CHR treatment.	L.Baynham	16/07/21	Agree	Closed	10/08/21
32	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021	CHR design speed should be 120km/h.	Calculations now show 120km/h	L.Baynham	16/07/21	Agree - ensure in 100% plan update	Closed	10/08/21
33	Concept	50%	GE-105, RD-113	A	Property	W. Prell	21/06/2021	What is the proposed treatment for the existing South Tomingley Rest Area?	Maintain existing rest area and AUL Treatment	L.Baynham	16/07/21	Detail treatment of existing Rest Area in the 100% Concept Design to allow TfNSW an opportunity to review additional intersection treatments.	Conditional	
34	Concept	50%	All Cross Section Sheets	A	Road Design	W. Prell	21/06/2021	What is the proposed treatment for the existing Newell Highway Pavement? There are areas where the proposed/existing interface creates a sag point. In these instances, the existing pavement should be removed and earth graded to avoid ponding near the proposed pavement.	Waiting on completion of Geotech Testing (delayed by wet weather)	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
35	Concept	50%	Pg 16	A	Constructability	W. Prell	21/06/2021	Details of construction staging for all construction activities within the existing Newell Highway corridor will be required at the Detailed Design phase.	Noted	L.Baynham	16/07/21	Agree	Closed	11/08/21
36	Concept	50%	All	A	Alignment	W. Prell	21/06/2021	Please show the road alignment overlain on a plan showing the extent of mining operations.	General plan has been added to the drawing set and the mine outline and blast line has been added to the plan.	L.Baynham	16/07/21	Agree	Closed	11/08/21

Design Review Comment Sheet

Project Number: 2E+06

RMS Registration Number: ???

Project	Tomingley Gold - Newell Highway Realignment
Design Report No.	Independent Verification
Design Drawing Nos.	???
Design Phase	100% Concept Design
Date Issued	??

COMPLIANCE STATUS	
O	Observation / Comment
D	From info currently provided not able to determine whether design / proposal is compliant.
N	Non-Compliant
M	Minor non-compliance for immediate action but subsequently documented in next stage

RESPONSE AGREEMENT STATUS	
O	Open
C	Closed
CS	Closed SUBJECT TO additional action / information by designer

Reviewer Name 1	John Coggan (Independent Verifier) - JC
Reviewer Name 2	
Reviewer Name 3	
Reviewer Name 4	
Reviewer Name 5	
Date of Review	01-September-2021

Item	Date	Document Reference	Rev	Reviewer Initials	Reviewer Comments	Discipline	DESIGNER			Reviewer Close-out Comments		
							Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
100% Concept Design Phase												
1	1-09-21	RD123, 125, 126	B	JC	120m length of superelevation transition has been provided. 80m minimum required and is probably best suited in this flat country environment. If the superelevation transition is too gradual then there is an increased likelihood of water ponding, resulting in the possibility of hydroplaning.	Superelevation	I have left the super as is. I have tested hydroplaning in these areas and all pass	13-09-21	LB	Hydroplaning not a problem - Designer has tested hydroplaning criteria. Statement in design report required.	CS	18-Sep-21
2	1-09-21	At chainage 00 on relevant drawings.	B	JC	Roadloc chainages should have been used throughout the project. It would be a major exercise to change everything at this stage so it is suggested that at chainage 00 on the relevant drawings and at the start of the alignment that a note, prominently displayed, stating that "chainage 00 on the drawings is equivalent to chainage 56300 from Parkes".	Alignment	Added note to relevant sheets	13-09-21	LB	The difference between Roadloc and the design is quite clear.	C	18-Sep-21
3	1-09-21	Plan sheets	B	JC	Setout details for the CHR intersections have not been shown.	Intersections	I have included setout details for typical intersections. Will included detailed setout plans for the 50% detailed design	13-09-21	LB	Accepted.	C	18-Sep-21
4	1-09-21	Plan sheets	B	JC	The tapers for the overtaking lanes appear to be approximately 10 m short but it is difficult to determine accurately from the drawings. The diverge taper should 126m and the merge taper should be 210m. Chainage points need to be nominated for all merges, diverges etc.	Overtaking Lanes	Diverge Tapers are correct, and extended the merge tapers	13-09-21	LB	Accepted.	C	18-Sep-21
5	1-09-21	Plan sheets	B	JC	Diagrams of turning paths, for the intersections, need to be included for checking purposes.	Intersections	Included in the design report	13-09-21	LB	Accepted.	C	18-Sep-21
6	1-09-21	Plan & Longitudinal Section sheets	B	JC	1. Safety barrier has been located at the edge of the 2m shoulder. Barriers with a lateral offset less than the shy-line offset of 2.8m should be flared at the terminals. The safety barrier needs to extend to, and beyond, the 6:1 batters. At least a 20m length plus flared terminals beyond the culvert. 2. Safety barrier location at culvert sites does not include an offset for provision for maintenance vehicles for culverts. It is suggested that the shoulders at culvert sites be 5m wide similar to the Typical Layby Layout detailed in the Transport NSW Road Design Guide. The entry taper would be 30m and the exit taper would be 10m. Also, the wider shoulders would be outside the 2.8m shy-line offset thus eliminating the need for flared terminals. 3. Depending on the type of safety barrier provided, the 1m verge width might not be enough to provide for the lateral deflection distance. 4. Type of safety barrier needs to be scheduled along with transition tapers proposed between bridge barriers and road barriers. 5. Culverts at chainages 3620 & 7040. The safety barrier needs to extend to, and beyond, the 6:1 batters. At least a 20m length plus flared terminals beyond the culvert.	Safety Barrier	All comments have been address and reflect in the updated 100% concept plan. Detail of the Safety barrier and schedules will be provided in the 50% detailed design	13-09-21	LB	1) Accepted but explanation needs to be stated in design report. (refer CDR Section 11) 2) Accepted but note required in design report. (refer CDR Section 14) 3) Designer has investigated this comment and details will be supplied at the 50% detailed design stage. 4) As per 3 above. 5) Designer has addressed this issue.	C	18-Sep-21
7	1-09-21	General	B	JC	1. A strategy for controlling the water ponding at the toe of fill batters will need to be developed. It is suggested that longitudinal catch drains, at a minimum grade of 0.5%, be included along the toe of fill until a low point is reached at which time either a relief culvert can be provided under the road to outlet downstream, or mitre drains be provided as the outlet to take the water away from the road foundation. 2. In extreme situations, such as this project, the drains can be drained at 0.3% but these drains need to be concrete lined in order that that water can flow. Also, these drains are difficult to construct due to the very flat grade. 0.5% grade should be used where possible and these need to	Drainage	Open drain has now be designed to move water away from the toe of the batter. Mitre drains will be designed in to divert the water to the natural surface flow towards the culverts.	13-09-21	LB	Accepted.	C	18-Sep-21
10.1	1-09-21	RA101-115	B	JC	1. Alignment Control schedule is missing details at chainages 4532.667 & 5493.156. 2. There are no details of existing permanent marks. The co-ordinates are just "points in space" unless they can be referenced to known permanent marks on the ground. The contract surveyors need this information for setting out the project.	Alignment	Fixed alignment control schedule to included missing segments. Added the Survey Marks and included the survey mark table	13-09-21	LB	Accepted.	C	18-Sep-21
8	1-09-21	RD127, 128	B	JC	Junctions for the Truck Parking Area - Is this intended for southbound vehicles only? Are the junctions intended for left in and left out only? Is there enough control to ensure that northbound trucks do not try to cross over the opposing lane to gain access? Suggest a longer length of straight for the southern exit, perpendicular to the Newell, be incorporated.	Junctions	I have adjusted the Truck Parking Area to be only a Left in and Left out for Southbound Traffic. This will also be signposted and shown in the linemarking plans for the 50% Detailed Design	13-09-21	LB	Accepted.	C	18-Sep-21
9	1-09-21	Relevant sheets	B	JC	Checks for hydroplaning potential will need to be made at approximate chainages 285, 1188, 1921, 2732, 4513, 5513, 6349, 6977, 7737, 8208.		Have tested all locations and all pass. Less the 4mm	13-09-21	LB	Accepted.	C	18-Sep-21
10	1-09-21	RC-101	B	JC	Chainages 60 to 120 cross sections do not show correct tie-in to the existing conditions. Are table drains required? Superelevation transition at this end might need modifying slightly for the tie-in.	Cross Sections Tie-in to existing conditions	Will need detailed survey before we adjust the tie-in detail	13-09-21	LB	Accepted - To be detailed at 50% stage.	C	18-Sep-21
11	1-09-21	RC-146, 147, 148, 149	B	JC	Stage construction will need to be detailed, on the plans, longsections, and cross sections, at approximate chainage 7180. At this location the new work crosses the existing highway. There is approximately 1.3m difference in level at this location.	Stage construction	Staging is required only in the 80% detailed plan. I will start to work on this as part of the detailed plans	13-09-21	LB	Accepted	C	18-Sep-21
12	1-09-21	Plan drawings and cross sections	B	JC	The location of permanent erosion and sedimentation control basins need to be shown on the drawings where required. Water quality, separation of "dirty water" and "clean water" strategies need to be shown. Basins	Water quality	Will discuss with TGO once we have received the hydrological assessment	13-09-21	LB	Accepted	C	18-Sep-21
13	4-09-21	All Culvert drawings	B	JC	1. Cross sections are normally drawn at a natural scale. (Not distorted)	Drainage structures	The WAD did not indicate this apart from a scale of 1:100/1:200, the exaggeration was decided upon for visual purposes on the drawing, if this item is to create issues with TNSW approvals it will be amended for the 50% Detail	10-09-21	TVS	Accepted	C	18-Sep-21

Reviewer						DESIGNER				Reviewer Close-out Comments		
Item	Date	Document Reference	Rev	Reviewer Initials	Reviewer Comments	Discipline	Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
14	4-09-21	All Culvert drawings	B	JC	2. A note "All dimensions of precast units supplied need to be verified on site before construction of slab" is required on each of the culvert drawings.	Drainage structures	Has been done, Revision-C plans will contain this on each drawing	10-09-21	TVS	Accepted	C	18-Sep-21
15	4-09-21	All Culvert drawings	B	JC	3. W/Beam safety barrier nominated but thrie beam should be considered over the large structures with transitions to W/Beam at the ends.	Drainage structures	A note has been added to the Rev-C plans indicating the safety barriers are to be a Thrie Beam over the culverts.	10-09-21	TVS	Accepted	C	18-Sep-21
16	4-09-21	All Culvert drawings	B	JC	4. No reinforcement details shown. Have drawings been reviewed by structural Engineer? 300mm thick invert slab seems excessive.	Drainage structures	Reinforcement details will be done in a subsequent submission as part of the detailed design	10-09-21	TVS	Accepted	C	18-Sep-21
17	4-09-21	All Culvert drawings	B	JC	5. Culvert lengths usually come in 1.22m or 2.44m lengths in NSW. The drawings seem to be very general and lack precise detail. Not all drawings prepared to scale.	Drainage structures	I have left the Culvert lengths unchanged, Rocla NSW currently supply the culvert units in 2.4m lengths or 1.2m on request.	10-09-21	TVS	Accepted - Independent Review will be done for this item at the 50% detailed design stage, following TfNSW comments.	C	18-Sep-21
18	4-09-21	All Culvert drawings	B	JC	6. Details of fixing link slab to precast units has not been included.	Drainage structures	Link slab fixing details will be done in a subsequent submission as part of the detailed design	10-09-21	TVS	Accepted - Independent Review will be done for this item at the 50% detailed design stage.	C	18-Sep-21
19	4-09-21	All Culvert drawings	B	JC	7. Precise link slab overall length and link slab span width have not been shown. This information is vital for setting out and checking purposes.	Drainage structures	Has been done, Revision-C plans will contain dimension on overall link slab lengths / spans on each drawing	10-09-21	TVS	Accepted - Independent Review will be done for this item at the 50% detailed design stage.	C	18-Sep-21
20	4-09-21	All Culvert drawings	B	JC	8. Precast wall widths of 165mm has been used for all precast units irrespective of cell height.	Drainage structures	The wall widths used on the conceptual plans are minimum widths, widths will be finalised with the structural design and the width dimensions will be added in a subsequent submission as part of the detailed design.	10-09-21	TVS	Accepted - Independent Review will be done for this item at the 50% detailed design stage.	C	18-Sep-21
21	4-09-21	All Culvert drawings	B	JC	9. 1500mm width of concrete apron has been used throughout. This width will vary, depending on the length of wingwall, skew angle etc.	Drainage structures	The apron widths used on the conceptual plans are minimum widths, widths will be finalised with the structural design and the apron sizing will be added in a subsequent submission as part of the detailed design.	10-09-21	TVS	Accepted - Independent Review will be done for this item at the 50% detailed design stage.	C	18-Sep-21
22	4-09-21	All Culvert drawings	B	JC	10. No wingwall thickness shown.	Drainage structures	Has been done, Rev-C plans will contain the wingwall widths shown on respective drawings.	10-09-21	TVS	Accepted - Independent Review will be done for this item at the 50% detailed design stage.	C	18-Sep-21

RSA Comment Sheet

Project Number: 2019116

RMS Registration Number: ???

Project: Tomingley Gold - Newell Highway Realignment

Design Report No.: Concept Design Road Safety Audit
 Design Drawing Nos.: ???
 Design Phase: 100% Concept Design
 Date Issued: ??

COMPLIANCE STATUS
 O Observation / Comment
 D From info currently provided not able to determine whether design / proposal is compliant.
 N Non-Compliant
 M Minor non-compliance for immediate action but

RESPONSE AGREEMENT STATUS
 O Open
 C Closed
 CS Closed SUBJECT TO additional action / information by designer

Reviewer Name 1: Michael Bloem
 Reviewer Name 2: Ben Rossiter
 Reviewer Name 3: Danielle Greentree
 Reviewer Name 4:
 Reviewer Name 5:
 Date of Review: 02-September-2021

ROAD SAFETY AUDITORS						DESIGNER/PROJECT MANAGER				Reviewer Close-out Comments		
Item	Date	Document Reference	Rev	Reviewer Initials	Reviewer Comments	Discipline	Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
100% Concept Design Phase												
4-1					It is noted that proposed line marking has been shown on the Road Alignment (RA) and Road Detail (RD) drawings. Consideration may need to be given for the provision of audio tactile line marking (ATLM) to address fatigue and/or lane departures. It is expected that the proposed line marking and pavement markings will be appropriately dimensioned in subsequent detailed design submissions.	Delineation	Will be included in the signs and linemarking plans for the 50% detail plan	13-09-21	LB			
4-2					It is noted that no delineation has been included with the concept design. Consideration will need to be given in future detailed design submissions with regards to the location of guideposts and retro-reflective raised pavement markers in accordance with Austroads, Australian Standards and relevant guidelines.	Delineation	Will be included in the signs and linemarking plans for the 50% detail plan	13-09-21	LB			
4-3					Show transition of standard centreline to wide centreline at either end to prevent incorrect installation and abrupt changes.	Delineation	Will be included in the signs and linemarking plans for the 50% detail plan	13-09-21	LB			
4-4					It is noted that no signage has been included with the concept design. Consideration will need to be given in subsequent detailed design submissions to the following in accordance with Austroads, Australian Standards and relevant guidelines: •Advanced warning signs for side road junctions. •Regulatory signage (e.g.: Give Way signs) on the side roads. •Sight boards (and finger boards, if required) opposite the intersections.	Traffic Signs	Will be included in the signs and linemarking plans for the 50% detail plan	13-09-21	LB			
4-5					regards to landscaped bunds for example at each end where the HW17 deviations begin such that road users are not distracted by the existing straight HW17 alignment.	Landscaping	Will be included in the signs and linemarking plans for the 50% detail plan	13-09-21	LB			
4-6					Whilst the designs for overhead power lines (OHPL) have not yet been completed, these designs will need to be integrated with the subsequent detailed designs to ensure that the location of power poles are beyond the clear zone and the clear distance between the new road surface level and the OHPL meets the minimum requirements of the electricity authority, particularly for any road crossings.	Roadside Hazards	Once all relevant information regarding the OHPL are received I will include it in the plans	13-09-21	LB			
4-7					Aquaplaning issues will need to be considered and addressed. There may be risk during heavy rainfall events for sheet flow across the highway given the wide sealed surface, particularly where there is one way crossfall of the road surface. It is unclear if these issues have been investigated and addressed as part of the 100% concept	Road Pavement	Checks have been made to ensure there is no aquaplaning issues	13-09-21	LB			
4-8					Whilst it is noted from the 50% concept design report that there are "Nil" departures from the design standards, it has been assumed that the independent design reviewer will check that the geometric design elements for the 100% concept design meet the required design standards.	Road Alignment and Cross Section	No comments have been made by the independent design reviewer regarding geometric design elements	13-09-21	LB			
4-9					It is noted that the locations for safety barrier have been included with this concept design. Consideration will need to be given for subsequent detailed design submissions with regards to the point of need, extents in terms of the transition from the 6:1 batters, and the most appropriate type of safety barrier and end terminals in accordance with the TfNSW approved products.	Safety Barriers	Guardrails have been extended pass the batter transition point	13-09-21	LB			
4-10					Where safety barrier is not proposed adjacent to culvert crossings (it is assumed these are located outside of the clear zone), consideration should be given to ensuring that trafficable headwalls are provided at these locations. The need for safety barrier should be assessed on a case by case basis dependant on the extent of the drop off and its perpendicular distance from the edge line.	Safety Barriers	This has been considered and designed for. Will reassess once the final hydrological report has been completed	13-09-21	LB			
4-11					It is noted that 6:1 batters have been adopted in lieu of full containment with safety barrier, particularly where the batters are over 2m in height. It is understood from the Safe Systems Approach that full containment is more desirable given the known outcome of an errant vehicle coming into contact with a barrier as opposed to the errant vehicle leaving the carriageway. From a design perspective, it may actually be cheaper to install safety barrier with steeper embankments as opposed to the additional cost to provide the 6:1 batters with the extended pavement profiles.	Safety Barriers		13-09-21	LB			
4-12					Vehicles need to be prevented from accessing HW17 from the old alignment of Back Tomingley West Road	Network Effects	cul-de-sac has been proposed to stop vehicles accessing HW17 from Back Tomingley West Road	13-09-21	LB			
4-13					Whilst proposed new rural property access points are not detailed on the 100% concept design, swept analysis for the design vehicle, appropriate sight distance requirements and storage will need to be considered for any proposed new rural property access points as a result of the HW17 deviation.	Intersections	This has been considered and will reflect in the 50% detailed design	13-09-21	LB			
4-14					Has adequate storage been allowed for the CHR to maintain deceleration distance, particularly at shift commencement for vehicles using the new alignment of Kyalite Road?	Intersections and Network Effects	The storage for the CHR has been designed to hold a B-triple	13-09-21	LB			

ROAD SAFETY AUDITORS						DESIGNER/PROJECT MANAGER				Reviewer Close-out Comments		
Item	Date	Document Reference	Rev	Reviewer Initials	Reviewer Comments	Discipline	Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
4-15					During the closing meeting it was discussed that the truck rest area located between ch7400 and ch7700 is for southbound heavy vehicles (HV) only. Subsequent detailed design submissions will need take into consideration modifications to the ingress and egress, inclusive of signage, to prevent northbound HV from entering this truck rest area. It was further noted that rest area provisions for northbound HV vehicles are available within the village of Tomingley located approximately 1km	Intersections and Heavy Vehicle Infrastructure	Noted	13-09-21	LB			
5-1					Consideration may need to be given in the detailed design submissions for the provision of edge line and centre line markings, particularly for the proposed sealed section of Kyalite Road.	Delineation	Line marking has been drafted and will show in the 50% detailed design as stated by TfNSW	13-09-21	LB			
5-2					It is noted that no delineation has been included with the concept design. Consideration will need to be given to the location of guideposts in accordance with Austroads, Australian Standards and relevant guidelines for the detailed design	Delineation	This will be included in the 50% detailed design as stated by TfNSW	13-09-21	LB			
5-3					It is noted that no signage has been included with the concept design. Consideration will need to be given to the following in accordance with Austroads, Australian Standards and relevant guidelines: <ul style="list-style-type: none"> · Advanced warning signs for approaching intersections. · Regulatory signage (e.g.: Give Way signs) for McNivens Lane, Back Tomingley West and Kyalite Road. Sight boards opposite the intersections.	Traffic Signs	This will be included in the 50% detailed design as stated by TfNSW	13-09-21	LB			
5-4					It is noted that the locations for safety barrier have been included with this concept design. Consideration will need to be given for subsequent detailed design submissions with regards to the point of need, extents in terms of the transition from the 6:1 batters, and the most appropriate type of safety barrier and end terminals in accordance with the TfNSW approved products.	Safety Barriers	This will be included in the 50% detailed design as stated by TfNSW	13-09-21	LB			
5-5					The location of safety barrier should be shown on the relevant cross sections along Kyalite Road for the subsequent detailed design submissions to show the width of the shoulder and the offset of the safety barrier.	Safety Barriers	This will be included in the 50% detailed design as stated by TfNSW	13-09-21	LB			
5-6					Where safety barrier is not proposed adjacent to culvert crossings (it is assumed these are located outside of the clear zone), consideration should be given to ensuring that trafficable headwalls are provided at these locations. The need for safety barrier should be assessed on a case by case basis dependant on the extent of the drop off and its perpendicular distance from the edge line.	Safety Barriers	This has been considered and designed for. Will reassess once the final hydrological report has been completed	13-09-21	LB			
5-7					Where table drains are proposed along Kyalite Road, need to ensure that the invert of the table drains is lower than the pavement layers.	Road Alignment and Cross Section	Table drains currently designed are below the pavement layers	13-09-21	LB			
5-8					Vehicles turning right from the old alignment of Back Tomingley West Road would cross the centre line and cut the corner given the approach alignment is significantly less than 90 degrees.	Road Alignment and Cross Section	The old alignment for Back Tomingley West Road will be cut of with the Cul-De-Sac to avoid traffic turning onto HW17	13-09-21	LB			
5-9					Consideration may need to be given for the provision of screen protection on the overpass to prevent spillages from vehicles conveying any type of product from falling off the side of the overpass onto vehicles using the mine site haul road.	Bridge Structures	TGO has stated the want screen protection and will be included in the bridge detailed design	13-09-21	LB			

APPENDIX 8: Requests for Information Register



2019116 - Tomingley Gold - Newell Highway Deviation

NO.	Date	RFI No	Subcontractor RFI No (If Applicable)	Description	Recipients	Closed Out	Outcome	Date Completed	Closout requested	Days open						
001	7/07/2021	Alk 001		WAD - procedural - minor departures - 11 items	Will Prell	20/07/2021	Items 1.11 - EIS approval timing - WAD to be amended		13/07/2021	7						
						20/07/2021	Item 1.13 - RFI process - no action	20/07/2021	13/07/2021	7						
							Item 1.14 - Basis of \$70m estimate - TfNSW to provide CSPL to provide our estimate for construction		13/07/2021							
						Rejected	Item 1.15 - Reducing security % during defects liability		13/07/2021							
						20/07/2021	Item 1.16 - Scheduling HSID workshop prior to 80% DD	20/07/2021	13/07/2021	7						
						20/07/2021	Item 1.18 - Submitting survey prior to 50% DD		13/07/2021	7						
						20/07/2021	Item 1.20 - Early works - acceptable via RFI		13/07/2021	7						
						20/07/2021	Item 1.23 - Remove requirement for viewing platform		13/07/2021	7						
						20/07/2021	Item 1.24 - Confirming 1.0m wide centreline	20/07/2021	13/07/2021	7						
						20/07/2021	Item 1.25 - Encroachment onto Crown Land Need to acquire land prior to construction		13/07/2021	7						
						20/07/2021	Item 1.27 - Reduce PI to \$10m		13/07/2021	7						
						20/07/2021	Item NK - Amend cross section scale		13/07/2021	7						
						002	7/07/2021	Alk 002		WAD - procedural - geometric standards - 3 items	Will Prell		Item 1.17 - Delay costs. Turnbull to check calcs and advise		20/07/2021	
												26/08/2021	Item 1.21 - Maintenance responsibility during		20/07/2021	37
26/08/2021	Item 1:26 - 1:20 flood immunity standard		20/07/2021	37												
003	7/07/2021	Alk 003		WAD - procedural - design standards - 4 items (includes 50%CD comments)	Will Prell		Item 2.1 - 4:1 batters - rejected		20/07/2021							
						30/07/2021	Item 1.6 - BAL/BAR at minor intersections - rejected		20/07/2021	10						
						30/07/2021	Item 1.9 - Removal of acceleration lane - accepted CSPL to provide widened shoulders at intersection		20/07/2021	10						
						30/07/2021	Item 1.29 - Shortening of passing lanes from 1500m - rejected		20/07/2021	10						
004	7/07/2021	Alk 004		WAD - procedural - review periods - 1 item	Will Prell	4/08/2021	Item 1.12 - review periods PV and TfNSW - accepted. WAD to be amended	20/07/2021	15							
005	8/07/2021	Alk 005		WAD - procedural - commercial/legal - 8 items	Will Prell	20/08/2021	Item 1.28 - Insurance amount confirmed		30/07/2021	21						
						20/08/2021	Item 1.28 - TfNSW costs - no further explanation		30/07/2021	21						
						20/08/2021	Item 1.28 - Indemnity change in wording - update WAD		30/07/2021	21						
						Rejected	Item 1.28 - delete "best interests clause" - update WAD		30/07/2021	21						
						20/08/2021	Item 1.28 - assignment of warranties - update WAD		30/07/2021	21						
						20/08/2021	Item 1.28 - time to rectify breach - update WAD		30/07/2021	21						
006		Alk 006				20/08/2021	Item 1.28 - time to rectify breach - update WAD		30/07/2021	21						
						20/08/2021	Item 1.28 - noted		30/07/2021	21						

Request for information

RFI Number:	Alk 001		
To:	Turnbull Engineering	From:	Steve O'Rourke
Attention:	Will Prell	Date:	7 July 2021

Project Name:	Alkane Resources – Newell Highway Deviation
Subject:	WAD Departures/Clarifications (minor procedural)

RFI Details:

Item	WAD Ref	WAD Requirement	Proposed/Clarification	Comment
1.11	2.1 b) ii)	Provide TfNSW with evidence of all Approvals required for the Works including the SEARs and EIS: Prior to the Developer's submission of the 50% Detailed Design.	Provide draft Conditions of Consent prior to 100% Detailed Design submission	Required to minimise delays to program
1.13	10.1	Developer must not make any modifications to the works...	Is the RFI process acceptable for managing these changes?	
1.14	Schedule Item 2	Estimate of cost of works - \$70m	Can you please provide details for the calculation of this amount	
1.15	Schedule Item 9	Release of Security on Practical Completion of \$1m	Release of Security on Practical Completion of 50% of Security held	In accordance with general contractual conditions
1.16	Attachment A CI 23	HSiD Workshop and Constructability Workshop following 80% design submission	1-day HSiD / Constructability Workshop prior to submission of 80% Detailed Design	Enables any changes to be incorporated into 80% detailed design
1.18	Attachment A CI 36	Survey control data and cadastral survey to be provided prior to submission of 100% Concept Design	Provide required survey information prior to 50% detailed design submission	Required to minimise delays to program

Item	WAD Ref	WAD Requirement	Proposed/Clarification	Comment
1.20	Attachment A CI 36	Approval to Commence Construction	Are early works permitted prior to issue of this e.g. can we commence culvert works: a) Delivery of precast components b) Culvert construction away from existing highway	Required to minimise delays to program
1.23	Attachment B CI 5	Provide a viewing platform	No viewing platform provided	Requirement for a viewing platform is contrary to the requirements of other government agencies which are requiring the works to be visually shielded
1.24	Attachment B CI 6	1.4m Wide centreline treatment	1.0m Wide centreline treatment	1.0m proposed and accepted on Strategic and 50% Concept Design. No central wire rope barrier proposed
1.25	Attachment B CI 7	No encroachment onto adjacent Crown Land	No works or road footprint shall encroach onto Crown Land	As noted in Strategic Design, 80m road corridor has a minor encroachment onto Crown Land
1.27	Attachment C iv)	Professional Indemnity cover of \$20m	Professional Indemnity cover of \$10m	Brings into alignment with general practice and TfNSW c71 Contract for design
	Attachment A CI 17 e	Cross sections at 1:400 scale	Cross sections at 1:400 scale	Improved legibility at A3

Project Manager:

A handwritten signature in black ink, appearing to be 'M. Le', written over a horizontal line.

Response Required by: 13 July 2021

RFI Response:

Respondent:

Template Revision 1 May 2020

Response to RFI

RFI Number	Alk 001
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	19/07/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (minor procedural)

Reference	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
1.11	William Prell - Turnbull	David Finlay - TfNSW	19/07/2021	Refer to Meeting 1 (050721) Minutes Rev 0 of 5th July 2021 provided by Constructive Solutions. TfNSW propose that the clause is amended for the draft Conditions of Consent to be available with the 80% Detailed Design submission. TfNSW further note that the Developer is cognisant of and will be responsible for the risks associated with proceeding to 100% Detailed Design prior to the final Conditions of Consent being provided?	TfNSW/Turnbull Engineering to amend WAD
1.13	William Prell - Turnbull	David Finlay - TfNSW	19/07/2021	The RFI process is acceptable for managing changes to technical requirements. Changes to commercial requirements are to be submitted through formal correspondence.	No action
1.14	William Prell - Turnbull	Paul Polansky - TfNSW	19/07/2021	Details regarding the calculation of \$70m estimated cost for the works will be provided by TfNSW. In the interim, the Developer is requested to provide their detailed estimate for the construction cost of the project.	TfNSW/Turnbull Engineering to provide
1.15	William Prell - Turnbull	David Finlay - TfNSW	19/07/2021	Not accepted. TfNSW will retain the specified security until expiration of the Defects Liability Period per Schedule Item 9. TfNSW refer to the very reasonable duration of the Defects Liability Period per Schedule Item 3.	No Action
1.16	William Prell - Turnbull	David Finlay - TfNSW	19/07/2021	Proposal is accepted.	TfNSW/Turnbull Engineering to amend WAD
1.18	William Prell - Turnbull	Paul Polansky - TfNSW	19/07/2021	Submitting the survey prior to the 50% Detailed Design will pose re-work risks to the developer. Provided that the Developer is cognisant and accepting of the risk posed by submitting survey prior to 50% Detailed Design, TfNSW accept Proposal.	TfNSW/Turnbull Engineering to amend WAD

Response to RFI

RFI Number	Alk 001
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	19/07/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (minor procedural)

Reference	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
1.20	William Prell - Turnbull	David Finlay - TfNSW	19/07/2021	Attachment A cl 36 does not relate to approval to commence work. It is assumed that the reference is to cl 40. Should the Developer wish to undertake early works, the Developer is to submit an RFI for TfNSW approval providing details of the proposed Early Works. Approved early works are to comply with the WAD; in particular, early works must comply with authority approval or Condition of Consent requirements.	No action
1.23	William Prell - Turnbull	Paul Polansky - TfNSW	19/07/2021	Proposal accepted. Agree that viewing platform should not be provided. Anti-gawking screening will be required.	TfNSW/Turnbull Engineering to amend WAD
1.24	William Prell - Turnbull	Paul Polansky - TfNSW	19/07/2021	Refer to minutes of meeting of 9th July 2021. Proposal accepted.	TfNSW/Turnbull Engineering to amend WAD
1.25	William Prell - Turnbull	Paul Polansky - TfNSW	19/07/2021	Encroachment onto Crown Land with the design is not permitted unless acquisition is undertaken prior to construction. This is a project risk to be managed by the Developer. TfNSW preferred position would be to acquire the land.	No action
1.27	William Prell - Turnbull	David Finlay - TfNSW	19/07/2021	Proposal is accepted.	TfNSW/Turnbull Engineering to amend WAD
No Reference Provided	William Prell - Turnbull	Paul Polansky - TfNSW	19/07/2021	Refer to minutes of meeting of 9th July 2021. Proposal accepted.	TfNSW/Turnbull Engineering to amend WAD

Request for information

RFI Number:	Alk 002		
To:	Turnbull Engineering	From:	Steve O'Rourke
Attention:	Will Prell	Date:	7 July 2021

Project Name:	Alkane Resources – Newell Highway Deviation
Subject:	WAD Departures/Clarifications (procedural)

RFI Details:

Item	WAD Ref	WAD Requirement	Proposed/Clarification	Comment
1.17	Attachment A CI 35	Compensation of \$730,000 per second delay	<p>Please provide assumptions and calculation on which this is based</p> <p>Does it take into account improved flood immunity provided by the proposal?</p>	
1.21	Attachment A CI 48	Developer is responsible for all road maintenance between the limits of the works during construction and end of the defects liability period	<p>Developer is responsible for all road maintenance between the limits of the works commencing from when the existing highway traffic is first using the existing highway as a temporary road up until new highway is fully in use.</p> <p>After that time the Developer will be responsible for repair to any defects on the new works, however will not be responsible for routine maintenance items e.g. storm or crash damage.</p>	<p>The proposed construction staging does not involve use of the existing highway as a sidetrack, other than during construction of the tie ins.</p> <p>Essentially it will be "business as usual" on the existing highway whilst the new road is built over the majority of its length nearly 1km away</p>

Item	WAD Ref	WAD Requirement	Proposed/Clarification	Comment
1.26	Attachment B Cl 11	Drainage structures to achieve 1:50 ARI, unless otherwise approved by TfNSW	Drainage structures will be designed to 1:20 ARI	This matches the flood immunity provided by adjacent sections of highway i.e. Lampes Causeway

Project Manager:



Response Required by: 20 July 2021

RFI Response:

Respondent:

Template Revision 1 May 2020

Response to RFI

RFI Number	Alk 002
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	26/08/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (procedural)

Reference	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
1.17	William Prell - Turnbull		26/08/2021	\$730,000 delay cost was based on initial calculations undertaken in August 2020 that consider the additional vehicle operating costs, travel time, maintenance and accidents associated with the deviation. TfNSW are currently reviewing the calculations and will advise the developer should the delay cost change, or otherwise provide further detail regarding the assumptions used.	TfNSW/Turnbull Engineering to review delay cost calculations and advise of any changes.
1.21	William Prell - Turnbull	David Finlay - TfNSW	26/08/2021	Not accepted. The developer will be responsible for all maintenance between the limits of works on the new alignment until the expiration of the defects liability period. TfNSW will continue to be responsible for maintenance on the existing Newell Highway between the proposed tie-in points during off-line construction of the new alignment.	No action
1.26	William Prell - Turnbull	Paul Polansky - TfNSW	26/08/2021	TfNSW will consider a concession for 1:20 ARI for flood immunity subject to the design achieving the requirements specified by TfNSW for the Newell Highway, including the provision of 6H:1V batters for the entire length of the new alignment, and CHR and AUL treatments at all public intersections.	Developer to incorporate response in 100% Concept Design.

Request for information

RFI Number:	Alk 003		
To:	Turnbull Engineering	From:	Steve O'Rourke
Attention:	Will Prell	Date:	7 July 2021

Project Name:	Alkane Resources – Newell Highway Deviation
Subject:	WAD Departures/Clarifications (procedural – design standards)

RFI Details:

The "TfNSW reference" refer to item numbers in the spreadsheet "HW17 Newell Highway Realignment Tomingley – 50% Concept Rev A"

Item	TfNSW or WAD Ref	Reviewers comment or WAD requirement	Proposed/Clarification	Comment
2.1	TfNSW 6	6:1 batters are required for the Newell Highway due to high percentage of heavy vehicles	4:1 batters	4:1 batters are required by Austroads Parts 3 Table 4.11. 6:1 are only "desirable" and would impose considerable additional cost to the project
1.6	WAD Schedule B Cl 4	Channelised right turn at all intersections with public roads	Back Tomingley West Road and McNivens Lane to have BAR/BAL treatments only	No warrant exists for a CHR at Back Tomingley West Road or McNivens Lane (ref Austroads Part 4 Fig A10) There is no use of either of these roads by Project traffic
1.9	TfNSW 24	Acceleration lanes are not the preferred left turn treatment on the Newell Highway	Confirm that you do not require a left turn acceleration lane at Kyalite Road intersection	

Item	TfNSW or WAD Ref	Reviewers comment or WAD requirement	Proposed/Clarification	Comment
1.29	WAD Schedule B CI 2	Allowance for overtaking lanes ...each with a minimum length of 1500m	Minimum length each of 1400m (excluding tapers)	To "fit in" between the Kyalite Rd and Back Tomingley West Rd intersections, passing lanes shortened to 1400m (excluding tapers) and have designed the diverge tapers to be separated by a painted median with a 50m gap between the continuity lines.

Project Manager:



Response Required by: 20 July 2021

RFI Response:

Respondent:

Template Revision 1 May 2020

Response to RFI

RFI Number	Alk 003
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	30/07/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (procedural - design standards)

Reference	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
2.1	William Prell - Turnbull	Paul Polansky - TfNSW	30/07/2021	Not accepted. Refer to minutes of meeting held 9th July 2021.	The developer is to provide 6:1 batters and document in 100% Concept Design.
1.6	William Prell - Turnbull	Paul Polansky - TfNSW	30/07/2021	Not accepted. Refer to minutes of meeting held 9th July 2021.	The developer is to provide CHR treatments at all intersections and document in 100% Concept Design.
1.9	William Prell - Turnbull	Paul Polansky - TfNSW	30/07/2021	Confirmed. Refer to minutes of meeting held 9th July 2021. Left Turn acceleration lanes are not preferred. Desirable treatment is for provision of widened shoulders at intersection to be used as a refuge for vehicles in the event of mis-timed turning movements. Intersections should also be located in positions where there is at least 5 seconds sight distance to oncoming vehicles, and through traffic on the Newell Highway is sufficiently warned of the presence of the intersection.	The developer is to remove left turn acceleration lanes and provide widened shoulders.
1.29	William Prell - Turnbull	Paul Polansky - TfNSW	30/07/2021	Not accepted. Refer to minutes of meeting held 9th July 2021.	The developer is to submit revised designs prior to 100% concept design to demonstrate achievement of 1500m overtaking lanes.

Request for information

RFI Number:	Alk 004		
To:	Turnbull Engineering	From:	Steve O'Rourke
Attention:	Will Prell	Date:	7 July 2021

Project Name:	Alkane Resources – Newell Highway Deviation
Subject:	WAD Departures/Clarifications (procedural – review periods)

RFI Details:

Item	WAD Ref	WAD requirement	Proposed/Clarification	Comment
1.12	CI 7.2	Submit for review 21 days prior to commencement TfNSW to provide comments within 21 days	Provide a simple schedule for each design submission: <ul style="list-style-type: none"> • PV 5 days to review and provide comment • TfNSW 10 days to review and provide comment (following close out of PVs comments) 	Inconsistencies within the WAD re review time.
	Attachment A CI 9 d)	TfNSW to provide review comments within 10 days, following PV's review		

Project Manager:



Response Required by: 20 July 2021

RFI Response:

Respondent:

Template Revision 1 May 2020

Response to RFI

RFI Number	Alk 004
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	3/08/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (procedural - Review Periods)

Reference	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
1.12	William Prell - Turnbull	David Finlay - TfNSW	3/08/2021	<p>TfNSW will amend the notification period in clause 7.2(b) from 20 Business Days to 10 Business Days to be consistent with Attachment A Project Requirements.</p> <p>Item 4 of Section 2 of Schedule 2 Project Verifier Services specifies: The response time by the Project Verifier will be mutually agreed with the Developer and TfNSW for each design package (generally within 15 days). TfNSW will consider reasonable timeframes agreed in writing between the Developer and the Project Verifier. The period must be reasonable to enable the Project Verifier to properly complete the verification services in accordance with the WAD. TfNSW note that 5 Business Days is expected to be sufficient for certain stages of submission.</p>	TfNSW/Turnbull Engineering to amend the WAD.

Request for information

RFI Number:	Alk 005		
To:	Turnbull Engineering	From:	Steve O'Rourke
Attention:	Will Prell	Date:	8 July 2021

Project Name:	Alkane Resources – Newell Highway Deviation
Subject:	WAD Departures/Clarifications (Legal)

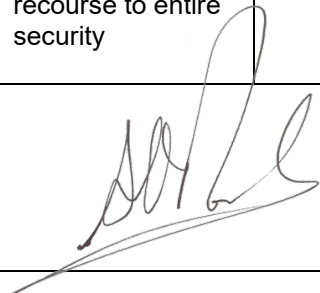
RFI Details:

Comments on WAD clauses.

Item	TfNSW or WAD Ref	Reviewers comment or WAD requirement	Proposed/Clarification	Comment
1.28	4.1	Approved Security	For discussion	Amount of Approved Security required by TfNSW to be confirmed.
1.28	13.1	TfNSW Costs	For discussion	Alkane would like to understand approximate amount of costs it is liable for under this clause.
1.28	Clause 14.1(a)	14.1(a) Indemnity	Please include the following words after the words 'The Developer...must' as follows: 'except to the extent caused or contributed to by a negligent act or omission by TfNSW, its employees, officers, agents or contractors...'	Developer's indemnity should be reduced proportionately where caused or contributed to by negligent acts or omissions of TFNSW. This is a standard carve out for an indemnity of this kind.
1.28	14.2(c)	Requirement for best methods and to act in TfNSW's best interests.	Please delete this sub-clause.	Clause is too broad and includes obligations and may give rise to duties which may not be ascertainable to the Developer e.g: Developer cannot be sure what are TfNSW's 'best interests'.

				Other provisions of clause 14.2 and elsewhere within the Deed are sufficient to ensure proper completion of the Works.
1.28	14.2(d)	Assignment of all subcontractor warranties.	Please delete this sub-clause.	Developer's warranties and defects liability are sufficient. Requiring that all subcontractor warranties are assignable to TfNSW may not be practical. Warranties from principal construction contractor can be assigned to TfNSW.
1.28	14.3(a)	10 day period to rectify breach	Please increase from 10 business days to 20 business days to remedy breach.	Certain breaches may require a longer period to rectify.
1.28	16.1	10 day period to rectify breach	Please increase from 10 business days to 20 business days to remedy breach event.	Certain breaches may require a longer period to rectify.
1.28	16.3	Termination and recourse to entire security	For discussion	Entire security may be more than TfNSW's actual losses.

**Project
Manager:**



**Response Required
by:**

30 July 2021

RFI Response:

Respondent:

Template Revision 1 May 2020

Response to RFI

RFI Number	Alk 005
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	20/08/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (Legal)

Reference	WAD Ref	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
1.28	4.1	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	TfNSW confirms that it requires \$6M Approved Security to be lodged until issue of Notice of Practical Completion. \$1M will be released to the developer upon issue of Notice of Practical Completion. \$5M will be released at the completion of the Warrantee Period. Refer to Item 10 of the Schedule.	
1.28	13.1	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	TfNSW will recover costs for any external Professional Services Contractor required to administer and/or surveil the works. TfNSW will invoice the developer actual costs.	
1.28	14.1(a)	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	Change accepted	TfNSW/Turnbull to update clause 14.1(a).
1.28	14.2(c)	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	Clause to remain unchanged	
1.28	14.2(d)	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	Change accepted	TfNSW/Turnbull to remove clause 14.2(d).
1.28	14.3(a)	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	Change accepted	TfNSW/Turnbull to update clause 14.3(a).

Response to RFI

RFI Number	Alk 005
Response To	Constructive Solutions
Attention:	Steve O'Rourke

From:	William Prell - Turnbull Engineering
Date:	20/08/2021

Project Name:	Alkane Resources - Newell Highway Deviation
RFI Subject:	WAD Departures/Clarifications (Legal)

Reference	WAD Ref	Respondent	TfNSW Reviewer	Response Date	Response	Required Actions
1.28	16.1	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	Change accepted	TfNSW/Turnbull to update clause 16.1.
1.28	16.3	William Prell - Turnbull	David Finlay - TfNSW	20/08/2021	Possible but unlikely. Security should remain as previously discussed by Director Development Services email.	

APPENDIX 9: Aquaplaning Checks

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH285, Southbound

Date

6/09/2021 11:31:09 AM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

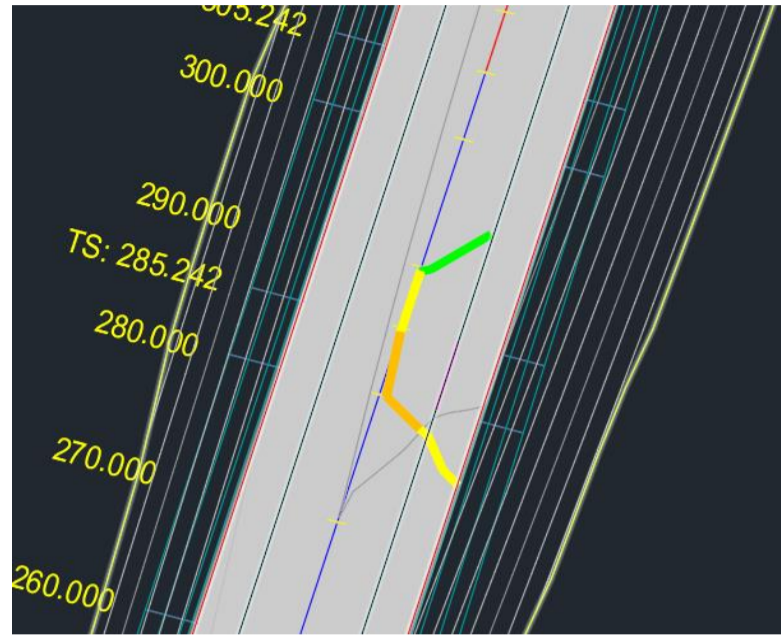
25

Design Speed (km/h)

120

Is Friction Demand High/Low

High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		267.06					
2	4.83	4.83	267.04	0.06	0.03	0.55	1.18	1.18
3	5.00	0.18	267.04	0.07	0.03	0.54	1.21	1.21
4	5.53	0.52	267.03	0.08	0.03	0.51	1.32	1.32
5	9.96	4.44	267.03	0.13	0.03	0.26	2.54	2.54
6	10.32	0.36	267.03	0.14	0.03	0.26	2.61	2.61
7	15.23	4.91	267.02	0.26	0.03	0.23	3.33	3.33
8	18.60	3.37	267.00	0.53	0.06	0.30	3.20	3.20
9	19.27	0.66	266.99	0.68	0.07	0.37	2.98	2.98
10	22.07	2.81	266.98	1.05	0.10	0.43	2.95	2.95
11	23.57	1.50	266.96	1.51	0.13	0.55	2.72	2.72

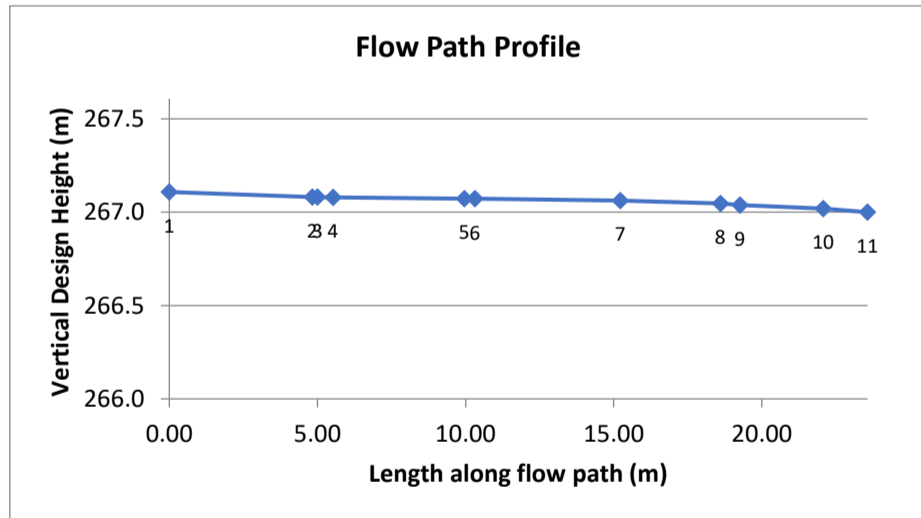
Total (m) 23.57

Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m



Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH1188, Southbound

Date

6/09/2021 11:35:39 AM

Version

100% Concept

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

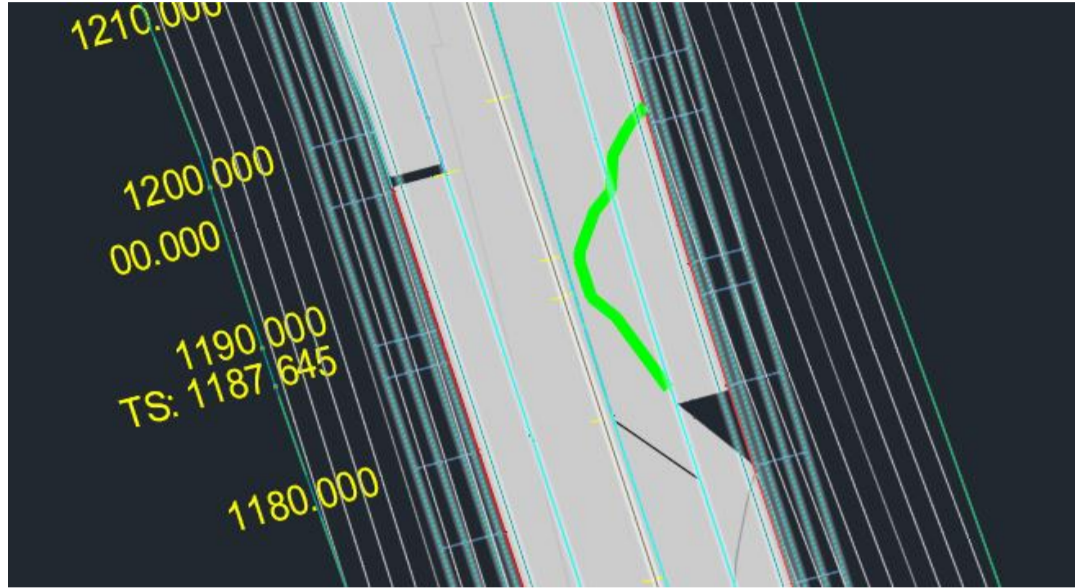
25

Design Speed (km/h)

120

Is Friction Demand High/Low

High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		264.94					
2	5.07	5.07	264.91	0.07	0.03	0.51	1.26	1.26
3	5.10	0.04	264.91	0.07	0.03	0.51	1.26	1.26
4	5.14	0.03	264.91	0.07	0.03	0.51	1.27	1.27
5	6.89	1.76	264.91	0.10	0.03	0.41	1.68	1.68
6	7.36	0.46	264.91	0.11	0.03	0.42	1.72	1.72
7	9.19	1.83	264.90	0.15	0.03	0.35	2.10	2.10
8	9.74	0.56	264.90	0.18	0.04	0.37	2.11	2.11
9	12.28	2.53	264.89	0.26	0.04	0.35	2.44	2.44
10	13.79	1.51	264.88	0.42	0.06	0.45	2.30	2.30
11	15.87	2.08	264.87	0.59	0.07	0.47	2.40	2.40
12	17.58	1.71	264.85	0.87	0.10	0.56	2.31	2.31
13	17.66	0.08	264.85	0.88	0.10	0.57	2.32	2.32
14	17.76	0.10	264.85	0.90	0.10	0.57	2.31	2.31
15	17.83	0.07	264.85	0.91	0.10	0.57	2.31	2.31
16	17.93	0.10	264.85	0.93	0.10	0.58	2.31	2.31
17	18.74	0.81	264.84	1.05	0.11	0.60	2.32	2.32
18	19.31	0.57	264.83	1.18	0.12	0.63	2.29	2.29

Total (m) 19.31

Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH1920, Northbound

Date

6/09/2021 11:54:26 AM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

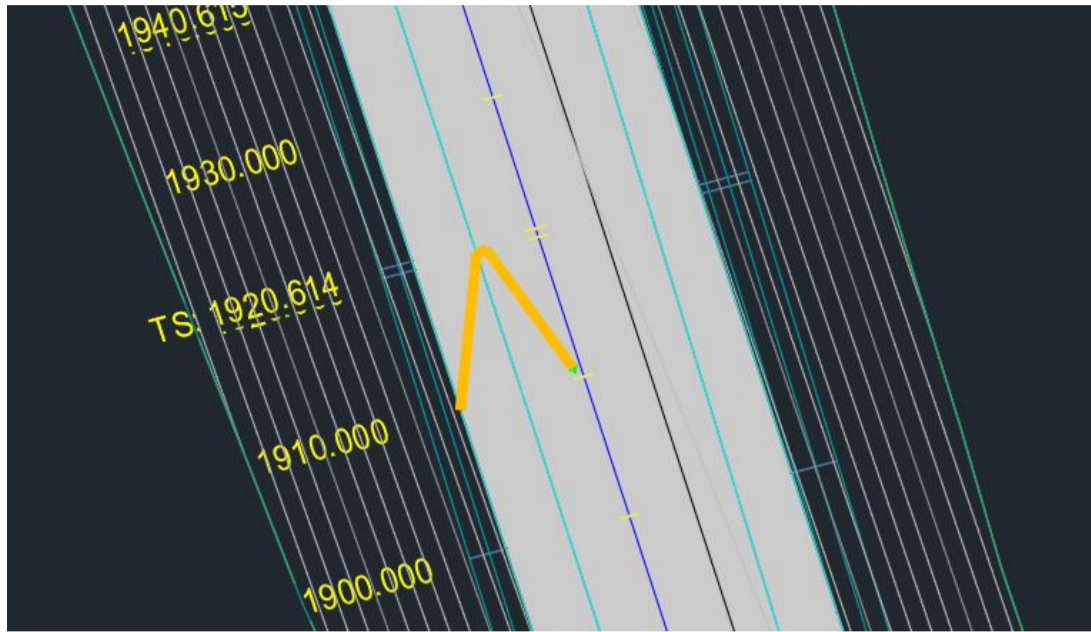
25

Design Speed (km/h)

120

Is Friction Demand High/Low

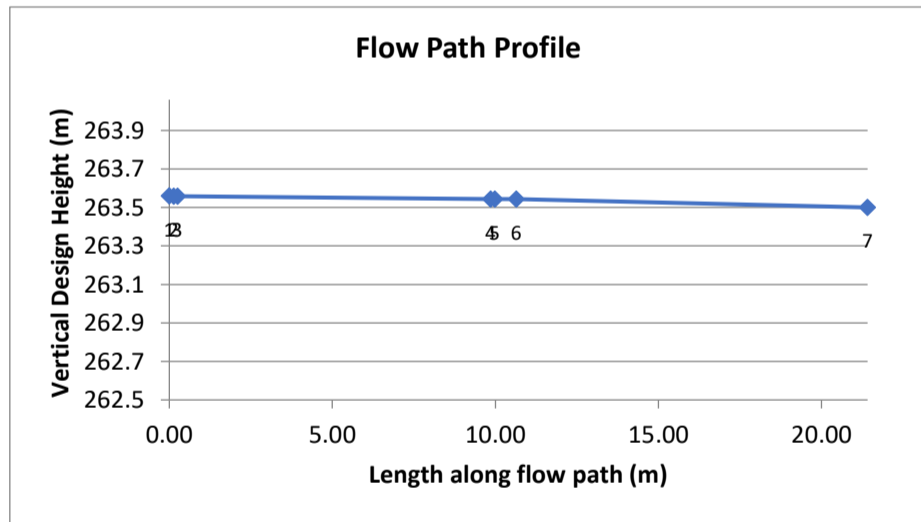
High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		263.54					
2	0.13	0.13	263.54	0.00	0.00	0.82	-0.12	-0.12
3	0.25	0.12	263.54	0.00	0.00	0.34	0.14	0.14
4	9.86	9.61	263.53	0.08	0.02	0.16	3.21	3.21
5	9.98	0.12	263.53	0.08	0.02	0.16	3.23	3.23
6	10.64	0.67	263.53	0.08	0.02	0.14	3.52	3.52
7	21.41	10.77	263.48	0.77	0.07	0.34	3.27	3.27

Total (m) 21.41



Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH2732, Northbound

Date

6/09/2021 12:17:04 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

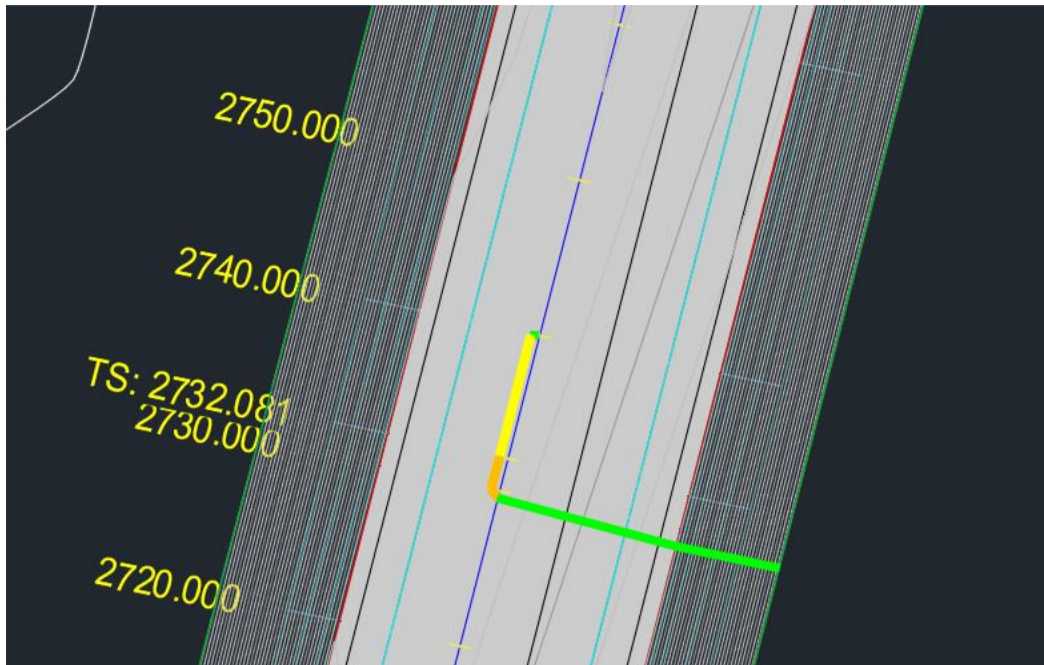
25

Design Speed (km/h)

120

Is Friction Demand High/Low

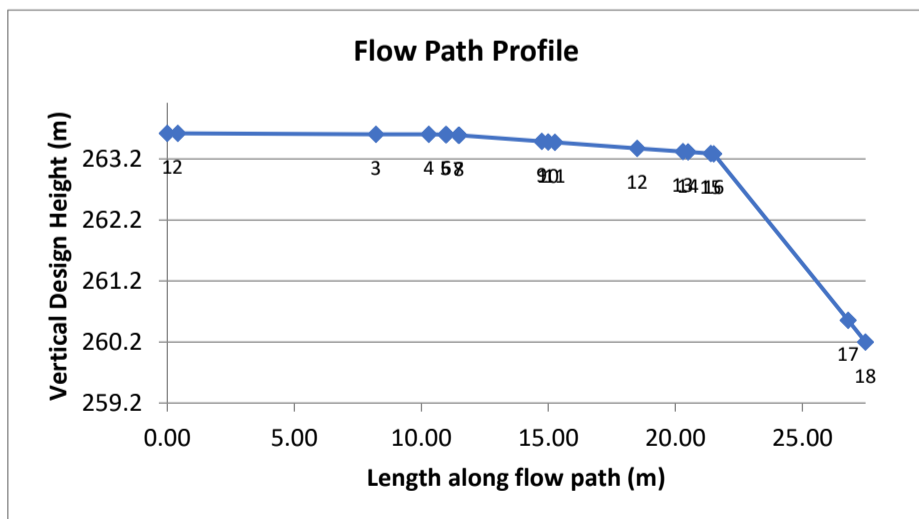
High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		263.67					
2	0.41	0.41	263.67	0.00	0.00	0.61	0.12	0.12
3	8.22	7.81	263.66	0.05	0.01	0.15	2.98	2.98
4	10.30	2.08	263.65	0.08	0.02	0.15	3.33	3.33
5	10.96	0.67	263.65	0.10	0.02	0.16	3.35	3.35
6	10.99	0.02	263.65	0.10	0.02	0.16	3.33	3.33
7	11.46	0.48	263.64	0.26	0.05	0.40	2.22	2.22
8	11.49	0.03	263.64	0.27	0.05	0.41	2.19	2.19
9	14.75	3.26	263.54	1.55	0.21	1.43	1.30	1.30
10	15.00	0.25	263.53	1.66	0.22	1.48	1.29	1.29
11	15.25	0.26	263.52	1.78	0.23	1.53	1.28	1.28
12	18.50	3.25	263.42	3.43	0.37	2.00	1.23	1.23
13	20.29	1.79	263.37	4.47	0.44	2.17	1.24	1.24
14	20.51	0.21	263.36	4.60	0.45	2.19	1.24	1.24
15	21.40	0.89	263.34	5.16	0.48	2.26	1.25	1.25
16	21.51	0.11	263.33	5.24	0.49	2.26	1.25	1.25
17	26.80	5.29	260.60	71.18	5.31	19.83	0.33	0.33
18	27.49	0.69	260.25	80.79	5.88	21.38	0.31	0.31

Total (m) 27.49



Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

*Between 2.5 - 3.2mm

*Between 3.2 - 4mm

*Greater than 4mm

Flow Path > 60m

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH4512, Northbound

Date

6/09/2021 12:19:31 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

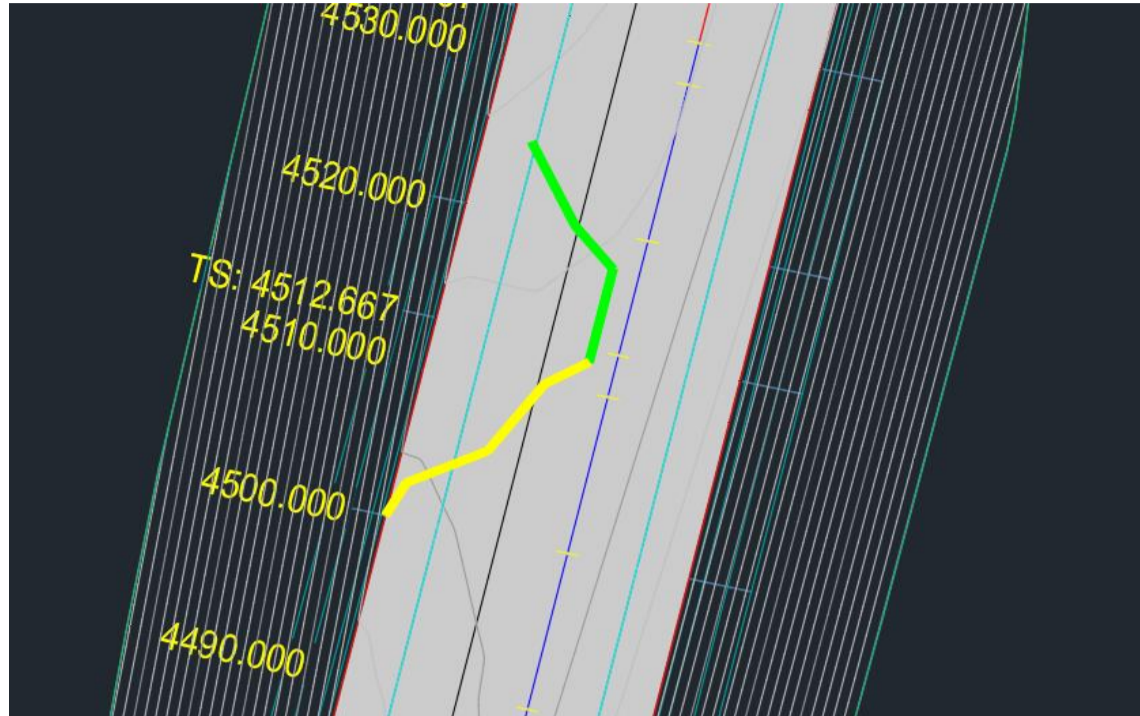
25

Design Speed (km/h)

120

Is Friction Demand High/Low

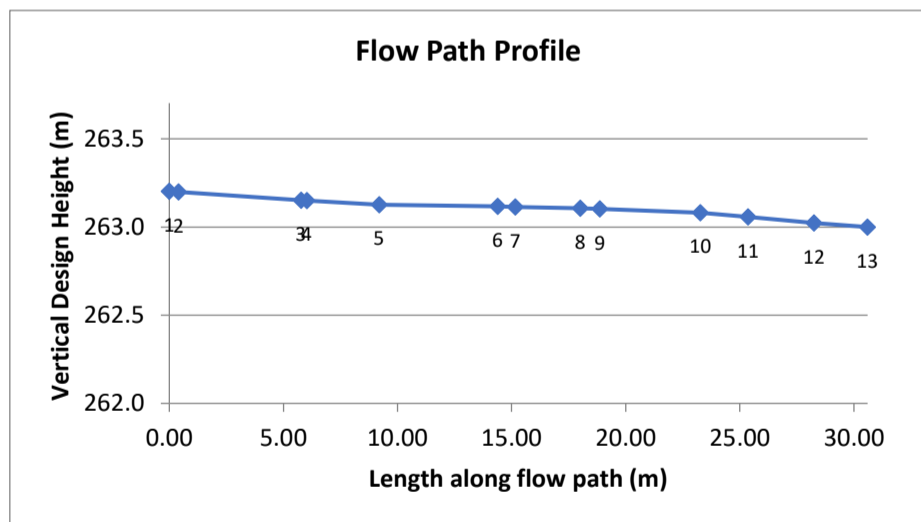
High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		263.16					
2	0.41	0.41	263.16	0.00	0.00	0.89	0.05	0.05
3	5.77	5.36	263.11	0.15	0.05	0.89	0.99	0.99
4	6.02	0.25	263.11	0.16	0.05	0.88	1.02	1.02
5	9.20	3.17	263.09	0.33	0.07	0.78	1.39	1.39
6	14.39	5.19	263.08	0.44	0.06	0.42	2.41	2.41
7	15.17	0.78	263.08	0.49	0.06	0.42	2.47	2.47
8	18.01	2.84	263.07	0.62	0.07	0.38	2.84	2.84
9	18.87	0.86	263.06	0.69	0.07	0.39	2.87	2.87
10	23.27	4.41	263.04	1.14	0.10	0.42	3.06	3.06
11	25.36	2.09	263.02	1.74	0.14	0.54	2.83	2.83
12	28.25	2.89	262.98	2.66	0.19	0.67	2.70	2.70
13	30.60	2.34	262.96	3.31	0.22	0.71	2.73	2.73

Total (m) 30.60



Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH5513, Northbound

Date

6/09/2021 12:22:43 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

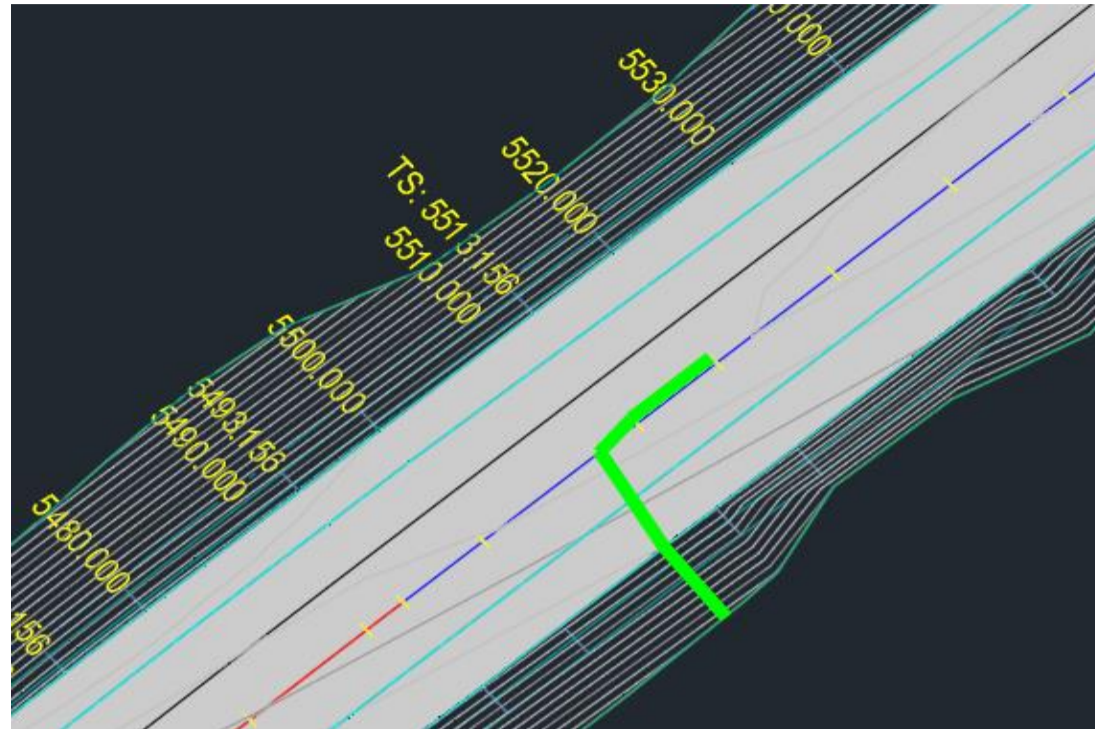
25

Design Speed (km/h)

120

Is Friction Demand High/Low

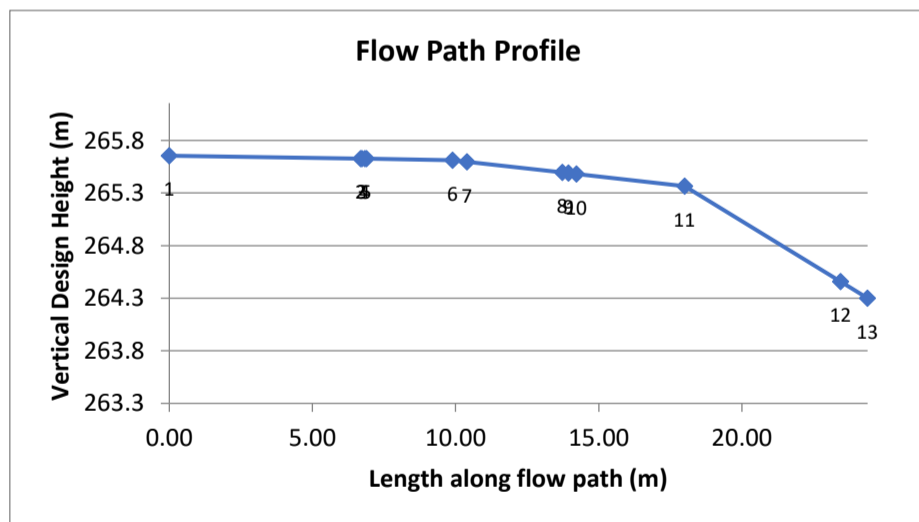
High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		265.68					
2	6.68	6.68	265.66	0.09	0.03	0.42	1.64	1.64
3	6.73	0.04	265.66	0.09	0.03	0.41	1.65	1.65
4	6.83	0.10	265.66	0.10	0.03	0.41	1.66	1.66
5	6.89	0.06	265.66	0.10	0.03	0.42	1.66	1.66
6	9.90	3.01	265.64	0.21	0.04	0.44	1.96	1.96
7	10.40	0.51	265.63	0.37	0.07	0.68	1.60	1.60
8	13.73	3.33	265.52	1.59	0.23	1.69	1.14	1.14
9	13.95	0.21	265.52	1.68	0.24	1.73	1.14	1.14
10	14.22	0.27	265.51	1.80	0.25	1.78	1.13	1.13
11	18.00	3.78	265.40	3.64	0.41	2.25	1.13	1.13
12	23.45	5.45	264.49	22.48	1.92	8.18	0.60	0.60
13	24.39	0.94	264.33	26.24	2.15	8.82	0.58	0.58

Total (m) 24.39



Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH3640, Southbound

Date

6/09/2021 12:24:16 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

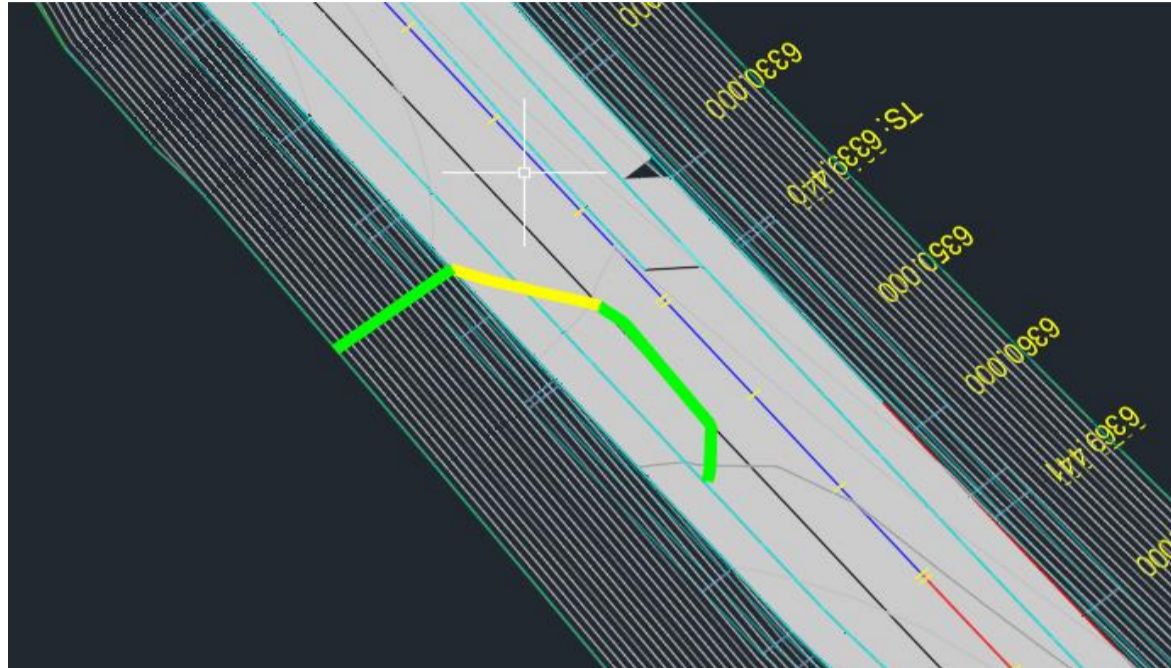
25

Design Speed (km/h)

120

Is Friction Demand High/Low

High



Water Film Depth Prediction

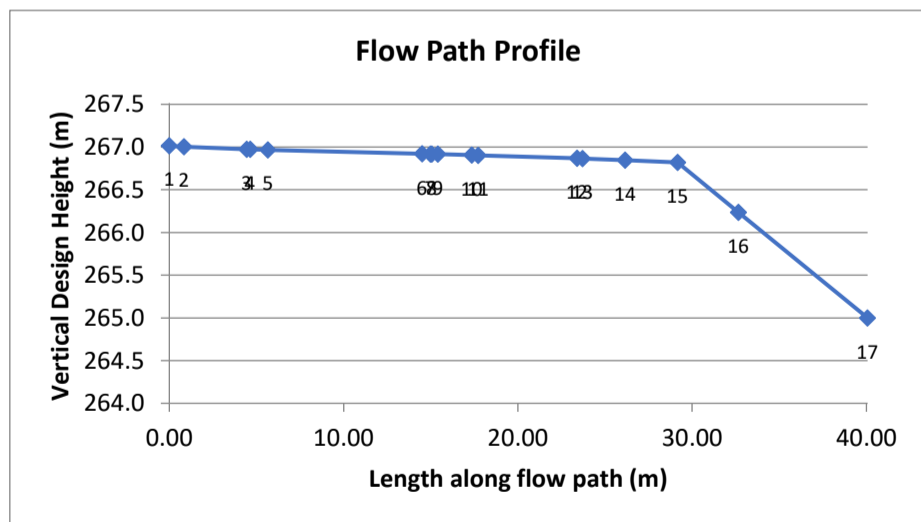
Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		267.01					
2	0.85	0.85	267.00	0.00	0.01	1.28	0.12	0.12
3	4.45	3.60	266.97	0.08	0.04	0.81	0.89	0.89
4	4.64	0.19	266.97	0.09	0.04	0.82	0.91	0.91
5	5.66	1.03	266.97	0.12	0.04	0.73	1.10	1.10
6	14.50	8.84	266.92	0.60	0.08	0.57	2.08	2.08
7	14.98	0.48	266.92	0.64	0.09	0.57	2.12	2.12
8	15.06	0.08	266.92	0.64	0.09	0.57	2.13	2.13
9	15.42	0.36	266.92	0.66	0.09	0.56	2.18	2.18
10	17.36	1.94	266.91	0.83	0.10	0.55	2.33	2.33
11	17.72	0.36	266.90	0.86	0.10	0.55	2.36	2.36
12	23.40	5.68	266.87	1.57	0.13	0.57	2.65	2.65
13	23.71	0.31	266.87	1.63	0.14	0.58	2.65	2.65
14	26.16	2.45	266.85	2.12	0.16	0.62	2.70	2.70
15	29.16	3.00	266.82	2.87	0.20	0.68	2.73	2.73
16	32.65	3.49	266.24	20.88	1.28	3.92	1.17	1.17
17	40.07	7.41	265.00	65.85	3.29	8.20	0.86	0.86

Total (m) 40.07

Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm
- Flow Path > 60m



Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH6987, Southbound

Date

6/09/2021 12:27:50 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

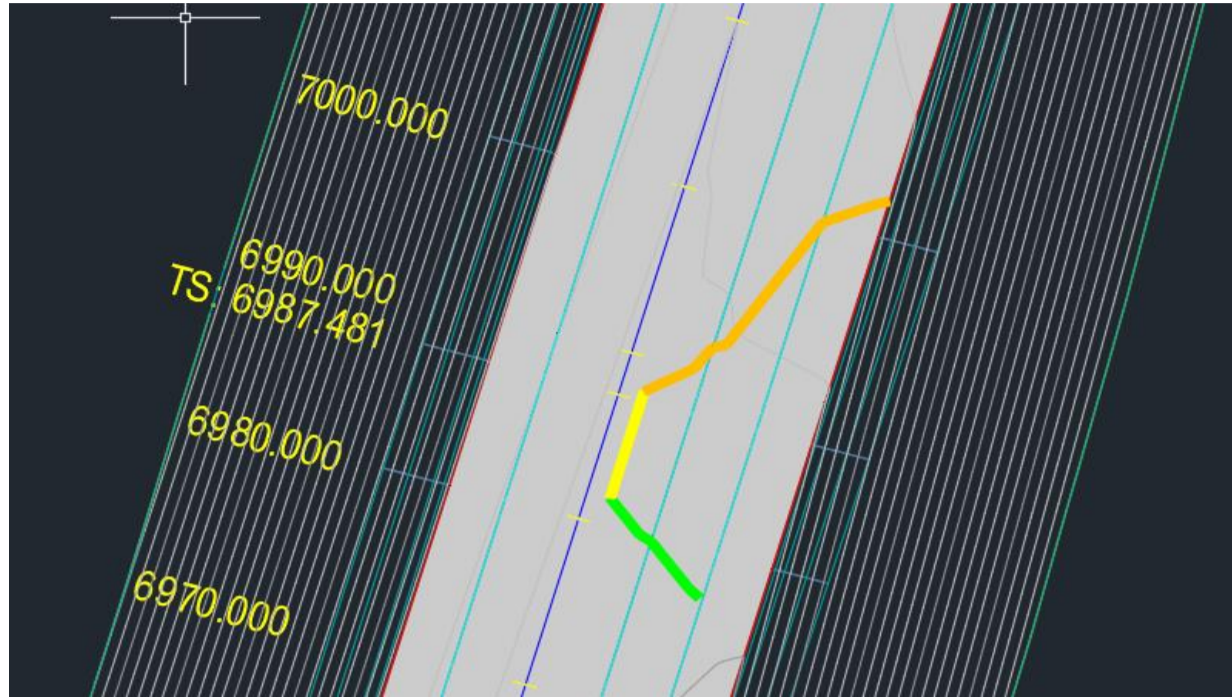
25

Design Speed (km/h)

120

Is Friction Demand High/Low

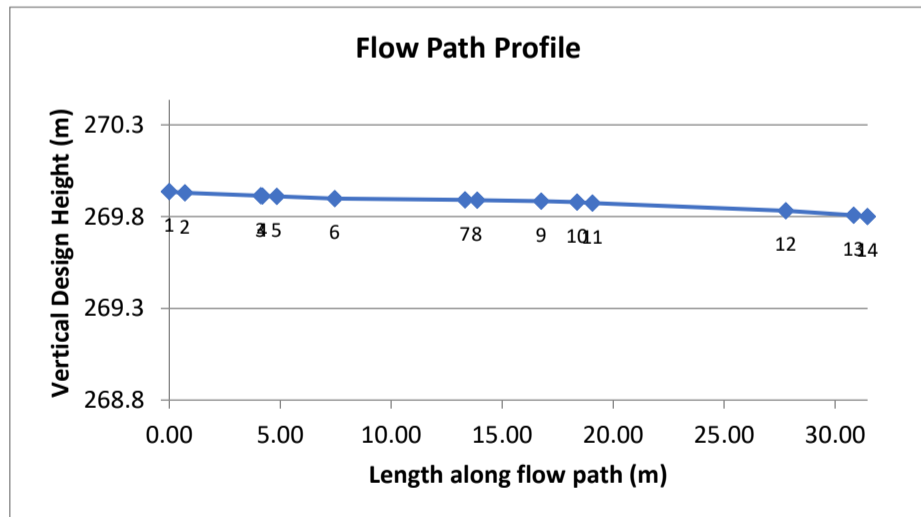
High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		269.97					
2	0.71	0.71	269.96	0.00	0.01	0.99	0.14	0.14
3	4.12	3.41	269.94	0.04	0.02	0.49	1.14	1.14
4	4.20	0.07	269.94	0.04	0.02	0.51	1.14	1.14
5	4.85	0.65	269.94	0.06	0.02	0.48	1.27	1.27
6	7.46	2.61	269.93	0.13	0.04	0.48	1.62	1.62
7	13.33	5.87	269.92	0.20	0.03	0.23	3.11	3.11
8	13.87	0.54	269.92	0.23	0.03	0.23	3.14	3.14
9	16.76	2.89	269.91	0.30	0.04	0.22	3.59	3.59
10	18.38	1.61	269.91	0.39	0.04	0.23	3.61	3.61
11	19.06	0.69	269.90	0.48	0.05	0.27	3.46	3.46
12	27.78	8.72	269.86	1.47	0.11	0.38	3.50	3.50
13	30.84	3.06	269.84	2.17	0.14	0.46	3.38	3.38
14	31.46	0.63	269.83	2.42	0.15	0.49	3.30	3.30

Total (m) 31.46



Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

*Between 2.5 - 3.2mm

*Between 3.2 - 4mm

*Greater than 4mm

Flow Path > 60m

Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH7736, Southbound

Date

6/09/2021 12:41:14 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

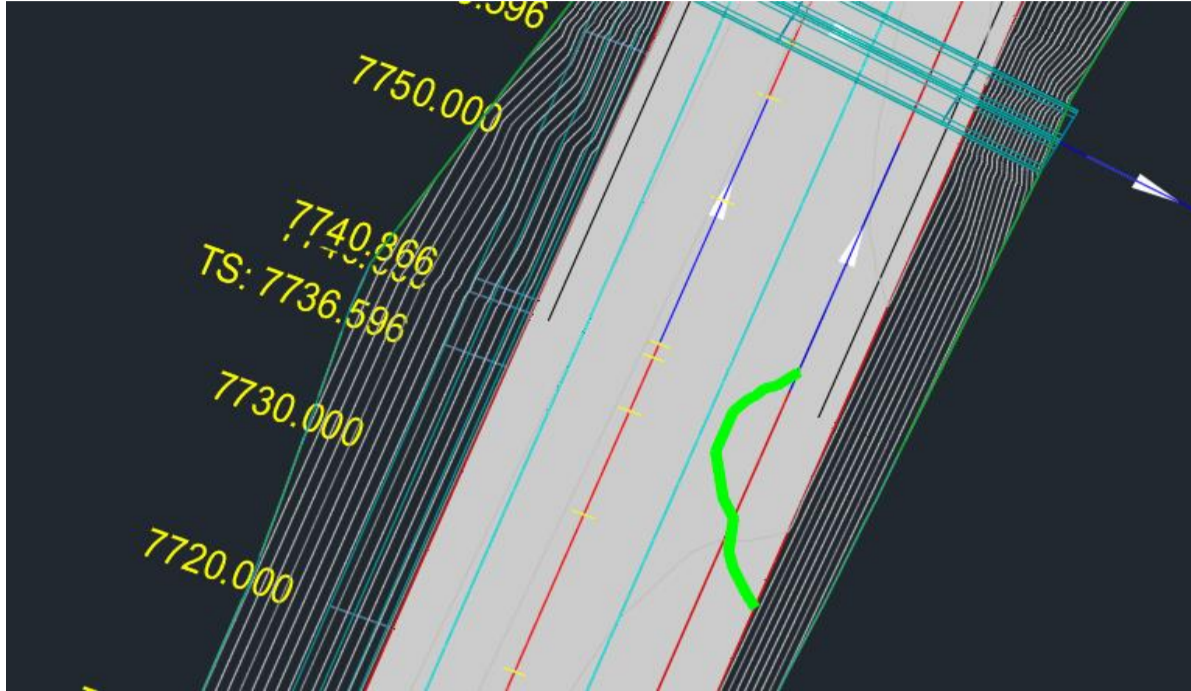
25

Design Speed (km/h)

120

Is Friction Demand High/Low

High



Water Film Depth Prediction

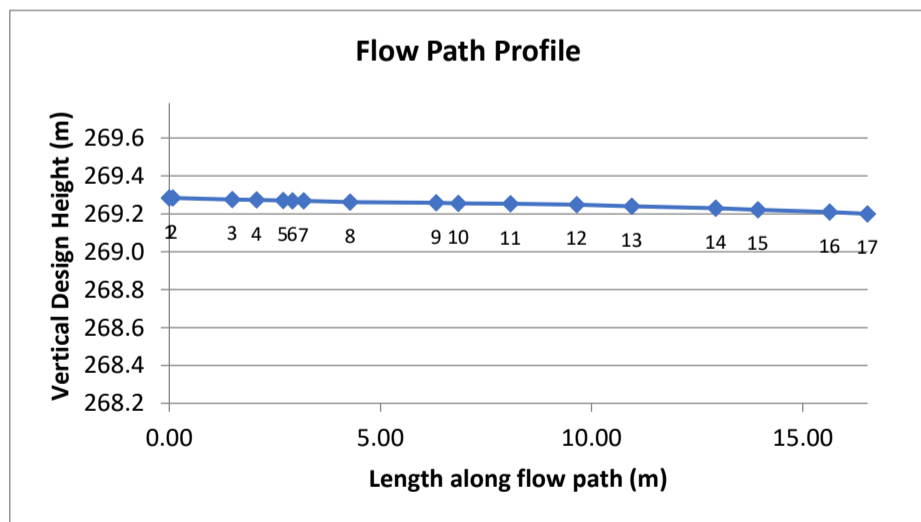
Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		269.25					
2	0.08	0.08	269.25	0.00	0.00	1.11	-0.19	-0.19
3	1.49	1.41	269.24	0.01	0.01	0.58	0.53	0.53
4	2.07	0.58	269.24	0.01	0.01	0.48	0.76	0.76
5	2.70	0.63	269.24	0.02	0.01	0.50	0.87	0.87
6	2.92	0.22	269.23	0.02	0.01	0.51	0.91	0.91
7	3.18	0.26	269.23	0.02	0.02	0.48	1.00	1.00
8	4.29	1.10	269.23	0.05	0.02	0.50	1.16	1.16
9	6.32	2.04	269.22	0.07	0.02	0.34	1.76	1.76
10	6.84	0.52	269.22	0.08	0.02	0.36	1.79	1.79
11	8.08	1.24	269.22	0.11	0.03	0.33	2.05	2.05
12	9.65	1.57	269.22	0.14	0.03	0.30	2.33	2.33
13	10.96	1.31	269.21	0.23	0.04	0.39	2.20	2.20
14	12.94	1.98	269.20	0.35	0.05	0.41	2.31	2.31
15	13.94	1.00	269.19	0.46	0.07	0.47	2.24	2.24
16	15.64	1.70	269.18	0.63	0.08	0.52	2.28	2.28
17	16.53	0.90	269.17	0.79	0.10	0.58	2.21	2.21
Total (m)		16.53						

Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m



Aquaplaning Potential Assessment

Project Information (Name,Chainage,Direction)

Newell Hwy, CH8208, Southbound

Date

6/09/2021 12:42:52 PM

Version

100% Concept Design

Calculated by

LB

Checked By

SOR

Texture Depth (mm)

0.4

Intensity (mm/h)

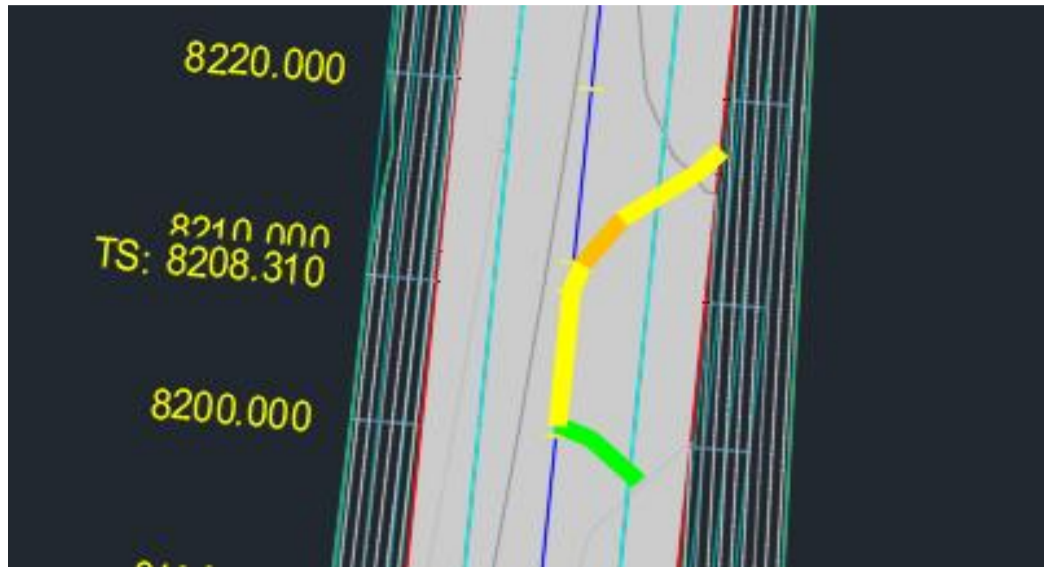
25

Design Speed (km/h)

120

Is Friction Demand High/Low

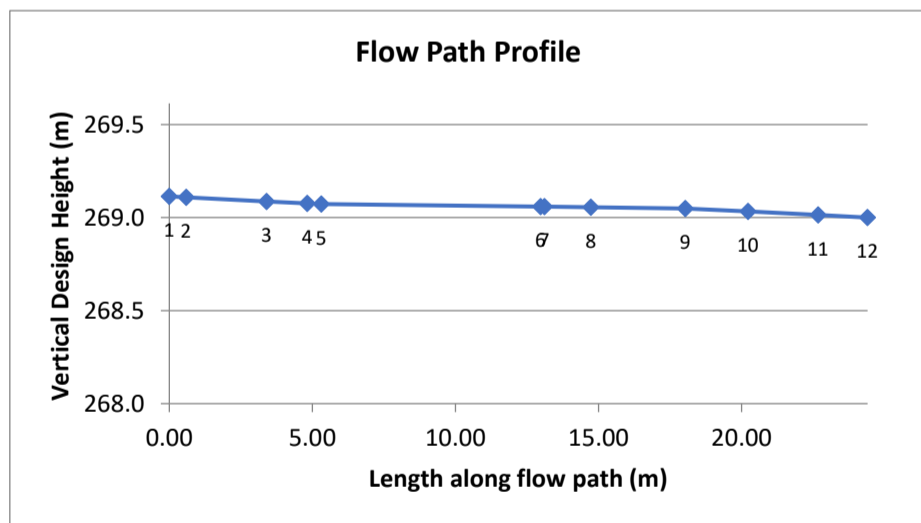
High



Water Film Depth Prediction

Point	Distance from	Section Length (m)	Vertical Design	Total Area (m2)	Equal Area Ordinate	Se (%)	Predicted Depth (mm)	
							T = 0.4	T = 0.4
1	0.00		269.10					
2	0.59	0.59	269.09	0.00	0.00	0.81	0.14	0.14
3	3.40	2.81	269.07	0.05	0.03	0.81	0.75	0.75
4	4.82	1.42	269.06	0.09	0.04	0.74	0.99	0.99
5	5.31	0.49	269.06	0.10	0.04	0.72	1.06	1.06
6	12.98	7.67	269.04	0.23	0.04	0.28	2.82	2.82
7	13.11	0.13	269.04	0.24	0.04	0.27	2.84	2.84
8	14.73	1.63	269.04	0.28	0.04	0.26	3.09	3.09
9	18.03	3.30	269.03	0.41	0.04	0.25	3.47	3.47
10	20.23	2.19	269.02	0.71	0.07	0.35	3.14	3.14
11	22.67	2.45	269.00	1.08	0.10	0.42	3.02	3.02
12	24.40	1.73	268.98	1.44	0.12	0.48	2.94	2.94

Total (m) 24.40



Warnings Legend

Guidelines for water film depth for design speed 120km/h & friction High

- *Between 2.5 - 3.2mm
- *Between 3.2 - 4mm
- *Greater than 4mm

Flow Path > 60m

APPENDIX 10: Project Verifier Certification

Schedule 8 – Design Documents Certificate

Project: HW17 Newell Highway Realignment - Tomingley
WAD: 21.129360.1030

Milestone: 100% Concept Design Phase | Road Design, Geotech, Structures, Hydraulics and Hydrology

In accordance with the terms of the Works Authorisation Deed (Deed) between Transport for NSW and the Developer with respect to the Works, we hereby certify that:

- (a) The attached Design Documents:
 - (i) comply with all the requirements of the Deed and the Project Documents; and
 - (ii) are documented to enable construction in compliance with the Project Documents.
- (b) The Developer has addressed all issues of review, comment, and consultation with Transport for NSW in respect of the Design Documents.



.....

Signed for and on behalf of

Dion Killiby

BE Civil (Hons) FIEAust CPEng EngExec NER

on Behalf of Peter Dearden

14 December 2021

Attachments:

- PV Geo Struct 100% CD Rev C_I Close out
- PV Hydrology Hydraulics100% CD Rev C
- PV Road Design 100% CD Rev D Closeout
- 50% Concept Review TfNSW Closeout

Road Name - HW17 Newell Highway



Road Name - Newell Highway Proposed Deviation 56.3km To 64.1km North Of Parkes

Drawing Registration Number: TBC

RMS Project No: TBC

Reviewers WBS: TBC

Comments Notes

Comments should give a clear & concise view of the issue raised identifying chainage, reference, feature or geographic point.

All comments should be identified as either:
- Observations; or
- Non-Compliances.

Observation

Comments regarding the design development, potential future compliance issue or other questions should be identified as Observations and should be raised in the preliminary (Draft 20%,50%,80%) phases only. Non-compliances during the 100% Pre AFC / AFC phases

Non-Compliance

Comments regarding non-compliances must refer to the relevant standards or reference documents and include the relevant clause that the issue is non-compliant with. Non-Compliances can be made at all stages. However, during the 100% Pre AFC / AFC phases comments should be limited to actual non-compliances, ONLY.

Close Out Status Legend

Open
Unaddressed or inadequate response to the reviewer comment / issue item

Closed
Adequate response given to the reviewer comment where no change is required or the design documents have updated to reflect the required change. Comment is considered closed.

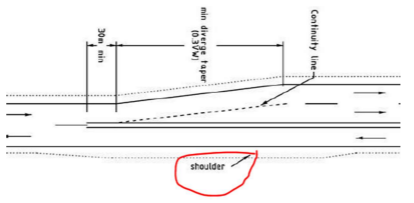
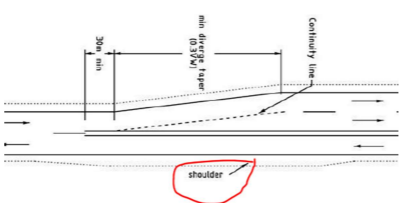
Conditional

Adequate response given to the reviewer comment, to be used where:
1. comment is minor and the design documents have not been updated to reflect the required change and can be addressed in the following design phase. Can only be used where there is agreement between the reviewer and the project manager.
2. A design departure is required to close the comment which is yet to be approved/signed. All Conditional comments must be closed prior to Pre-AFC of Delivery Readiness.

Close out columns to be completed by Reviewer Only. Comments entered from other sources will be ignored and deleted from the Reviewers Closure column.

All Departures from Standards will require sign off so that the Design Review Comments can be officially closed.

Background				Review						Response			Close Out		
Issue No	Gateway	Issue Phase %	Document / Reference	Rev	Discipline / Aspect	Name / Reviewer	Review Issue Date	Comment Type	Reviewer's Comment Reviewer's additional comment inc date and feedback	Designer's Response / Action Designer's additional response inc date and feedback	Name	Response Date	Reviewer's Closure	Status	Closure Date
50% CONCEPT DESIGN, 100% CONCEPT DESIGN, 50% DETAILED DESIGN, 80% DETAILED DESIGN, 100% DETAIL DESIGN & IFC															
1	Concept	50%	All	A	Drafting	D. Woods / Evan Ralph	11/06/2021		ROADLOC system should be applied.	Proposed disposition raised in Meeting 1 (050721) Item 1.5. Awaiting response	L.Baynham	05/07/21	NO - tfsnw to provide Road Loc reference details for future iterations	Conditional	
2	Concept	50%	GE-101 - GE-105; RD-101 - RD-113	A	Drafting	D. Woods / Evan Ralph	11/06/2021		Add curve Radii. Not on key plan.	Added Radii to sheets GE-103 to GE-106	L.Baynham	16/07/21	Agree	Closed	10/08/21
3	Concept	50%	GE-102; RD-102 - RD-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Add notes to terminate existing Back Tomingley West Road before existing intersection.	Added note to GE-102 and a solid hatched area	L.Baynham	16/07/21	Agree	Closed	10/08/21
4	Concept	50%	GE-105; RD-114	A	Alignment	D. Woods / Evan Ralph	11/06/2021		Arc length for curve should be checked to ensure it meets minimum.	The last curve on the alignment was not standard. I have added in an additional curve with a radius of 6000m and increased the radius of the last curve to bring the arc length to standard	L.Baynham	16/07/21	Agree - But add Nototaiion of Curve size to plan GE-106. We not the wobble in alignment ?? Why not provide a straight alignment?	Conditional	
5	Concept	50%	RA-100	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Top soil to be provided on batters. Verge rounding should be 2m on a 1m wide verge. Adjust note on verge rounding detail. Typical should give range for typical sections. Typical should detail super elevation range for curves ?.	Changed note to reflect a 2m verge rounding. Sheets GE-107 and GE108 show typical sections, showing full width of passing lanes and areas of full superelevation.	L.Baynham	16/07/21	Agree - future iterations should show seal widths with call outs to pavement design ?	Closed	10/08/21
6	Concept	50%	RA-100	A	Road Design	D. Woods / Evan Ralph	11/06/2021		6:1 batters are required for the Newell Highway due to high percentage of heavy vehicles	Design now showing 6:1 Batters along the length of the job, pending finalisation of discussions TfNSW/Alkane	L.Baynham	16/07/21	Agree	Closed	10/08/21
7	Concept	50%	RA-101 - RA-107	A	Drafting	D. Woods / Evan Ralph	11/06/2021		Add survey marks / alignment bearings.	Survey marks have been included on the overall plan of Newell Highway and alignment bearing table has been added to all RA sheets.	L.Baynham	16/07/21	Agree - add to alignment and plan long sheets for future iterations of plans	Closed	10/08/21
8	Concept	50%	GE-104; RA-106; RD-111	A	Alignment	D. Woods / Evan Ralph	11/06/2021		Curve at 6200 to 6500 has an unnecessary lateral movement in curve.	TS label have been used to flag to the designer and the construction contractor that at the TS point is where the pavement crossfall is level through the superelevation transition. There are no spirals or lateral shifts on the Newell Highway over the project length	L.Baynham	16/07/21	Agree - we note intersection moved , excellent	Closed	10/08/21
9	Concept	50%	GE-102; RA-102 - RD-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Adjust location of New Back Tomingley West Road to the south to improve vehicle manoeuvre distance from southbound overtaking lane merge (i.e. manoeuvre distance to pass a standing vehicle at Back Tomingley West Road intersection). Current design arrangement is not desirable.	Location and the diverge tapers of the passing lanes adjusted to obtain the distance required between the southbound passing lane and the start of the CHR treatment for Back Tomingley West Road	L.Baynham	16/07/21	Agreed - refer to email response Willian Prell dated Mon 9/08/2021 12:16 PM, advising slight adjustment	Conditional	
10	Concept	50%	RD-101	A	Alignment	D. Woods / Evan Ralph	11/06/2021		Vertical alignment should tie-in with reverse curves to ease the vertical grading into the existing road level.	Reverse verticale curves have been added to each tie-in	L.Baynham	16/07/21	Agree	Closed	10/08/21

11	Concept	50%	RD-101 - RD-114	A	Drafting	D. Woods / Evan Ralph	11/06/2021		HW39 referenced instead of HW17	Changed to show HW17	L.Baynham	16/07/21	Agree	Closed	10/08/21
12	Concept	50%	RA-102	A	Road Design	D. Woods / Evan Ralph	11/06/2021		No provision for protected right turn at McNivens Road or Back Tomingley West Road. Noting that traffic volumes on side road are low, it is desirable to provide CHR and AUL treatments on basis of safety not volume. Consider situation where a vehicle is stopped to make a right turn. Is there enough manoeuvring distance for a vehicle from the overtaking lane merge to pass a standing vehicle at new Back Tomingley West Road? Wide shoulder required.	All 3 council road intersection with the Newell Highway are now designed as a CHR treatment. In order to achieve this curves 1,2 & 3 from Radius reduced from 2000m to 1500m	L.Baynham	16/07/21	Agree - But reference to plans set dated 14/07/21 RA-102	Closed	10/08/21
13	Concept	50%	RD-105 - RD-106; RD-110 - RD-111	A	Drainage	D. Woods / Evan Ralph	11/06/2021		No details provided on headwall locations or proposed safety barriers for culverts. Ensure clear zone is met to Austroads for 110km/h.	Guardrails will be required where culverts are located. Need final culvert sizes	L.Baynham	16/07/21	Agree - Take issue forward for future reference	Conditional	
14	Concept	50%	All	A	Drainage	D. Woods / Evan Ralph	11/06/2021		No detail provided on drainage design apart from notation on plans.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - Take issue forward for future reference	Conditional	
15	Concept	50%	RD-105 - RD-106; RD-110 - RD-111	A	Drainage	D. Woods / Evan Ralph	11/06/2021		Maintenance access to culvert structures will be required, particularly at large culverts.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - Take issue forward for future reference	Conditional	
16	Concept	50%	RA-102	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Check and adjust shoulder widths and treatments at merges and diverges per Austroads requirements for runoff.	Designed runoff provided for both passing lane merge tapers - See sheets RD-108 & RD-120	L.Baynham	16/07/21	Agree	Closed	10/08/21
17	Concept	50%	RA-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Adjust adjacent opposing shoulder width at north bound overtaking lane diverge per Austroads requirements. Refer to image below: 	Shoulder in this area have been extended to 3m - See sheets RD-108	L.Baynham	16/07/21	Agree	Closed	10/08/21
18	Concept	50%	RA-102 - RD-103	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Adjust adjacent opposing shoulder width at south bound overtaking lane diverge per Austroads requirements. Refer to image below: 	Shoulder in this area have been extended to 3m - See sheets RD-120	L.Baynham	16/07/21	Agree	Closed	10/08/21
19	Concept	50%	RA-104	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Remove note end taper for Kyalite Road acceleration lane.	Kyalite Road Acceleration lane has been removed and replaced with left turn out shoulder treatment	L.Baynham	16/07/21	Agree	Closed	10/08/21
20	Concept	50%	RA-106; RD-111	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Intersection tapers merge against the LHS Horizontal curve. This manoeuvre is not desirable. Relocate intersection taper clear of curve. Ideally there should be 3 - 5 seconds travel time separation between curve and intersection.	Newell and Kyalite Road Alignment shifted to move the intersection taper off the horizontal curve. There is now approximately 1.5 seconds of travel time between the end of the CHR and the 1000m Radius Curve	L.Baynham	16/07/21	Agree	Closed	10/08/21
21	Concept	50%	GE-104; RA-106; RD-112	A	Road Design	D. Woods / Evan Ralph	11/06/2021		McNiven Lane has been located within a horizontal curve with diminishing line of sight to the south. Additionally the alignment of McNiven Lane is on a slight skew exacerbating the line sight across a drivers shoulder to Right. Desirable treatment is to relocate intersection out of curve, or otherwise square up intersection.	McNivens Lane squared up with The Newell Highway	L.Baynham	16/07/21	Agree	Closed	10/08/21
22	Concept	50%	RD-104	A	Drainage	D. Woods / Evan Ralph	11/06/2021		Low point in terrain, provide additional culverts.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
23	Concept	50%	RD-109	A	Drainage	D. Woods / Evan Ralph	11/06/2021		Low point in terrain, provide additional culverts.	Waiting on final Hydrological Assessment	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
24	Concept	50%	GE-102; GE-104; RD-103; RD-111 RD-112	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Acceleration lanes are not the preferred left turn treatment on the Newell Highway as large heavy vehicles are typically not able to reach within 20km/h of the through traffic speed, leading to accidents.	Kyalite Road Acceleration lane has been removed and replaced with left turn out shoulder treatment	L.Baynham	16/07/21	Agree	Closed	10/08/21

25	Concept	50%	RD-115	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Leading taper required Left turn in and out.	BAL has been designed for all intersections and have added a left turn out shoulder treatment - See sheet RD-106	L.Baynham	16/07/21	Agree	Closed	10/08/21
26	Concept	50%	RD-116	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Leading taper required Left turn in and out.	BAL has been designed for all intersections and have added a left turn out shoulder treatment - See sheet RD-122	L.Baynham	16/07/21	Agree	Closed	10/08/21
27	Concept	50%	RD-117	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Leading taper required Left turn in and out.	BAL has been designed for all intersections and have added a left turn out shoulder treatment - See sheet RD-125	L.Baynham	16/07/21	Agree	Closed	10/08/21
28	Concept	50%	Pg 4, Pg10,	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Tables for intersection treatments conflict with each other. CHR and AUL proposed for Back Tomingley West Road in Table 3 but not in Table 10.	Tables in the design report will be updated for the 100% Concept Design	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
29	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Acceleration Lane design speed in table is 110km/h not 120km/h. Posted speed is 110km/h. Truck acceleration should be to a speed no less than 20km/h below, therefore acceleration lane length should be adopted to reach 90km/h not 80km/h.	Kyalite Road Acceleration lane has been removed	L.Baynham	16/07/21	Agree - note doesnt apply	Closed	10/08/21
30	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021		AUL design speed should be 120km/h.	AUL has been designed to 120km/h	L.Baynham	16/07/21	Agree	Conditional	
31	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021		Standard BAR length as per Austroads does not allow enough length for a B-triple to pass a standing B-Double. BAR length should be determined by the vehicle turn paths.	All 3 council road intersection with the Newell Highway are now designed as a CHR treatment.	L.Baynham	16/07/21	Agree	Closed	10/08/21
32	Concept	50%	Appendix 4 - Intersection Design Calculations	A	Road Design	D. Woods / Evan Ralph	11/06/2021		CHR design speed should be 120km/h.	Calculations now show 120km/h	L.Baynham	16/07/21	Agree - ensure in 100% plan update	Closed	10/08/21
33	Concept	50%	GE-105, RD-113	A	Property	W. Prell	21/06/2021		What is the proposed treatment for the existing South Tomingley Rest Area?	Maintain existing rest area and AUL Treatment	L.Baynham	16/07/21	Detail treatment of existing Rest Area in the 100% Concept Design to allow TfNSW an opportunity to review additional intersection treatments.	Conditional	
34	Concept	50%	All Cross Section Sheets	A	Road Design	W. Prell	21/06/2021		What is the proposed treatment for the existing Newell Highway Pavement? There are areas where the proposed/existing interface creates a sag point. In these instances, the existing pavement should be removed and earth graded to avoid ponding near the proposed pavement.	Waiting on completion of Geotech Testing (delayed by wet weather)	L.Baynham	16/07/21	Agree - carry issue forward	Conditional	
35	Concept	50%	Pg 16	A	Constructability	W. Prell	21/06/2021		Details of construction staging for all construction activities within the existing Newell Highway corridor will be required at the Detailed Design phase.	Noted	L.Baynham	16/07/21	Agree	Closed	11/08/21
36	Concept	50%	All	A	Alignment	W. Prell	21/06/2021		Please show the road alignment overlain on a plan showing the extent of mining operations.	General plan has been added to the drawing set and the mine outline and blast line has been added to the plan.	L.Baynham	16/07/21	Agree	Closed	11/08/21

Design Review Comment Sheet

Project Number: 21.129360.1030
 RMS Registration Number: 21.129360.1030

Project	HW17 Newell Highway Realignment Tomingley
Design Report No.	2019116 dated 20 September 2021 Issue 1 Revision 0
Design Drawing Nos.	100% Concept Design dated 10 September 2021 (GE, RA, RD, PV, RF, RC, SM, ST, TP and PW drawing sets)
Design Phase	100% Concept Design
Date Issued	20-September-2021

COMPLIANCE STATUS
 O Observation / Comment
 D From info currently provided not able to determine whether design / proposal is compliant.
 N Non-Compliant
 M Minor non-compliance for immediate action but subsequently documented in next stage

RESPONSE AGREEMENT STATUS
 O Open
 C Closed
 CS Closed SUBJECT TO additional action / information by designer

Reviewer Name 1	Dr Stephen Salim (Structural Project Verifier)
Reviewer Name 2	
Reviewer Name 3	
Reviewer Name 4	
Reviewer Name 5	
Date of Review	

Item	Date	Document Reference	Rev	Reviewer		Discipline	DESIGNER			Reviewer Close-out Comments		
				Reviewer Initials	Reviewer Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
100% Concept Design Phase												
1	25-09-21	Drawing No. RA-102	C	SS	Plan - Incorrect drawing reference for Culvert 20, should refer to SM-123 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
2	25-09-21	Drawing No. RA-104	C	SS	Plan - Incorrect drawing reference for Culvert 1, should refer to SM-101 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
3	25-09-21	Drawing No. RA-105	C	SS	Plan - Incorrect drawing reference for Culvert 2, should refer to SM-103 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
4	25-09-21	Drawing No. RA-106	C	SS	Plan - Incorrect drawing reference for Culvert 3, should refer to SM-105 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
5	25-09-21	Drawing No. RA-107	C	SS	Plan - Incorrect drawing reference for Culvert 4, should refer to SM-107 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
6	25-09-21	Drawing No. RA-111	C	SS	Plan - Incorrect drawing reference for Culvert 16, should refer to SM-115 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
7	25-09-21	Drawing No. RA-112	C	SS	Plan - Incorrect drawing reference for Culvert 7, should refer to SM-113 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
8	25-09-21	Drawing No. RA-113	C	SS	Plan - Incorrect drawing reference for Culvert 18, should refer to SM-117 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
9	25-09-21	Drawing No. RA-114	C	SS	Plan - Incorrect drawing reference for Culvert 9, should refer to SM-119 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
10	25-09-21	Drawing No. RA-115	C	SS	Plan - Incorrect drawing reference for Culvert 19, should refer to SM-121 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
11	25-09-21	Drawing No. RD-104	C	SS	Plan - Incorrect drawing reference for Culvert 20, should refer to SM-123 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
12	25-09-21	Drawing No. RD-108	C	SS	Plan - Incorrect drawing reference for Culvert 1, should refer to SM-101 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
13	25-09-21	Drawing No. RD-110	C	SS	Plan - Incorrect drawing reference for Culvert 2, should refer to SM-103 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
14	25-09-21	Drawing No. RD-111	C	SS	Plan - Incorrect drawing reference for Culvert 3, should refer to SM-105 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
15	25-09-21	Drawing No. RD-113	C	SS	Plan - Incorrect drawing reference for Culvert 4, should refer to SM-107 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
16	25-09-21	Drawing No. RD-122	C	SS	Plan - Incorrect drawing reference for Culvert 16, should refer to SM-115 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
17	25-09-21	Drawing No. RD-123	C	SS	Plan - Incorrect drawing reference for Culvert 7, should refer to SM-113 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
18	25-09-21	Drawing No. RD-126	C	SS	Plan - Incorrect drawing reference for Culvert 8, should refer to SM-101 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
19	25-09-21	Drawing No. RD-127	C	SS	Plan - Incorrect drawing reference for Culvert 18, should refer to SM-117 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
20	25-09-21	Drawing No. RD-128	C	SS	Plan - Incorrect drawing reference for Culvert 9, should refer to SM-119 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
21	25-09-21	Drawing No. RD-129	C	SS	Plan - Incorrect drawing reference for Culvert 19, should refer to SM-121 instead.	Structures	Drawing reference is now correct	9-10-21	LB	No further comments.	C	16-Oct-21
22	25-09-21	General	-	SS	Please provide a general structures notes drawing or include specific structural notes in relevant culvert drawings in the next design submission.	Structures	This will be included in the 50% detailed design as per TfNSW requirements	9-10-21	LB	Noted, pending further review at 50% Detailed Design.	O	
23	25-09-21	General	-	SS	Please refer to marked-up drawings.	Structures	Subgrade prep details will be provided as part of the 50% detail design. All other comments have been addressed or already had notes provided	9-10-21	LB	Noted, pending further review at 50% Detailed Design.	O	
24	25-09-21	General	-	SS	Please state max. & min. fill height for each culvert design.	Structures	This information is in the long section for each culvert	9-10-21	LB	Noted. No further comments.	C	16-Oct-21
25	25-09-21	General	-	SS	Please provide design flood level for each culvert structure.	Structures	Will included in the 50% detailed design once we have received the drainage model files	9-10-21	LB	Noted, pending further review at 50% Detailed Design.	O	
26	26-09-21	Design Report	0	SS	Section 4 of the report states that the drainage design is based on 5% AEP, has consideration given to climate change.	Structures	Yes climate change has been incorporated. Please refer to hydrological report	10-10-21	SOR	Noted. No further comments.	C	16-Oct-21

Item	Date	Document Reference	Rev	Reviewer		Discipline	DESIGNER			Reviewer Close-out Comments		
				Reviewer Initials	Reviewer Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
27	26-09-21	Design Report	0	SS	There should be a dedicated section on "Design & Performance Criteria" summarising design standards and geotechnical information.	Structures	This will be incorporated in the 50% Detailed Design submission once structural design and geotechnical report have been finalised	10-10-21	SOR	Noted, pending further review at 50% Detailed Design.	O	
28	26-09-21	Design Report	0	SS	There should be a dedicated section on "Design Approach" summarising proposed culvert structural description, base slab, wingwalls & headwalls, design loads & proposed structural modelling for the culverts.	Structures	This will be incorporated in the 50% Detailed Design submission once structural design has been finalised	10-10-21	SOR	Noted, pending further review at 50% Detailed Design.	O	
29	26-09-21	Design Report	0	SS	Suggest to include a Section on "Design Compliance" to demonstrate the design has been undertaken in accordance with the WAD, outlining review & approvals including independent verification.	Structures	Section 1.3 of the Concept Design Report notes the WAD and the role of the Project Verifier and their comments are included in Appendix 7. the WAD does not require an Independent Verifier (other than the PV). Constructive Solutions has chosen to use one as part of its design assurance processes.	10-10-21	SOR	Noted. No further comments.	C	16-Oct-21
30	26-09-21	Design Report	0	SS	Please include a Section on "Durability" to summarise design life and specific design and construction requirements (i.e. exposure class, concrete strength & cover requirements).	Structures	This will be incorporated in the 50% Detailed Design submission once the geotechnical report has been finalised. Appropriate testing to determine durability performance has been undertaken	10-10-21	SOR	Noted, pending further review at 50% Detailed Design.	O	
31	26-09-21	Design Report	0	SS	Suggest to include a Section on "Operation & Maintenance".	Structures	Noted and will be incorporated in the 50% Detailed Design submission	10-10-21	SOR	Noted, pending further review at 50% Detailed Design.	O	
32	26-09-21	General		MM	Verification of the bridge structure (part of the local road package) is pending.	Structures	Outside of scope of WAD (and therefore PV's responsibilities)	10-10-21	SOR	Noted. No further comments.	C	17-Oct-21
33	26-09-21	General		MM	Verification of hydrological aspects relevant to the bridge structure (contained in the hydrological study report) is pending	Structures	Outside of scope of WAD (and therefore PV's responsibilities)	10-10-21	SOR	Noted. No further comments.	C	17-Oct-21

Design Review Comment Sheet

Project Number: 21.129360.1030

RMS Registration Number: 21.129360.1030

Project	HW17 Newell Highway Realignment Tomingley	COMPLIANCE STATUS O Observation / Comment D From info currently provided not able to determine whether design / proposal is compliant. N Non-Compliant M Minor non-compliance for immediate action but subsequently documented in next stage
Design Report No.	Project Verifier Hydrology & Hydraulics - Partial Review Comments - Hydraulics Model	
Design Drawing Nos.	TUFLOW Model - E009 / D033	
Design Phase	100% Concept Design	
Date Issued	20-September-2021	
Reviewer Name 1	Luke Mclean - Project Verifier - Hydrology & Hydraulics	
Reviewer Name 2	Sam Drysdale - Project Verifier - Hydrology	
Reviewer Name 3		
Reviewer Name 4		
Reviewer Name 5		
Date of Review	2021.11.19	

RESPONSE AGREEMENT STATUS	
O	Open
C	Closed
CS	Closed SUBJECT TO additional action / information by designer

Item	Date	Document Reference	Rev	Reviewer		Discipline	DESIGNER			Reviewer Close-out Comments			DESIGNER Response Take 2			Reviewer Close-out Comments		
				Initials	Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed	Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
100% Concept Design Phase																		
1	2021.11.03	TUFLOW Model	N/A	LMM		Hydrology & Hydraulics	This request was received and files provided to Constructive Solutions on 01/11/2021. One set of check files were simulated due to large output size and that has already been provided. The only difference between the different events is the hydrology input (ts1 files). Hydrology input has been provided. The provision of the data to date is considered sufficient for a review process.	8-11-21	SC	Results and logs have been submitted.	C	2021.11.19						
							- Full set of results not provided for critical storm durations identified in Table 3-3 of Annexure B Hydrology and Hydraulics Technical Report 002. Only processed max grids have been provided - Full set of checks not provided for critical storm durations identified in Table 3-3 of Annexure B Hydrology and Hydraulics Technical Report 002. No checks files have been provided for any of the identified critical storm durations - Full set of logs not provided for critical storm durations identified in Table 3-3 of Annexure B Hydrology and Hydraulics Technical Report 002. Only results from 5% AEP 360 min TP08 have been provided - D033 - Full set of results not provided for critical storm durations identified in Table 3-3 of Annexure B Hydrology and Hydraulics Technical Report 002. Only processed max grids have been provided - Full set of checks not provided for critical storm durations identified in Table 3-3 of Annexure B Hydrology and Hydraulics Technical Report 002. No checks files have been provided for any of the identified critical storm durations - Full set of logs not provided for critical storm durations identified in Table 3-3 of Annexure B Hydrology and Hydraulics Technical Report 002. Only results from 5% AEP 360 min TP08 have been provided											
2	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	Cell wet/dry depth would be expected to be set to 0.0002 given the use of 2d_rf inputs. Modelling Originator comment required.	8-11-21	SC	Adopting a HPC solution scheme means that the model is inherently stable, and instabilities will not present as mass errors. Adoption of a wet/dry cell depth of 0.0002 is recommended by the software manufacturer for situations where either a. direct rainfall is adopted, or b. model elevations are in excess of 100 mAHd. As both of these criteria have been satisfied for this modeling, if this is not to be adopted it would be expected that a sensitivity test be completed to demonstrate that the results are not affected by this.	CS	2021.11.19	A sensitivity run was performed on the 5% and 1% AEP with wet/dry cell depth of 0.0002. 13mm increase was observed in the 5% upstream of the Newell Highway. No change was observed in the 1%. Flood maps and TUFLOW results have been provided with this response.	1-12-21	SC	The effect on the flood levels resulting from the adoption of a lower wet/dry cell depth alone has been quantified as 13 mm. This does not take into account any cumulative effect of this in conjunction with other comments. If the project requires quantitative assessment of the impact of works, where the relative impact is known and quantified, it is recommended that this change be implemented.	C	2021.12.09
3	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	Downstream HQ boundaries set to a slope of 0.004. Interrogation of the DEM_Z indicates that these boundaries are not all of the same slope.	8-11-21	SC	The hydraulic grade shows that the boundary is sufficiently downstream enough to not impact results at the highway. Whilst the slope could be changed, results at the Highway would not change. Results are considered appropriate for Concept Design.	C	2021.11.19						
4	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	Downstream HD boundary displays some positive afflux intersecting the code boundary during one or more design events. To quantify the extent of impact, the boundary should be moved such that all afflux is contained within the model's 1d_code boundary.	8-11-21	SC	Response adequately addressed comment, appropriate for Concept Design only. Comment has been closed.	C	2021.11.19						
5	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	2d_rf polygons have been used to input flows into the model. Analysis of trapped depressions in the landscape shows that while some are reasonable, and others drained by the 1d_nwk, there are small areas where there is depression storage remaining that should be addressed.	8-11-21	SC	A sensitivity analysis has already been performed on this during an internal QA process. A hotstart file was used at the start of the simulation to 'fill' the minor depressions in the terrain. Results showed that there would be < 20mm afflux in most sections of highway, with up to 100mm at a short section (compared to the no hotstart case). The large freeboard designed into the Highway takes into account modelling uncertainties such as this.	CS	2021.11.19	A sensitivity run was performed on the 5% and 1% AEP with hotstart file and latest tcf. 25mm increase was observed in the 5% upstream of the Newell Highway. No change was observed in the 1%. Flood maps and TUFLOW results have been provided with this response.	1-12-21	SC	The effect on the flood levels resulting from the removal of trapped terrain lowpoints has been quantified as 25 mm. This does not take into account any cumulative effect of this in conjunction with other comments. If the project requires quantitative assessment of the impact of works, where the relative impact is known and quantified, it is recommended that this change be implemented.	C	2021.12.09
6	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	1d_nwk element ID_10 has a pBlockage of 99.9. Modelling Originator comment required	8-11-21	SC	This was an earlier design culvert. Instead of removing from the model, a 99.9% blockage was used.	C	2021.11.19						
7	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	1d_nwk element ID_20 has no HConF_or_W or WConF_or_W losses defined. Modelling Originator comment required.	8-11-21	SC	Check file shows that default losses have been applied automatically by TUFLOW.	C	2021.11.19						
8	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	The Hydrology and Hydraulics Technical Report states that the 5% AEP CC event was simulated for the project, however the .tef file does not reflect that the model is set up to run this event. Modelling Originator comment required.	8-11-21	SC	The climate change event was simulated as a sensitivity run on a different tcf (D031). The difference between D031 and D033 is the design of Back Tomingley West Road. This would have no impact on the conclusions reached at the Newell Highway.	O	2021.11.19	Climate change for the 5% has been rerun with D033. Results are same as those reported in the report. The flood map and TUFLOW results have been provided with this response.	1-12-21	SC	Comment closed based on Designer Response.	C	2021.12.09
9	2021.11.03	TUFLOW Model	E009 / D033	LMM		Hydrology & Hydraulics	No .tmf file inputs have been provided. The models are unable to be run.	8-11-21	SC	Apologies. This will be provided along with the responses to the comments.	C	2021.11.19						
10	2021.11.19	TUFLOW Model		SD		Hydrology & Hydraulics	Full checks files have not been provided for all critical AEP events as requested. Checks files that were provided related to a different tcf (i.e. different model) than that being assessed as part of this review.				O	2021.11.19	Full check files for the climate change run has been provided with this response, as requested.	1-12-21	SC	Comment closed based on files provided by Designer	C	2021.12.09
11	2021.11.19	XP-RAFTS Model		SD		Hydrology & Hydraulics	0.025 is low for a pervious manning's value, was sensitivity testing undertaken for higher values consistent with grazing/cropland.				O	2021.11.19	Yes sensitivity on Mannings n, ARF, SF factor, IL, CL have been undertaken in RAFTS. The working spreadsheet with results of these tests has been provided with this response. Also note that Mannings'n of 0.04 was adopted. I believe the incorrect RAFTS model (with a lower Mannings'n value of 0.025) was supplied. We have supplied the adopted RAFTS model with this submission - the only change from the previously supplied model is the Mannings'n.	1-12-21	SC	Sensitivity demonstrates conservative representation of flows in regards to RFFE. Adopted run ARF-Mannings'0.04-SF1+PBNL and CL 1.9 is consistent with associated guidelines.	C	2021.12.10
12	2021.11.19	XP-RAFTS Model		SD		Hydrology & Hydraulics	The existing mine holes on the eastern side of the highway are currently not represented within the 5m dataset (comparison undertaken on dataset from ELVIS), as any information been assessed on this or has the assumption been all water will be diverted around the existing holes?				O	2021.11.19	Yes assumption is water is diverted around the holes	1-12-21	SC	Noted.	C	2021.12.10

Item	Date	Document Reference	Rev	Reviewer		Discipline	DESIGNER			Reviewer Close-out Comments		DESIGNER Response Take 2			Reviewer Close-out Comments			
				Reviewer Initials	Reviewer Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed	Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
13	2021.11.19	XP-RAFTS Model		SD	A continuing loss of 1.9mm/hr is consistent with Probability Neutral loss guidance. Considering the standard ARR continuing loss of 2.59 mm/hr for the FFA-reconciled catchment (immediately east of the mountain range at the top of the catchment), and a recommended storm loss of -1.5mm/hr, 1.9mm/hr seems appropriate, has a sensitivity been undertaken using a continuing loss of 1mm/hr? Looking at eSpade the Hydrologic Soil Group is generally Slow Infiltration which supports a lower continuing loss.	Hydrology & Hydraulics					O	2021.11.19	Yes sensitivity on Mannings n, ARF, SF factor, IL, CL have been undertaken in RAFTS. The working spreadsheet with results of these tests has been provided with this response	1-12-21	SC	Sensitivity demonstrates conservative representation of flows in regards to RFFE. Adopted run ARF-AMannings0.04-SF01, PBNL and CL 1.9 is consistent with associated guidelines.	C	2021.12.10
14	2021.11.19	TUFLOW Model		LMM	There is a discrepancy between the loss values for IL/CL applied in the hydrology and the hydraulics. Modelling Originator comment is required.	Hydrology & Hydraulics					O	2021.11.19	Preburst has been taken away from the IL in the Mannings'n layer. The initial loss minus preburst was extracted from Storm Injector (supplied previously).	1-12-21	SC	Noted. Comment closed	C	2021.12.10
15	2021.11.19	XP-RAFTS Model		SD	ARFs calculated on an area of 209.6 km2 (representative of four catchment areas combined). However, each of these catchments are acting independent of each other to the area of interest. As such, each individual catchment and their respective areas should be considered separately (i.e. ARE based on each catchment area) especially if adopted the point temporal patterns.	Hydrology & Hydraulics					O	2021.11.19	Yes sensitivity on Mannings n, ARF, SF factor, IL, CL have been undertaken in RAFTS. The working spreadsheet with results of these tests has been provided with this response.	1-12-21	SC	Sensitivity demonstrates conservative representation of flows in regards to RFFE. Adopted run ARF-AMannings0.04-SF01, PBNL and CL 1.9 is consistent with associated guidelines.	C	2021.12.10
16	2021.11.19	XP-RAFTS Model		SD	An ARF applicable to a catchment area of 209.6km2 has been adopted for full model area. IFD stated for no spatial variability and point temporal patterns adopted. There is some inconsistency in this approach. However if the ARFs are altered in line with the above comment for the respective catchments then the approach of point temporal patterns for three of the four catchments is valid. However, Catchment G is some -96km2 which does trigger the use of an areal temporal pattern.	Hydrology & Hydraulics					O	2021.11.19	Catchment G discharges to an area outside the Newell Highway Upgrade boundary and does not impact the highway. It was included for completeness. ARF testing has been undertaken (see supplied spreadsheet) and flows were found to be grossly overestimated with an ARF of 1.	1-12-21	SC	Noted.	C	2021.12.10
17	2021.11.19	XP-RAFTS Model		SD	RFFE used for validation, adopted peak flows are consistently higher than the RFFE, converging for high order events to a difference of 4% under the 1% AEP event. The nearby gauges for the RFFE look like a good match for shape, intensity etc, but looking at the locations, most of the gauges are significantly biased to the east of the catchment. Given the known limitations of the RFFE and the implications of changing Mannings, losses and ARFS with the comments above, would an alternative validation be worthwhile? Perhaps a rational method - or comparison of flows from TUFLOW RoG configuration and the XP-RAFTS model?	Hydrology & Hydraulics					O	2021.11.19	The Rational Method has been used to calculate local catchment S-1 and compared to the Rain-on-Grid flows for the same catchment from the TUFLOW model. Likewise, the Rational Method was used to calculate the total catchment to B-5 and compared to the total flows from the XP-RAFTS model (total flows were applied in the TUFLOW model for the B-5 catchment). The results are in the "Rational Method" sheet of this .xlsx. Results show that the flows applied in the TUFLOW model are close to, or higher than that calculated from the Rational Method. It should be noted that ARR2016 recommends that the Rational Method not be used for design. The calculations performed here are for comparison only.	1-12-21	SC	Noted and agreed.	C	2021.12.10
18	2021.11.19	Report		LMM	The results of the modelling indicate that there is residual afflux located outside of the Project boundary. While it is highly likely that flows will change as a result of the hydrology comments, and thus affect results, it is the expectation of the Reviewer that the Project demonstrates compliance with the requirements of the floodplain manager around the acceptance of permissible residual afflux outside of the Project boundary.	Hydrology & Hydraulics					O	2021.11.19	The afflux at the model boundary are mostly negative afflux (i.e. reduction in flood level). The exception is the 20% AEP where it is showing afflux of 15mm at the model boundary. There are no sensitive landuses downstream of this 15mm and it is expected that the 15mm would dissipate quickly. Noting that Jacobs' scope of works was to support the EIS, not design for construction. It was expected that the EIS conditions would define acceptable afflux criteria, and, if required, the model would be extended when these conditions are received. However it is the opinion of the designer that the model extension is not required at this stage, given the low afflux and the non-sensitive land use.	1-12-21	SC	Based on the Designer response, this comment can be closed. This comment will be reopened at a later date should the requirements of the EIS warrant it's opening.	C	2021.12.09
19	2021.11.19	TUFLOW Model		LMM	Has any sensitivity testing been conducted using reduced CNFs to determine if the timestep is having a material difference on the results?	Hydrology & Hydraulics					O	2021.11.19	A sesensitivity run was performed on the 5% and 1% AEP with Control Number Factor =0.8. No change was observed upstream of the Newell Highway in the 5% or 1% AEP. Flood maps and TUFLOW results have been provided with this response.	1-12-21	SC	Based on the Designer response and the outcomes of the sensitivity runs, this comment can be closed.	C	2021.12.09

Design Review Comment Sheet

Project Number: 21.129360.1030

RMS Registration Number: 21.129360.1030

Project: HW17 Newell Highway Realignment Tomingley

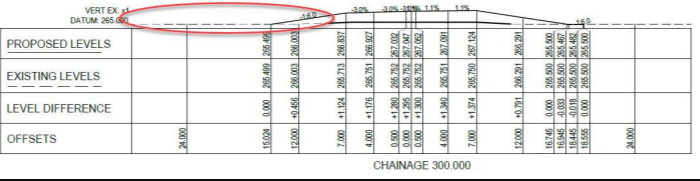
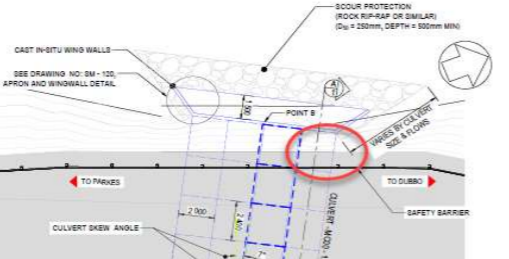
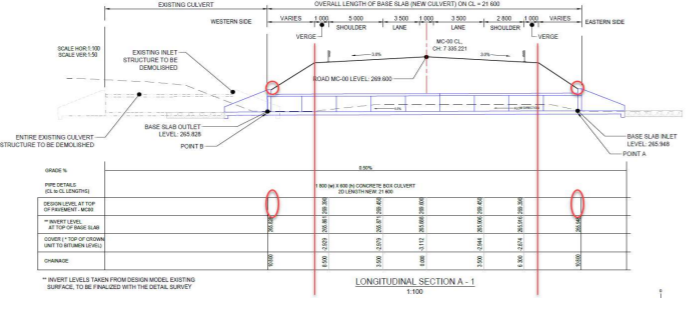
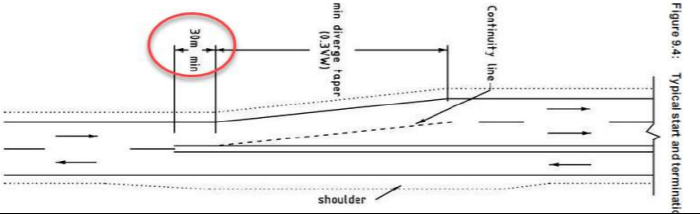
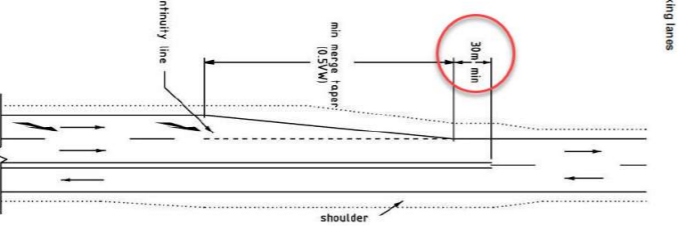
Design Report No. 2019116 dated 20 September 2021 Issue 1 Revision 0
 Design Drawing Nos. 100% Concept Design dated 10 September 2021 Revision C
 Design Phase 100% Concept Design
 Date Issued 44459

Reviewer Name 1 James Gorrie (Road Design Verifier)
 Reviewer Name 2
 Reviewer Name 3
 Reviewer Name 4
 Reviewer Name 5
 Date of Review 27-September-2021

COMPLIANCE STATUS
 O Observation / Comment
 D From info currently provided not able to determine whether design / proposal is compliant.
 N Non-Compliant
 M Minor non-compliance for immediate action but subsequently documented in next stage

RESPONSE AGREEMENT STATUS
 O Open
 C Closed
 CS Closed SUBJECT TO additional action / information by designer



Item	Date	Document Reference	Rev	Reviewer		Discipline	DESIGNER			Reviewer Close-out Comments		
				Reviewer Initials	Reviewer Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
100% Concept Design Phase												
1	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 1 This does not appear to have been fully resolved for the 100% Concept Design submission. Start Chainage on the through road needs to represent the TfNSW linear reference system. The Start Chainage should be ~56300.000.	Road Design	The start of the alignment is now 56300	30-09-21	LB	Noted. Closed subject to additional changes required for the notes on the drawings set to reflect the update chainage e.g. "START OF BAL TREATMENT 1200" on sheet RA-103	CS	
2	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 4 This does not appear to have been fully resolved for the 100% Concept Design submission. The response advises a radius 6000m has been adopted. This is not apparent in the 100% Concept Design. Additional issues have been raised below regarding the alignment plans, setout table and long sections discrepancies.	Road Design	I have made this more clear in the plans. And will be updated in the design report	8-10-21	LB	Noted. Closed subject to supply and review of updated CDR	CS	
3	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 9 PV has not been provided the email correspondence from William Prell dated Mon 9/08/2021 12:16 PM, advising slight adjustments. Please provide for review and consideration.	Road Design	Email attached to response (actually from Dwayne Woods on 090821). Issues raised are no longer relevant as the intersection has been moved and the curve radii on either side has been reduced	10-10-21	SOR	Noted. Closed subject to email being provided.	CS	
4	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 13 The proposed guard rail have been shown in the 100% Concept submission. However, the extent of the proposed barrier type or terminal type have not been included. This may impact many other features including but not limited to: 1. width of verge proposed behind the barrier 2. the formation at the terminal location 3. the point of need location in the terminal 4. the minimum/maximum length of the system 5. depth of post and clearance to structures Also, please refer to review Item 6 for further consideration.	Road Design	I have added more notes around the guardrail, showing the start and end terminals and stated that it is ezyguard	8-10-21	LB	Noted. Closed subject to review of barrier length/point of need calculations. Presumably being provided in the CDR.	CS	
5	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 14 The proposed drainage structures have been shown in the 100% Concept submission. However, please refer to review Item 6 for further consideration.	Road Design	Noted	8-10-21	LB	Closed.	C	
6	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 15 The proposed maintenance access facilities have been shown in the 100% Concept submission. However, there are a number of further considerations that should be made regarding the proposed arrangement. 1. In some instances, why are these facilities not provided or only provided on one side of the road? It is acknowledged that fast lane/turning lane closure will be available at some but not all locations. 2. Are the maintenance bays required directly on top of the culvert? If not, if these were located either immediately prior to or after the structure this may reduce the required length of the structure, reducing the capital and future maintenance costs. 3. Noting that road side safety barrier is proposed at these locations, the proposed trailing tapers are not appropriate as this will result in a likely impact angle of an errant vehicle greater than the MASH max. 25 degrees. This will also likely result in angles in the barrier rail that are outside of the manufactures specifications. 4. The continuous barrier at these locations may not be appropriate depending on the requirements for access of plant and equipment during maintenance. A break/overlapping in the barrier may be more appropriate.	Road Design	Service bays have been adjusted to be not over the culverts, reducing the length of the culverts. I have increased the taper length for the service bay to reduce the impact angle of an errant vehicle	8-10-21	LB	Noted.	C	
7	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 28 The alignment sheets do not align with the alignment table e.g. last Radius C6 is shown as R=1010 on plan view however, the alignment table indicates a R=1500? Also inconsistent with the design report Table 5.	Road Design	Plans have been updated to show C6 is R=1500 and report has been updated	8-10-21	LB	Noted. Closed subject to supply and review of updated CDR	CS	
8	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 30 Table 4 should be updated to reflect the change in design speed for the AUL.	Road Design	Updated the design speed in table 4	8-10-21	LB	Noted. Closed subject to supply and review of updated CDR	CS	
9	27-09-21	TfNSW 50% Concept Design Review		JG	Issue No. 34 Check for sag points between the new/existing pavements. There appears to be low points created between the new and existing formations where tie-ins are located. This may result in undesirable water ponding close to pavement layers.	Road Design	Once detailed survey of the existing road is completed, I will adjust the road. Will have this as an action for the 50% detailed design	8-10-21	LB	Noted. Deffered to 50% DD review.	O	
10	27-09-21	Tomingley 100% CDR (Rev 0)	Rev 0	JG	It is noted that the sight distance calculations have been undertaken and recorded in the design report however, sight distance checks have not been provided.	Road Design	Appendix 10 added to Design Report which includes sight distance checks	12-10-21	SOR	Noted. Closed subject to supply and review of updated CDR	CS	

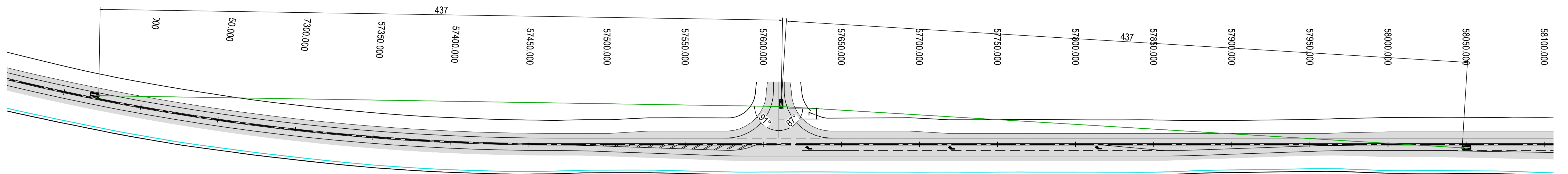
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				Reviewer Initials	Reviewer Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
11	27-09-21	GE-103 -Ch300	Rev C	JG	Tomingley Road - this is noted to be terminate prior to the existing intersection. What is the proposed treatment for the residual road between the highway and the cul-de-sac indicated?	Road Design	Earthmound is to be constructed at the end of the cul-de-sac. Road will be removed between cul de sac and existing Highway and area reinstated and grassed	10-10-21	SOR	Noted. Closed subject to detail being shown on plans and appropriate narrative being provided in the CDR.	CS	
												
12	27-09-21	All culverts	Rev C	JG	Need to check the slopes from the embankment hinge to the tops of headwall hob. If slopes are steeper than 2 to 1 the batter may become a maintenance liability. Particular situations where this can become an issue is when the culvert headwall are skewed to the road formation.	Road Design	I have squared the culvert alignment and have checked that the batter is no steeper than 2:1	8-10-21	LB	Noted.	C	
												
13	27-09-21	All culverts	Rev C	JG	Longitudinal section of the drainage structures do not align with the formation hinge. A level where the batter intersects the headwall hob would also be beneficial. (refer below example).	Road Design	All longitudinal sections now show the additional levels	8-10-21	LB	Noted. Closed subject to the updated longitudinal sections being refined. In some cases the batter slopes do not intersect the culvert headwall leaving the pipe/box exposed.	CS	
												
14	27-09-21	All culverts	Rev C	JG	Section B-1 for all structures does not appear to be to scale.	Road Design	I have labelled this as NTS I will correct the scale for the 50% detailed design	8-10-21	LB	Noted.Deferred to 50% DD review.	O	
15	27-09-21	RA, RD, RC	Rev C	JG	The RA, RD and RC packages do not show the extent/location of the sealed shoulder. This not only makes it difficult to check the design for compliance but will transfer into a construction risk.	Road Design	Added additional information to the typical cross sections to show the extent of seal	8-10-21	LB	Noted. Please show the extent of the sealed area on the RD and RC Sheets as a minimum.	CS	
16	27-09-21	RC	Rev C	JG	The proposed barriers are not shown on the detailed cross sections. This not only makes it difficult to check the design for compliance but will transfer into a construction risk.	Road Design	Barriers are now shown on the cross sections	8-10-21	LB	Noted. Closed subject to review of barrier length/point of need calculations. Presumably being provided in the CDR.	CS	
17	27-09-21	RC	Rev C	JG	There are no feature labels provided on the cross sections. This not only makes it difficult to check the design for compliance but will transfer into a construction risk.	Road Design	Added labels to the cross sections	8-10-21	LB	Noted. Please show the extent of the sealed area on the RC RC.	CS	
18	27-09-21	OTLs	Rev C	JG	Diverge tapers on the overtaking lanes do not appear to have the 30m minimum 3m sealed shoulder width prior to the start point of the diverge. (refer to above item regarding edge of seal not shown)	Road Design	Increased shoulder width diverge tapers	8-10-21	LB	Noted. Please add a note similar to that used for the start and end of tapers indicating the chainage. FYI this is an example of where the seal width being indicated on the plan set would be beneficial.	CS	
												
19	27-09-21	OTLs	Rev C	JG	Merge tapers on the overtaking lanes do not appear to have the 30m minimum 3m sealed shoulder width past the end point of the merge. (refer to above item regarding edge of seal not shown)	Road Design	Increased shoulder width merge tapers	8-10-21	LB	Noted. Please add a note similar to that used for the start and end of tapers indicating the chainage. FYI this is an example of where the seal width being indicated on the plan set would be beneficial.	CS	
												
20	27-09-21	Entire length	Rev C	JG	Longitudinal grade of the alignment is predominantly less than 0.5%. Has consideration been given to the longitudinal grade of table drains and whether these require to be independently graded to avoid ponding and ensure flow to transverse structures? It appears that the current design of longitudinal open drains adopts the road alignment grade.	Road Design	The table drains will be diverted at low points via a mitredrain to overland flow. This will be shown in the 50% detailed design once we receive detailed survey	8-10-21	LB	Noted.Deferred to 50% DD review.	O	
21	27-09-21	Tomingley 100% CDR (Rev 0)	Rev 0	JG	Road Safety Audit - the General Observations have been transferred to an RSA Comments and Designer Responses have been included however there have been no Reviewer Close-out Comments recorded? PV review of RSA Responses and actions have been delayed until 50% DD phase where it is proposed most items of the RSA will be addressed.	Road Design	Advice from Road Safety Auditors is that as no CARS were raised, they would not normally close out Observations	10-10-21	SOR	Noted.Deferred to 50% DD review.	O	

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				Reviewer Initials	Reviewer Comments		Response Comments	Date	By Initials	Reviewer Close-out Comments	Response Status	Date Closed
22	27-09-21	Tomingley 100% CDR (Rev 0)	Rev 0	JG	Design Review Comments (John Coggan IV) - many of the items raised have been addressed by stating that the detail will be included in the 50% Detailed Design. These items should not be "C" closed but rather "CS" closed subject to additional action / information by designer.	Road Design	Noted	8-10-21	LB	Noted. Closed subject to supply and review of updated CDR	CS	
23	27-09-21	RF	Rev C	JG	Roadside Furniture Part has not been included in the 100% Concept Design submission (Although listed in the Part index). This will be reviewed at 50% Detailed Design submission.	Road Design	I have removed roadside furniture from the part index for the 100% concept plan. I will add it back as part of the 50% detailed design	8-10-21	LB	Noted.Deffered to 50% DD review.	O	
24	27-09-21	SM	Rev C	JG	Stormwater Part does not include any plan sheets with design and existing contours. This will aid identifying and surface flow issues that may not have been highlighted or addressed.	Road Design	An additional layout plan showing the overall design with drainage and contours will be included in the 50% detailed design	8-10-21	LB	Noted.Deffered to 50% DD review.	O	
25	27-09-21	SM	Rev C	JG	Part SM Drawing numbers out of sequence.	Road Design	The culverts are now in the correct order	8-10-21	LB	Closed.	C	
26	27-09-21	Various	Rev C	JG	Minor drafting errors - some overlapping text need to be rectified. e.g. RA-115	Road Design	completed	8-10-21	LB	Closed.	C	
27	27-09-21	General		JG	POSI plan needs to be developed during Detailed Design.	Road Design	Noted	8-10-21	LB	Noted.Deffered to 50% DD review.	O	

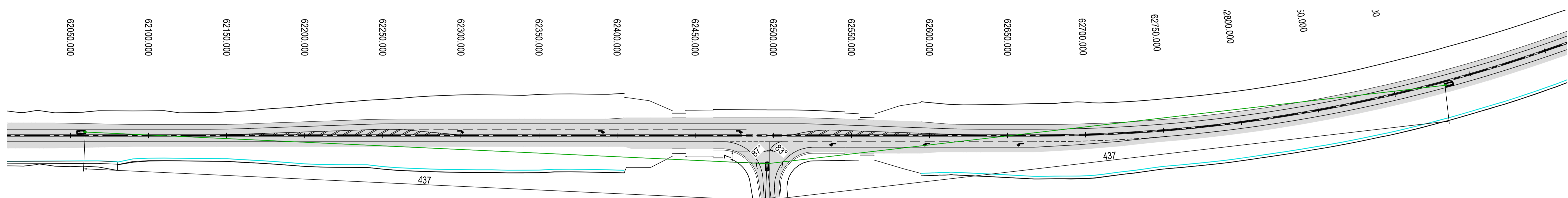
APPENDIX 11: Sight Distance Checks

NOTES:
 SAFE INTERSECTION SIGHT DISTANCE (SISD) IS
 BASED OFF EQUATION 2 - AUSTRROADS GUIDE
 TO ROAD DESIGN PART 4A.
 S=120m
 V=120km/h
 d=0.24

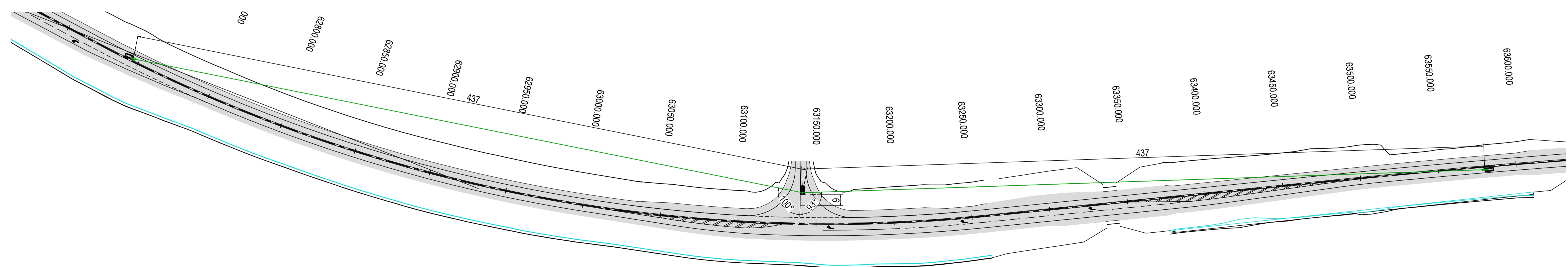
SIGHT DISTANCE PASSED (437m) 
 SIGHT DISTANCE FAILED (437m) 



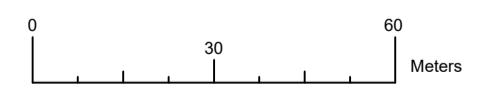
BACK TOMINGLEY WEST ROAD
 1:1250



KYALITE ROAD
 1:1250



McNIVENS ROAD
 1:1250

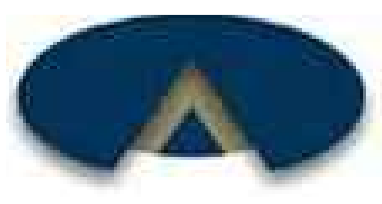


REV	DATE	REVISION DETAILS	APPROVED
A	11-10-21	SIGHT DISTANCE CHECK	SOR

DRAWN	DESIGNED	CHECKED	APPROVED
L.BAYNHAM	L.BAYNHAM	S.O'ROURKE	S.O'ROURKE

PROJECT	DRAWING TITLE
NARROMINE SHIRE COUNCIL, HW17 - NEWELL HIGHWAY DEVIATION 56.3km TO 64.1km NORTH OF PARKES	SIGHT DISTANCE CHECK

CLIENT



TOMINGLEY
 GOLD OPERATIONS PTY LTD
 (A wholly owned subsidiary of Albane Resources Ltd)



constructive solutions
 Civil | Structural | Environmental

100% CONCEPT

TNWS REGISTRATION No.	SIZE
TBA	A1
DRAWING NUMBER	REV
001	A

date		11/10/2021 time		15:06:04	
Alignment	MC-00	EyePath Profile		Design-MC-00	
Eye Height	1.1 Object Height		0.1		
Station	ActualSightDistance	MinimumSightDistance	ObstructionPoint	Violated?	
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56320.000m	350.000m	350.000m		No	
56340.000m	350.000m	350.000m		No	
56360.000m	350.000m	350.000m		No	
56380.000m	350.000m	350.000m		No	
56400.000m	350.000m	350.000m		No	
56420.000m	350.000m	350.000m		No	
56440.000m	350.000m	350.000m		No	
56460.000m	350.000m	350.000m		No	
56480.000m	350.000m	350.000m		No	
56500.000m	350.000m	350.000m		No	
56520.000m	350.000m	350.000m		No	
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56580.000m	350.000m	350.000m		No	
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63340.000m	350.000m	350.000m	No
63360.000m	350.000m	350.000m	No
63380.000m	350.000m	350.000m	No
63400.000m	350.000m	350.000m	No
63420.000m	350.000m	350.000m	No
63440.000m	350.000m	350.000m	No
63460.000m	350.000m	350.000m	No
63480.000m	350.000m	350.000m	No
63500.000m	350.000m	350.000m	No
63520.000m	350.000m	350.000m	No
63540.000m	350.000m	350.000m	No
63560.000m	350.000m	350.000m	No
63580.000m	350.000m	350.000m	No
63600.000m	350.000m	350.000m	No
63620.000m	350.000m	350.000m	No
63640.000m	350.000m	350.000m	No
63660.000m	350.000m	350.000m	No
63680.000m	350.000m	350.000m	No
63700.000m	350.000m	350.000m	No
63720.000m	350.000m	350.000m	No
63740.000m	350.000m	350.000m	No
63760.000m	350.000m	350.000m	No
63780.000m	350.000m	350.000m	No
63800.000m	350.000m	350.000m	No
63820.000m	350.000m	350.000m	No
63840.000m	350.000m	350.000m	No
63860.000m	350.000m	350.000m	No
63880.000m	350.000m	350.000m	No
63900.000m	350.000m	350.000m	No
63920.000m	350.000m	350.000m	No
63940.000m	350.000m	350.000m	No
63960.000m	350.000m	350.000m	No
63980.000m	350.000m	350.000m	No
64000.000m	350.000m	350.000m	No
64020.000m	350.000m	350.000m	No
64040.000m	350.000m	350.000m	No
64060.000m	350.000m	350.000m	No
64080.000m	350.000m	350.000m	No
64100.000m	350.000m	350.000m	No
64120.000m	350.000m	350.000m	No
64140.000m	350.000m	350.000m	No
64160.000m	350.000m	350.000m	No
64180.000m	350.000m	350.000m	No
64200.000m	350.000m	350.000m	No

64220.000m	350.000m	350.000m	No
64240.000m	350.000m	350.000m	No
64260.000m	350.000m	350.000m	No
64280.000m	350.000m	350.000m	No
64300.000m	350.000m	350.000m	No
64320.000m	337.121m	350.000m	No
64340.000m	317.121m	350.000m	No
64360.000m	297.121m	350.000m	No
64380.000m	277.121m	350.000m	No
64400.000m	257.121m	350.000m	No
64420.000m	237.121m	350.000m	No
64440.000m	217.121m	350.000m	No
64460.000m	197.121m	350.000m	No
64480.000m	177.121m	350.000m	No
64500.000m	157.121m	350.000m	No
64520.000m	137.121m	350.000m	No
64540.000m	117.121m	350.000m	No
64560.000m	97.121m	350.000m	No
64580.000m	77.121m	350.000m	No
64600.000m	57.121m	350.000m	No
64620.000m	37.121m	350.000m	No
64640.000m	17.121m	350.000m	No
64657.121m	0.000m	350.000m	No

3.2.2 Safe Intersection Sight Distance (SISD)

SISD is the minimum sight distance which should be provided on the major road at any intersection. Designers should note that the object height for the application of SISD has been increased to 1.25 m (previously driver eye height was used i.e. 1.1 m) based on research by the Department of Main Roads (Lennie et al. 2008). The basis of the 1.25 m object height for cars is that this height is 0.2 m less than the 15th percentile height of passenger cars (1.45 m) as determined by the study.

Equation 2 provides the formula for SISD:

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)} \quad 2$$

where

SISD = safe intersection sight distance (m)

D_T = decision time (sec) = observation time (3 sec) + reaction time (sec) – refer to *AGRD Part 3* (Austroads 2016b) for a guide to values

V = operating (85th percentile) speed (km/h)

d = coefficient of deceleration – refer to Table 3.3 and *AGRD Part 3* for a guide to values

a = longitudinal grade in % (in direction of travel: positive for uphill grade, negative for downhill grade)

Dt	6
V	120
d	0.24
a	0
SISD	436.2205

5.3 Stopping Sight Distance (SSD)

Stopping Sight Distance (SSD) is the distance to enable a normally alert driver, travelling at the design speed on wet pavement, to perceive, react and brake to a stop before reaching a hazard on the road ahead.

SSD is derived from two components:

1. the distance travelled during the total reaction time
2. the distance travelled during the braking time from the design speed to a stop and their relationship is shown in Equation 1.

$$SSD = \frac{R_T V}{3.6} + \frac{V^2}{254(d + 0.01a)} \quad 1$$

where

- R_T = reaction time (sec)
 V = operating speed (km/h)
 d = coefficient of deceleration (longitudinal friction factor)
 a = longitudinal grade (% , + for upgrades and – for downgrades)

Values of R_T and d must be assumed in order to compute the values of SSD appropriate to a specified initial speed; these can be obtained from Table 5.2 and Table 5.3 respectively.

Rt	3
V	120
d	0.24
a	0
SSD	336.2205

Constructive Solutions Pty Ltd

www.constructivesolutions.com.au

Tamworth Office:

PO Box 1498

Tamworth NSW 2340

Phone: 02 6762 1969

Email: admin@constructivesolutions.com.au

Brisbane Office

PO Box 133

Paddington QLD 4064

Phone: 0427 011 143

Email: admin@constructivesolutions.com.au



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