

NZTA

SH1 IMPROVEMENTS LONG TUNNEL FEASIBILITY ASSESSMENT

JUNE 2024

CONFIDENTIAL





SH1 IMPROVEMENTS - LONG TUNNEL
FEASIBILITY ASSESSMENT

NZTA

WSP
Wellington
L9 Majestic Centre
100 Willis Street
Wellington 6011, New Zealand
+64 4 471 7000
wsp.com/nz

REV	DATE	DETAILS

	NAME	DATE	SIGNATURE
Prepared by:	s 9(2)(a)	14 June 24	s 9(2)(a)
Reviewed by:	s 9(2)(a)	14 June 24	s 9(2)(a)
Approved by:	s 9(2)(a)	14 June 24	s 9(2)(a)

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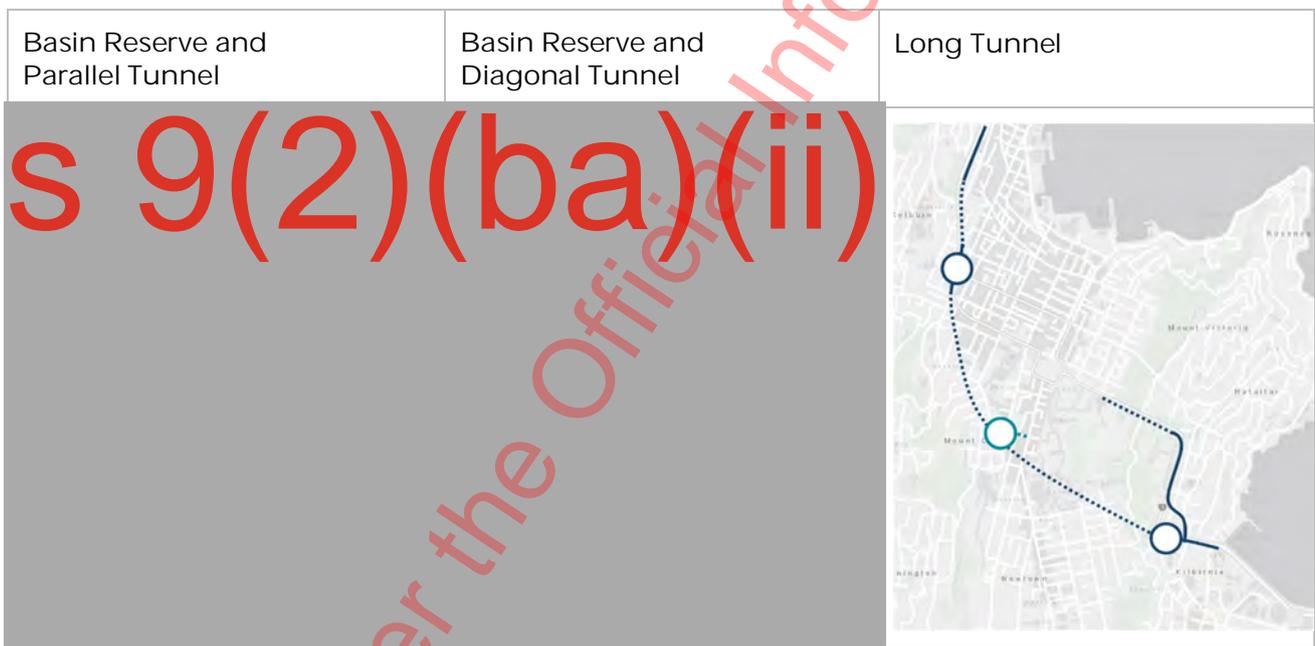
1 INTRODUCTION

NZ Transport Agency Waka Kotahi (NZTA) is undertaking initial scoping work in relation to options for improvements to the State Highway 1 corridor through the Wellington central city. Previous, separate, work undertaken by NZTA has included planning for a second Mt Victoria Tunnel and Basin Reserve upgrade which is identified as a Road of National Significance (RoNS).

That previous work completed an Indicative Business Case (IBC) in late 2022 and has progressed to approximately 50% completion of the associated Detailed Business Case (DBC).

NZTA is now also further developing a previously considered option as an alternate to the Mt Victoria Tunnel and Basin Reserve upgrade, namely a 2.8km tunnel running from the Terrace Tunnel to Kilbirnie, referred to as the Long Tunnel. The Long Tunnel option is significantly less developed relative to the Mt Victoria Tunnel and Basin Reserve options. The options currently under consideration by NZTA are summarised in **Figure 1.1**.

Figure 1.1. Scheme Options (May 2024)



WSP has been commissioned by NZTA to develop a concept design for the Long Tunnel – limited to geotechnical, tunnelling and engineering services. This work has been undertaken over a period of ten weeks (April- June 2024) and has been based on existing information, no stakeholder interaction, and limited budget. It has been necessary to make assumptions to progress in the timeframe required. A summary of assumptions and decisions has been captured in this document. A review of alternatives is out of scope as it has not been possible in this timeframe.

The focus of the WSP team has been:

- **Identify a technically feasible solution.** This has been tested through design/construction challenge (internal and external by others in the NZTA team) and by specialists reviewing the option to identify any flaws or opportunities for improvement with a focus on consenting and construction risk. See **Appendix G** for the details of the challenge session.

- **Inform cost estimate development.** The design is being used as a basis for others within the NZTA team to develop a cost estimate and construction programme. The WSP team has provided information that will enable a reasonable indication of option cost to the best of our knowledge within these constraints.

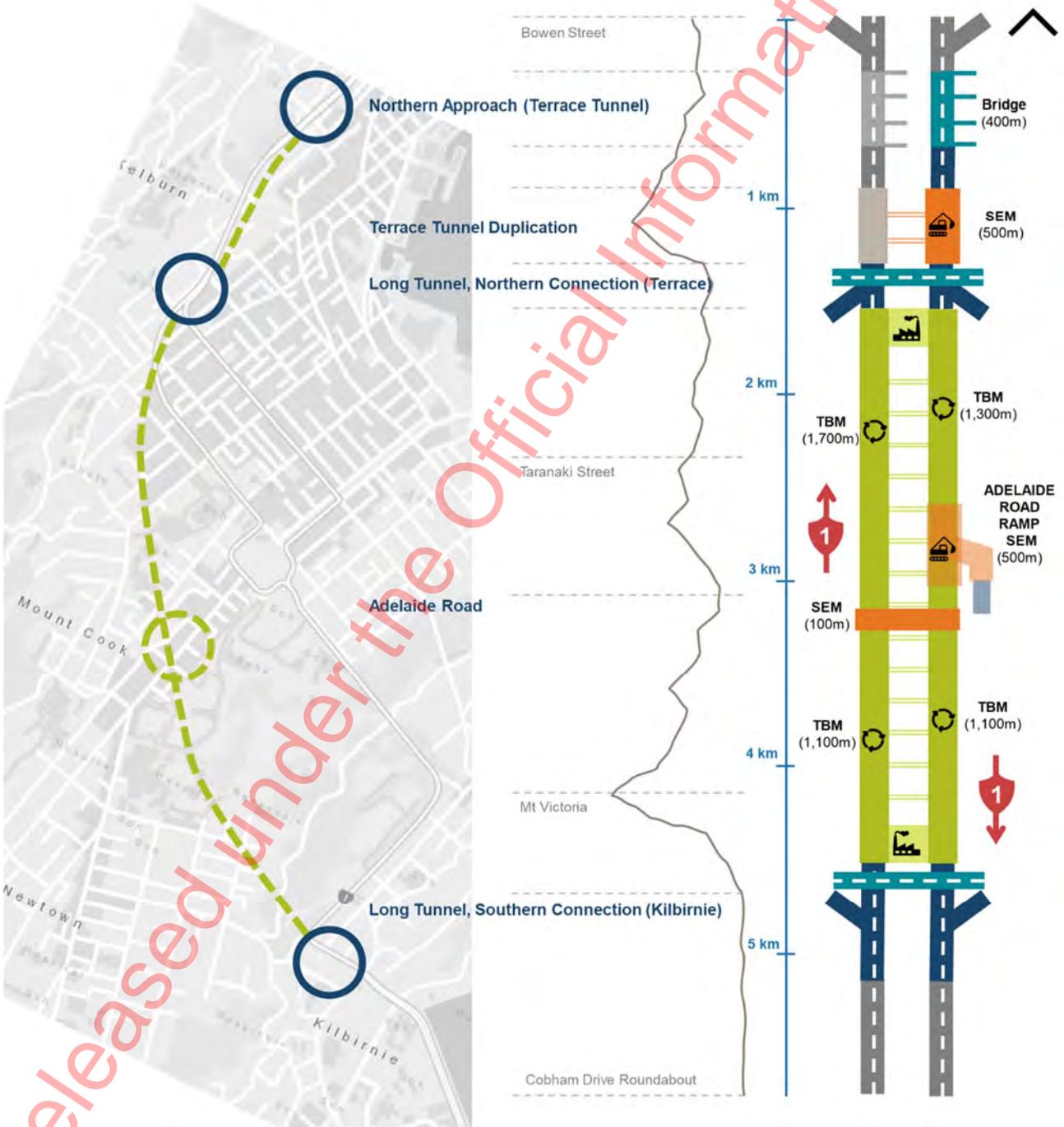
This document summarises work undertaken in developing the Long Tunnel design. The deliverables have been produced for technical feasibility and cost estimation and is not to be used for presentation and consultation purposes.

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2 SCHEME OVERVIEW AND DESIGN DETAILS

The concept design has been based on a previously developed option as shown in Figure 2.1, each of the components shown has been considered in more detail and described in the following pages.

Figure 2.1. Option Scope and components



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The design described in this document is based on limited information and has been completed in a tight timeframe. The following section identifies some of the approach that has been used to test technical feasibility and have been provided to others to inform the constructability review and cost estimate development.

2.1 NORTHERN APPROACH (TERRACE TUNNEL)

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2.1.1 NORTHERN APPROACH CONSTRUCTION

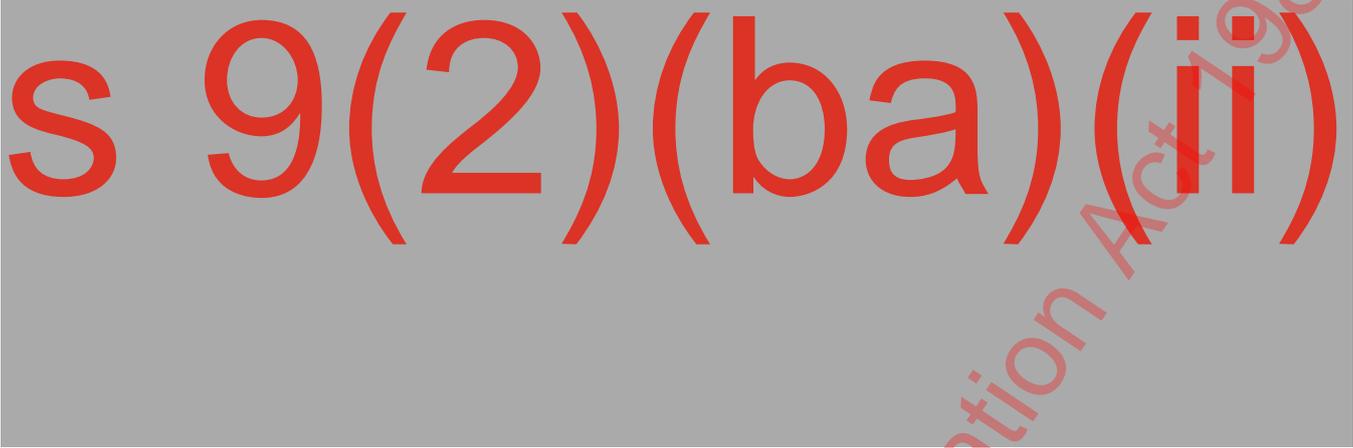
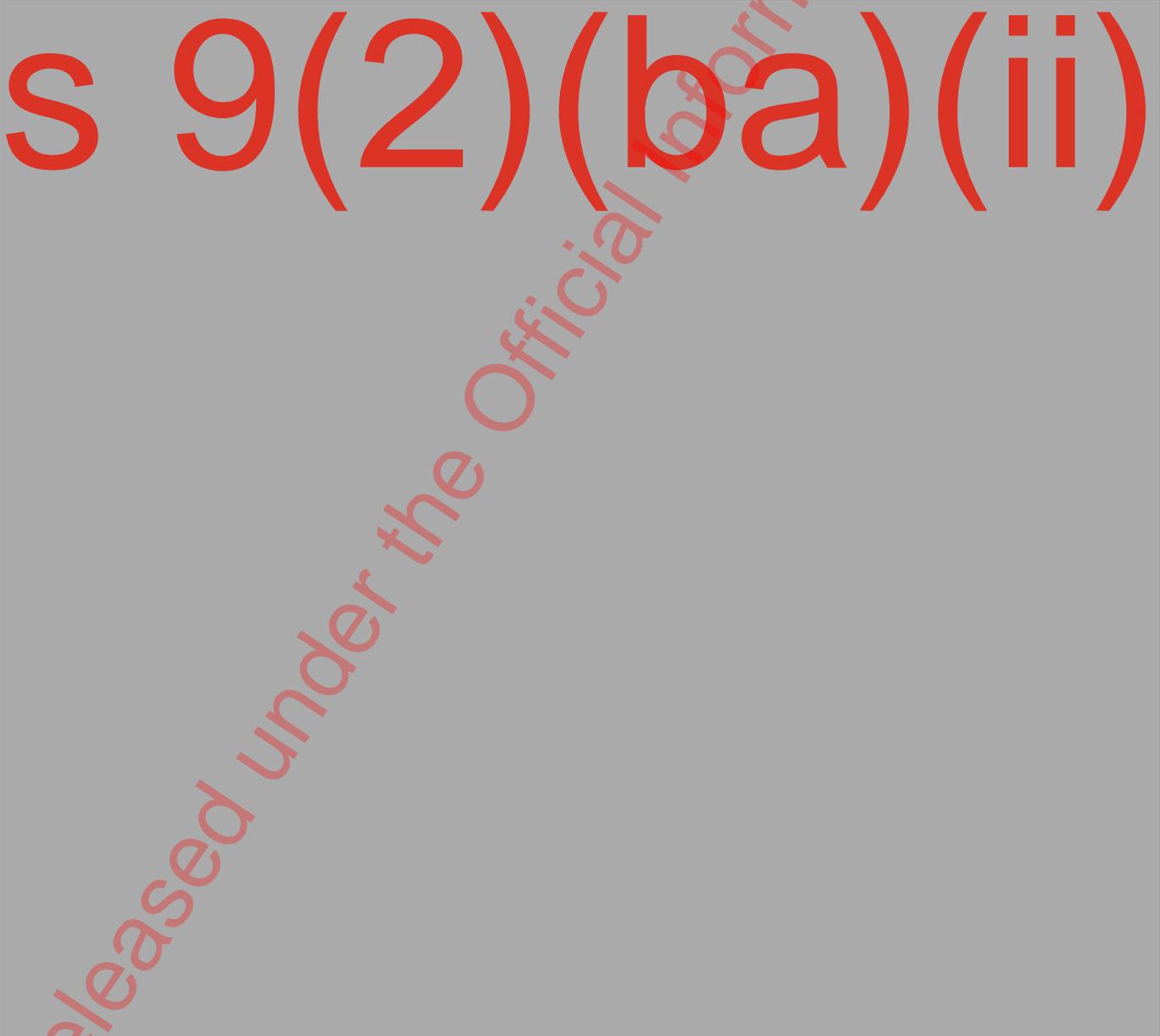


Figure 2.3. Northern Approach - Structures



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2.2 TERRACE TUNNEL DUPLICATION

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2.2.1 TERRACE TUNNEL DUPLICATION CONSRTUCTION

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Figure 2.4. Terrace Tunnel Construction Areas

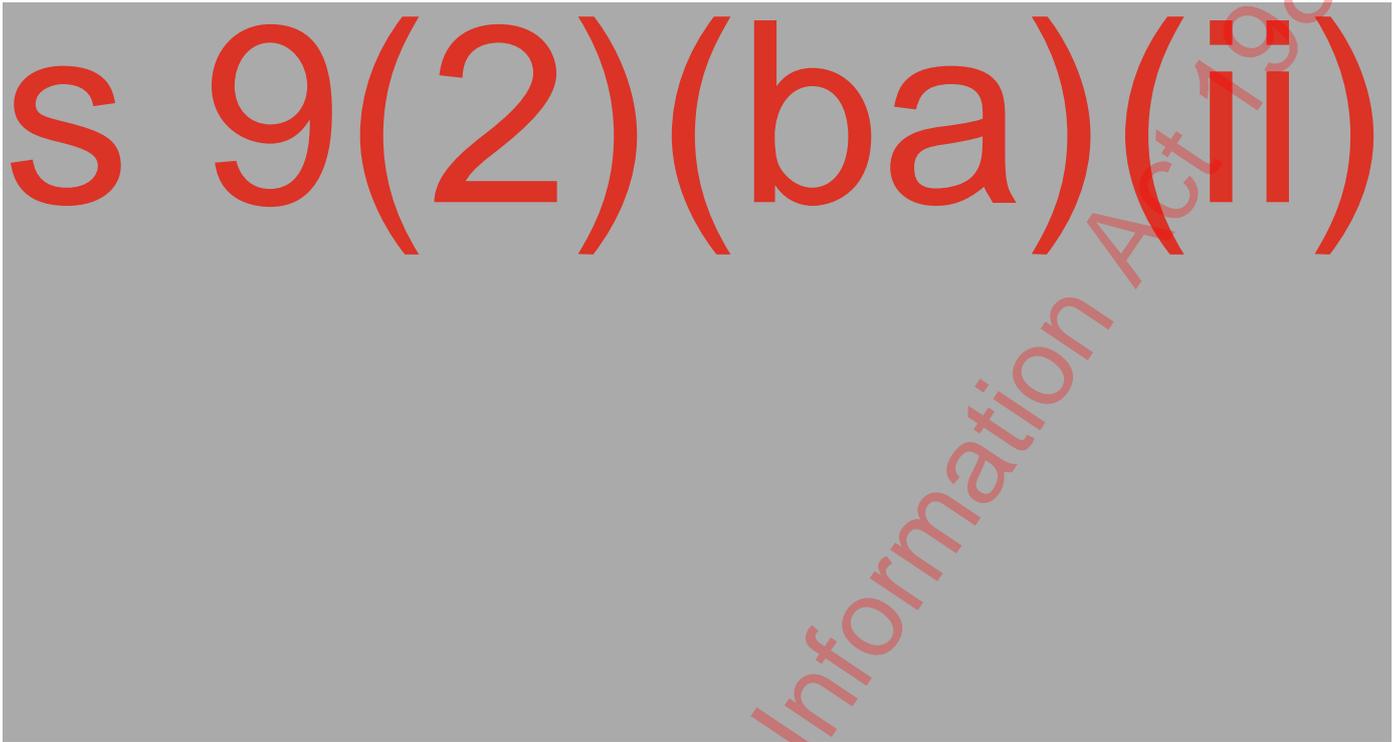


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2.3 LONG TUNNEL NORTHERN CONNECTION (TERRACE)

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Figure 2.6. Overview of Long Tunnel Northern Connection (Terrace)



2.3.1 NORTHERN CONNECTION CONSTRUCTION

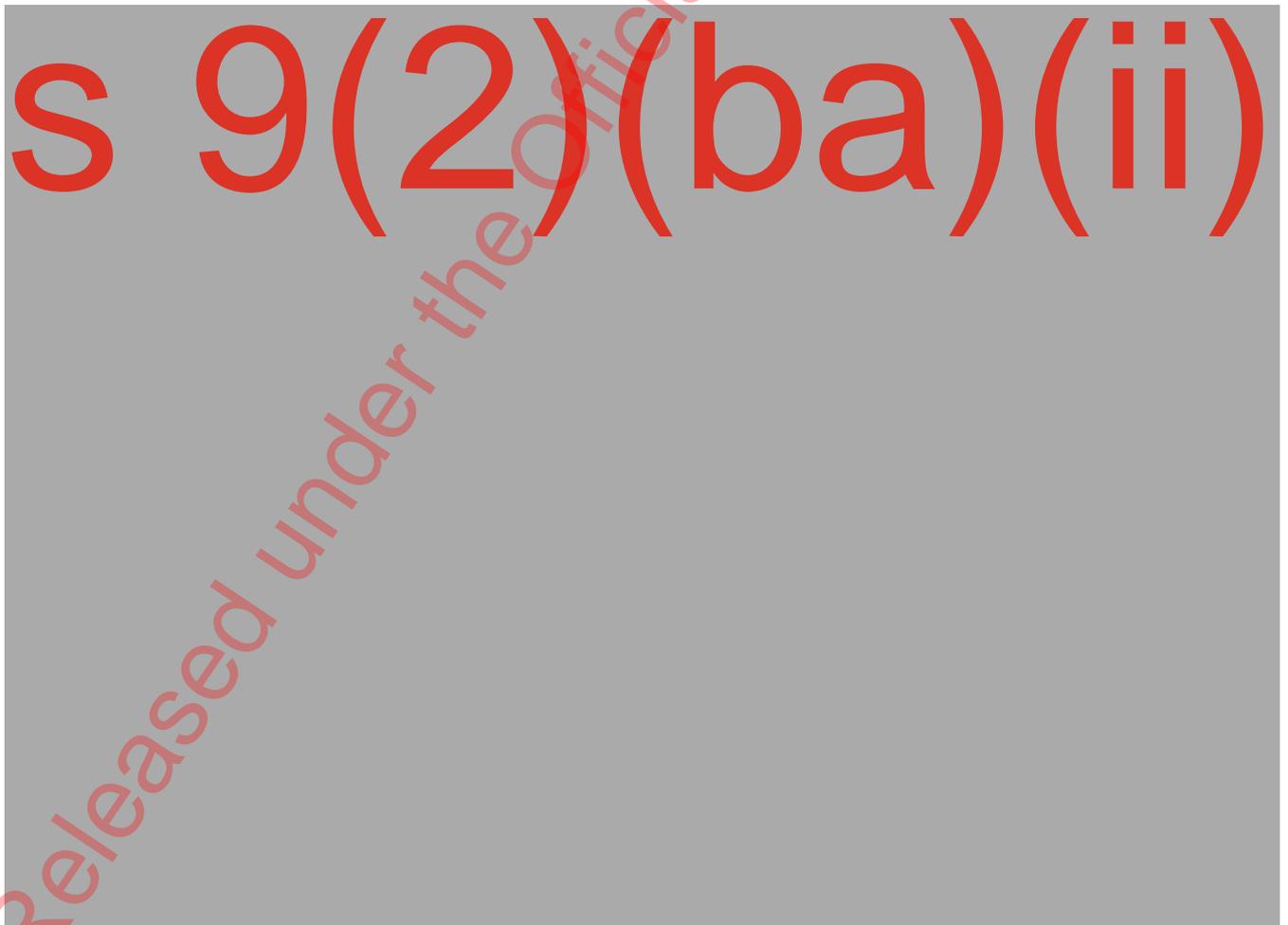


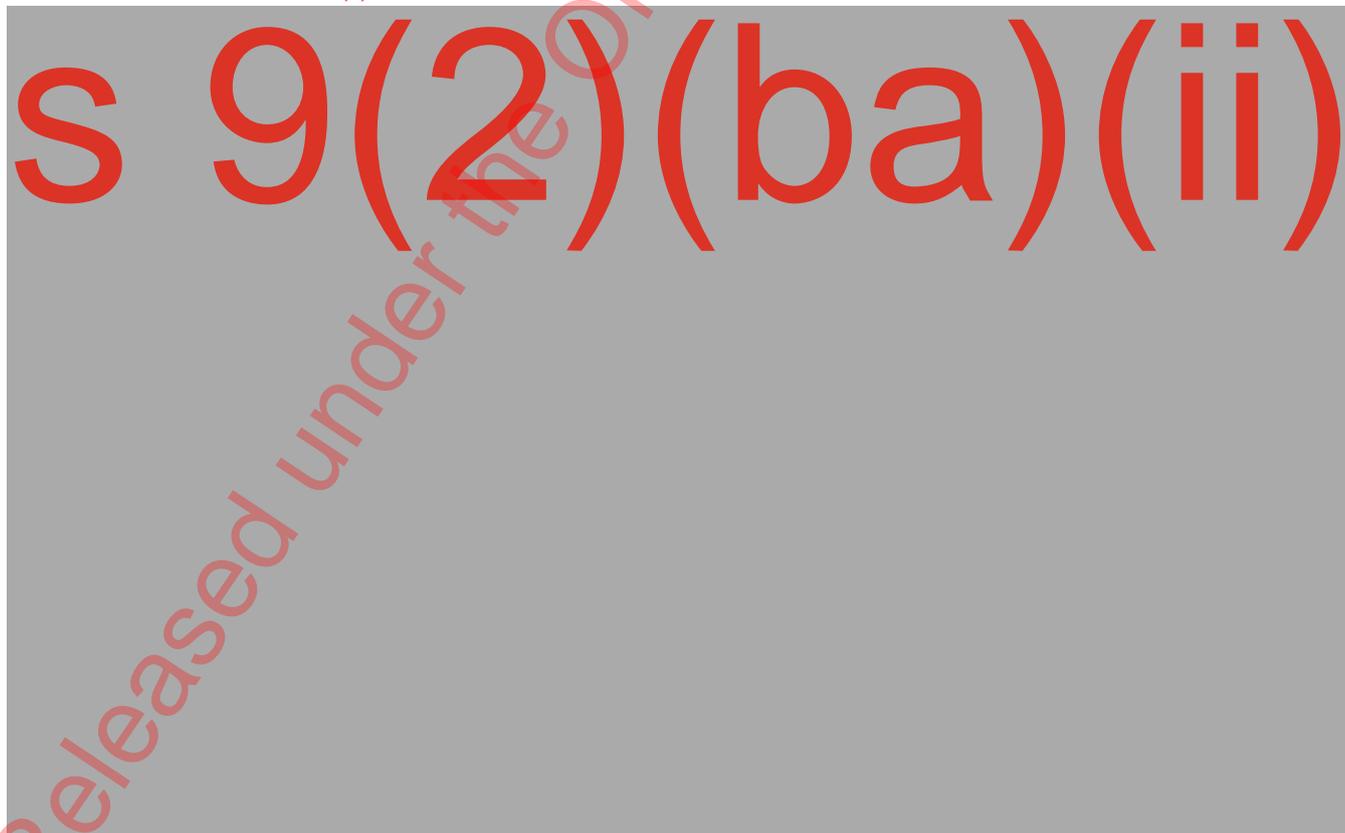
Table 2.4 Northern Approach – Retaining Structures

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Table 2.5 Northern Approach – Civil Structures

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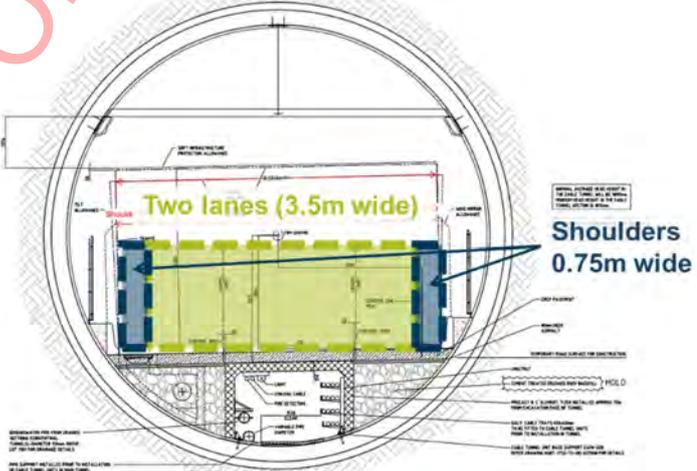
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2.4 LONG TUNNEL

The Long Tunnel will provide two two-lane tunnels running from Willis Street to Wellington Road in Kilbirnie. **Table 2.6** describes the features of the Long Tunnel.

Table 2.6 Features of the Long Tunnel

FEATURES	LONG TUNNEL
Length	~ 2840m
Gradient	max 5%, crossfall min 2%
Cross-section	TBM section, 12.5m OD (outer diameter)
No. of lanes	<p>2 lanes unidirectional (3.5m wide, 0.75m shoulders)</p> <p><i>Cross section source: North-South Bypass Tunnel (Brisbane)</i></p> 
Speed limit	<p>Design speed 70km/hr</p> <p>Posted speed 60 km/hr</p>

Ventilation	<p>Ventilation buildings (exhaust stations) at each end with an exhaust stack for vehicle emissions with an allowance to emit air from vehicle emissions at the exit portal of each tunnel.</p> <p>A smoke duct has been allowed for in the cross section but there is opportunity to remove this requirement and manage the FLS risk via traffic control. This will be investigated in the next phase of design.</p>
Fire and Life Safety Solution	<p>Hazardous goods vehicles will be prohibited in the road tunnels.</p> <p>Cross passages approximately every 150m to provide egress to the non-event tunnel.</p> <p>Fixed fire-fighting systems in each tunnel.</p>

2.4.1 RESILIENCE – EARTHQUAKE HAZARDS

Of important consideration in future design phases will be the impact of potential natural earthquake hazards on the tunnel. Two key areas of focus will include:

1. Fault rupture. Discussion has been included in this document for a potential design solution associated with the Aotea fault (See **Section 2.4.3**). As more geotechnical information is available on this and other faults then the design team will consider:
 - a. *Operational resilience*. How a potential loss of service will could be reinstated, and the likely cost, time and disruption impacts of doing so.

Assessment of the frequency of each hazard, and the time-varying magnitude of impacts. It is important to determine and prioritise the hazards in terms of their risk to availability. For example, fault rupture on any regional fault including the Hikurangi subduction interface, Wellington fault and Wairarapa fault could cause subsidence, uplift, tilting and folding of the tunnel and are much more likely than rupture of the Aotea fault. While this is not a significant threat to life safety, it could cause damage to tunnel linings and drainage and cause closure for repairs.
 - b. *Risk to life*. The design will look to minimise the risk to those using the tunnel during a major earthquake event that might rupture the tunnel wall. This will include consideration of potential water ingress and how the area impacted will be localised and addressed. It is worth noting that there are grey areas in terms of how this is covered within the Building Act and early engagement with Wellington City Council would help future design and construction phases.
2. Tsunami. The vertical design of the tunnel will need to consider how the risk of inundation from Tsunami can be minimised, particularly at the Southern Portal.

In both instances a resilience framework approach considering robustness, resilience and response will be developed by the project teams at the next phase. For example, the operational ability to prevent vehicles entering the tunnel when event warnings occur (primarily tsunami) would be considered as a potential response.

2.4.2 LONG TUNNEL CONSTRUCTION

The long tunnel construction will utilise a Tunnel Boring Machine (TBM). The current assumption is to use two TBMs with associated programme and cost implications.

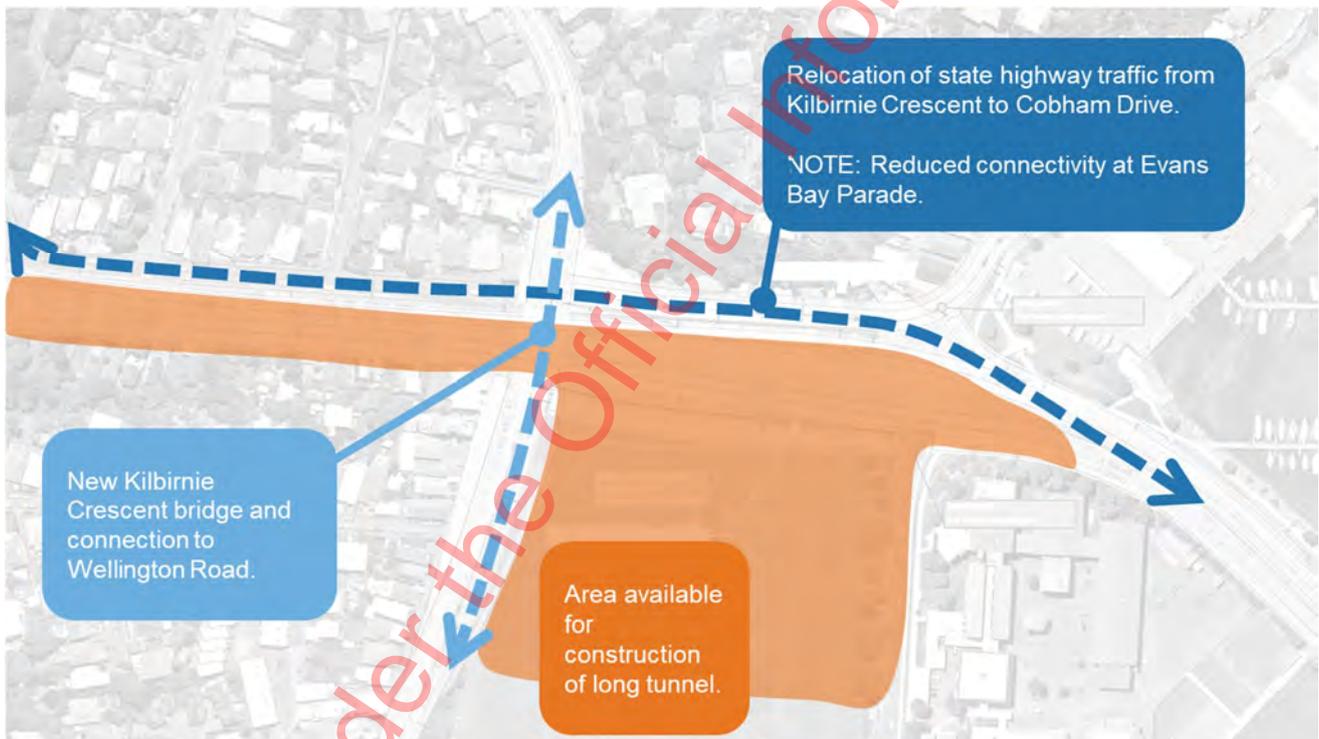
There will be two mined sections where a TBM will not be used as follows:

- Adelaide Road ramp –including widened (merge) section of southbound tunnel. See **Section 2.5**.
- Aotea Fault – Section of mined tunnel to assist in resilience (See **Section 2.4.3**).

An indicative TBM support site and launch and operations area has been identified in Kilbirnie and is shown in **Figure 2.8**.

Precast segments for tunnel construction will be transported from this site. Excavated spoil will be conveyed through the tunnel to this construction area in Kilbirnie prior to disposal.

Figure 2.8. Long Tunnel Primary Construction Area



2.4.3 AOTEA FAULT

In the vicinity of Adelaide Road, the long tunnel is expected to encounter the Aotea Fault. Very limited information exists on this fault and further investigations are required. In the absence of more information, it is assumed that some localised work will be undertaken to improve the resilience of the tunnel at this location. At this time, it is proposed that a specific design solution will be employed similar to that used for the Los Angeles Pink Line that crosses the Hollywood Fault. This includes excavating an oversized cavern across the fault. This would help the tunnel accommodate potential movement and also improve the ability to repair the tunnel after an event.

This will require construction of a temporary shaft over the tunnel alignment and mining of this area prior to receiving the TBM at this location.

2.4.4 OPERATIONS STRUCTURES

At each portal for the long tunnel it will be necessary to provide a portal exhaust system (elevated outlet approximately 20m in height) and a control building (approximately 80m x 30m footprint). Examples of these structures from other projects are shown in **Figure 2.9**.

Figure 2.9 Examples of tunnel operations structures from other projects.



Portal Exhaust Structure, Waterview Auckland



Southern Tunnel Portal and Control Building with portal exhaust structure, Waterview Auckland

These structures will not be required for the Adelaide Road Ramp. The pollution generated in this short length of single lane off ramp will be low and external air quality requirements are likely to be met when emitting the vitiated tunnel air from the portal. If external air quality criteria is not met, then the ventilation system can be used to push air in from the portal and down the off ramp into the mainline tunnel.

Further details on this design approach are included in **Appendix D**.

2.5 ADELAIDE ROAD RAMP

The inclusion of a ramp to Adelaide Road (southbound off-ramp) was considered through the process and is an option of the Long Tunnel option. **Table 2.7** describes the features of the Adelaide Road Ramp.

Table 2.7 Features of the Adelaide Road Ramp

FEATURES	Adelaide Road
Length	~260m
Gradient	max 6%, crossfall min 2%
Cross-section	Horse-shoe
No. of lanes	<p>One lane (3.5m wide) initially. Transitions to 2 lanes (3.5m wide) 750mm minimum shoulder.</p> <p><i>Cross section source: North-South Bypass Tunnel (Brisbane)</i></p>
Speed limit	Design speed 70km/hr, Posted speed 60 km/hr
Ventilation	<p>Assumption that a portal exhaust system is not required given the offramps size and distance from the portals.</p> <p>Design basis of portal emissions being acceptable or portal emissions can be controlled by using jet fans in the ramp to push air against traffic back into the mainline tunnel.</p>
Fire and Life Safety Solution	Longitudinal egress passage to be provided.

The Adelaide Road Ramp would have a portal on the east side of Hanson Street and come out to an intersection with Adelaide Road as shown in **Figure 2.10**.

Figure 2.10. Overview of Adelaide Road Ramp

LT02B – Long Tunnel

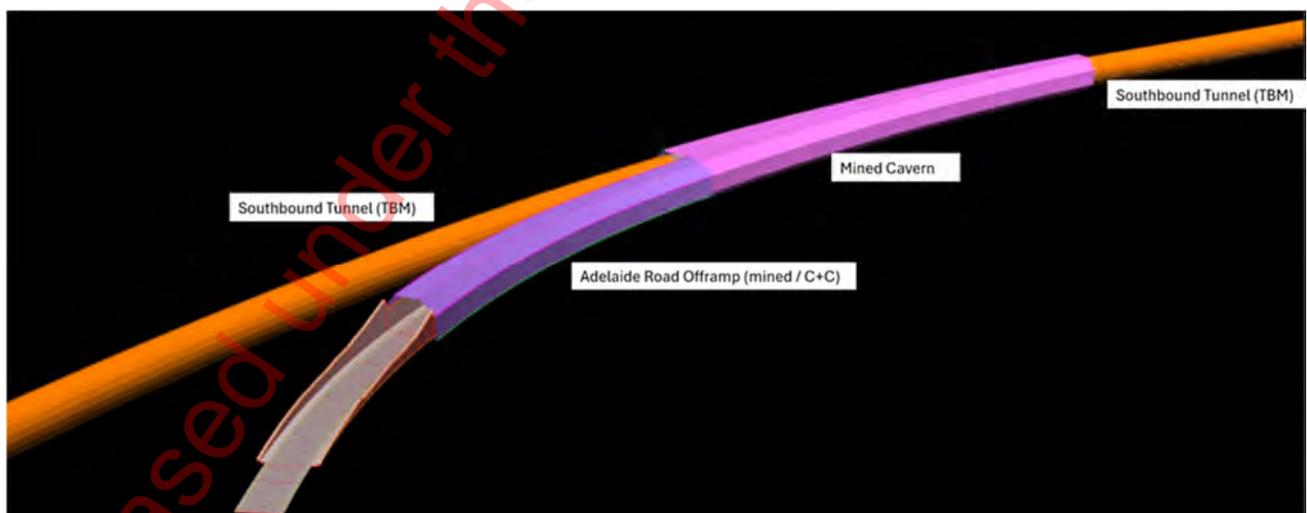
Adelaide Road Southbound Off-ramp



2.5.1 ADELAIDE ROAD OFF-RAMP CONSTRUCTION

A possible Adelaide Road Ramp was developed to include an offramp and mined cavern as shown in **Figure 2.11**.

Figure 2.11. Adelaide Road Ramp mined sections (in purple and pink)



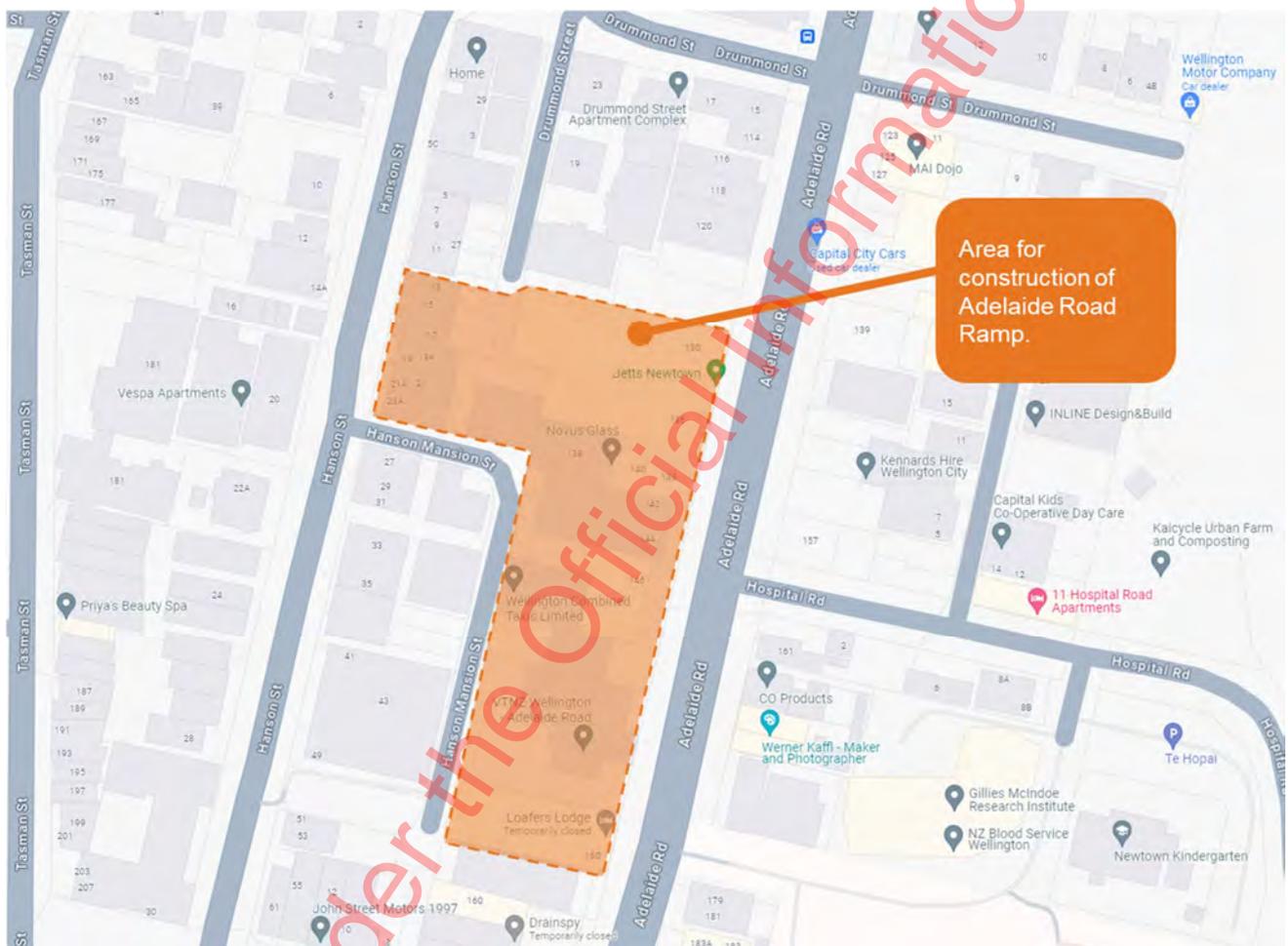
The mined cavern would need to be around 20 m wide at the widest section and can be constructed using sequential excavation method. It would be mined with a combination road-

headers and excavators as required based on the materials encountered. The excavation will be temporarily supported by shotcrete lining and a range of support types including canopy tubes, spiles, and rock bolts. Permanent lining could be constructed upon completion of excavation and waterproofing.

This mined section would need to be completed before the TBM reaches this location.

A construction area would be required at Adelaide Road and is currently estimated to cover the extents shown in **Figure 2.12**.

Figure 2.12 Adelaide Road Ramp Construction Area



Further details on this design approach are included in **Appendix E**.

2.6 LONG TUNNEL SOUTHERN CONNECTION (KILBIRNIE)

The Long Tunnel Southern Connection provides access between the Long Tunnel and Cobham Drive. The interchange at this location also needs to provide local connectivity, access from the airport (and east) to the city (via Haitaitai and the existing Mt Victoria tunnel), walking and cycling

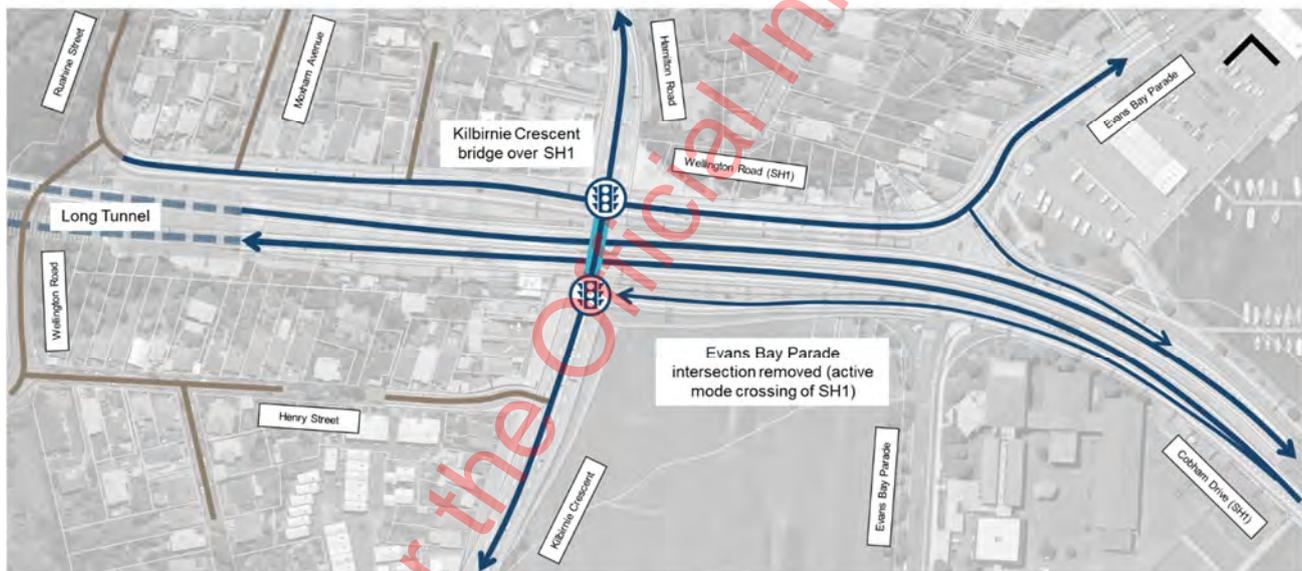
links to the Town Belt and safeguard (through widening) for improved bus priority on Kilbirnie Crescent. It will include the elements illustrated in **Figure 2.13** and listed as follows:

- Reconstruction of the State Highway from the Long Tunnel through to Cobham Drive.
- Realignment and construction of a bridge for Kilbirnie Crescent / Hamilton Road to provide grade separation from the State Highway.
- Ramps to and from SH1 as follows:
 - Southbound on-ramp to Cobham Drive from Hamilton Road.
 - Northbound off-ramp from Cobham Drive to Kilbirnie Crescent.
- A new local connection from Evans Bay Parade (north) to Hamilton Road.
- Closure of Evans Bay Parade (south).

Figure 2.13. Overview of Long Tunnel Southern Connection (Kilbirnie)

LT01 – Long Tunnel

Kilbirnie Interchange



2.6.1 SOUTHERN CONNECTION CONSTRUCTION

The Southern Connection design is illustrated in **Figure 2.14**, a description of new retaining and civil structures is shown in **Table 2.8**.

Figure 2.14. Southern Connection - Structures



The structures shown have a non-sequential numbering as some have been removed due to optimisation in alignment.

Table 2.8 Southern Connection – Retaining and Civil Structures

ID	BRIEF DESCRIPTION	FORM
SI-RW-01	South Portal Wall	3100 Soil nail/rock anchor wall west from this point 23m deep 1:2 slope
SI-RW-02	Northbound Wall 1	3200-3300 Soil nailed wall assume 1:2 for space proofing (and allows temporary slope for TBM).
SI-RW-03	Northbound Wall 2	3320-3340 MSE - build from bottom up
SI-RW-05	Kilbirnie Wall 1	South of Bridge, approx. 120m long. MSE Wall
SI-RW-06	Kilbirnie Wall 2	Permanent MSE wall required east to the park
SI-RW-07	Kilbirnie Cres Offramp Wall 1	3370-3480 MSE wall
SI-RW-08	Kilbirnie Cres Offramp Wall 2	3370-3460 MSE wall
SI-RW-09	Southbound Wall 1	3370-3520 MSE wall
SI-RW-12	Hamilton Wall 1	40m cut wall adjacent to 115 Hamilton Road. Rock bolt/trimming to existing
SI-RW-13	Hamilton Wall 2	(by northwestern corner of Hamilton-Wellington road intersection) Currently a slope
SI-RW-14	Southbound Wall 2	3200-3370 MSE to support bridge abutment, built during phase 1

ID	BRIEF DESCRIPTION	FORM
SI-ST-01	Mainline Propped Trench	3100-3200 Secant piled walls outside and down the median with props above TBM level for temporary (approx. 10.5m). May need additional bracing and or anchors in the temporary case at the western end. Approx 21-22m temp depth west, to 16m permanent. Approx 14-15m temporary depth, 10m permanent at east.
SI-ST-02	Kilbirnie Cres Bridge	3350-3370 Two span -900 hollowcore + surfacing, 1000 total. Approx length 35-40m Abutment MSE

Further details on this design approach are included in **Appendix F**.

2.7 LONG TUNNEL ADDITIONAL ELEMENTS

To accommodate changing travel patterns there are several additional construction items that will need to be included as part of the Long Tunnel project. These are summarised in **Figures 2.15 – 2.19**.

Figure 2.15. **s 9(2)(ba)(ii)**

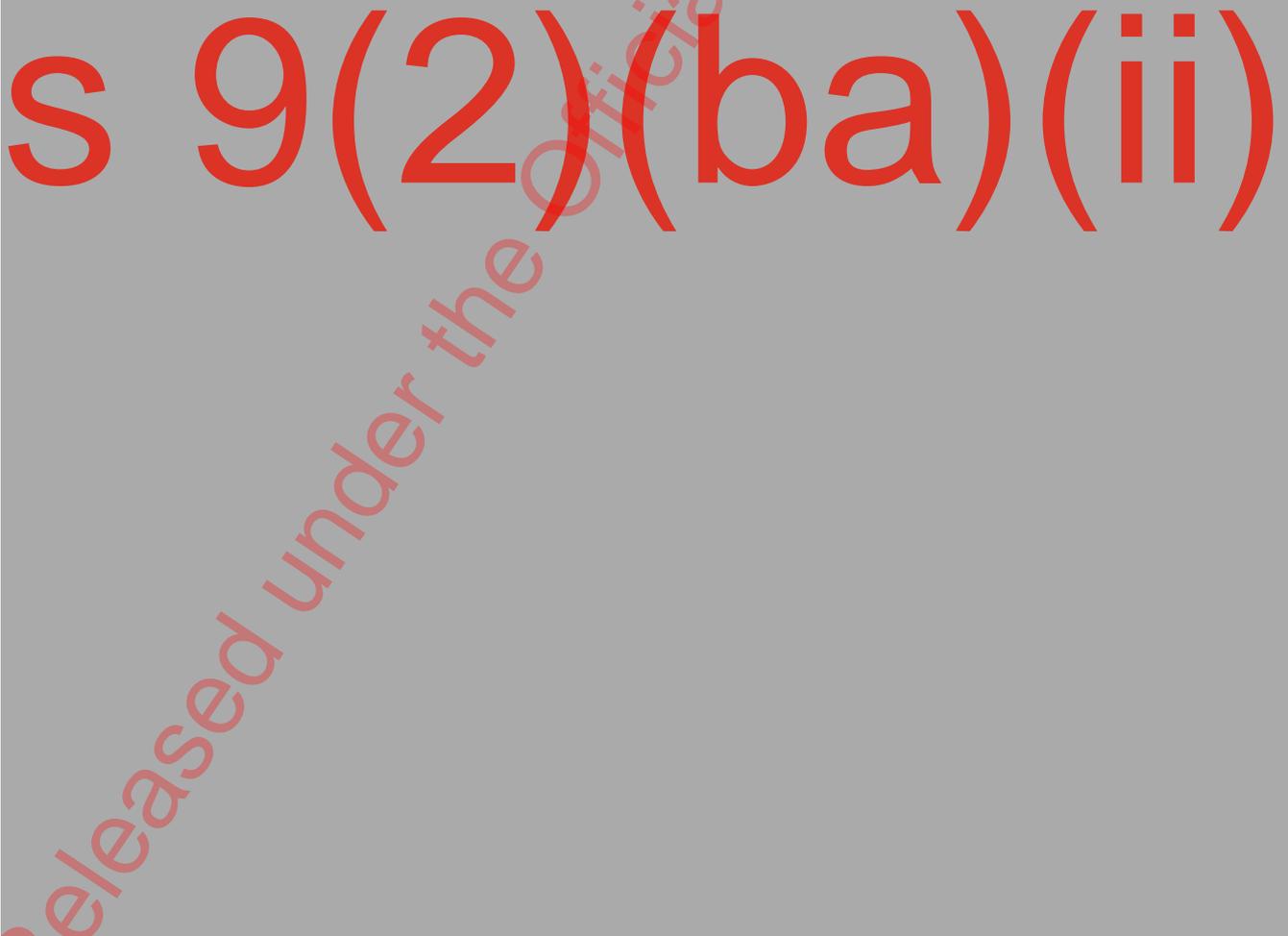


Figure 2.16.

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Figure 2.17.

s 9(2)(ba)(ii)

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Figure 2.18. s 9(2)(ba)(ii)

s 9(2)(ba)(ii)

s 9(2)(ba)(ii)

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Figure 2.19.

s 9(2)(ba)(ii)

s 9(2)(ba)(ii)

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3 DESIGN OPTIONS CONSIDERED

Through the design process there have been several options that have been considered and discounted or parked for future design phases. These options are captured here to provide background on the design development and to inform future work.

3.1 OPTIONS CONSIDERED

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s 9(2)(ba)(ii)

3.1.2 s 9(2)(ba)(ii)

s 9(2)(ba)(ii)

3.1.3 s 9(2)(ba)(ii)

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3.1.4 TUNNEL CONSTRUCTION METHODOLOGY

There were two decisions considered with respect to alternative construction methodologies as follows:

1. **One vs Two TBMs.** The design team looked at options to turn a TBM so that one TBM could bore both directions. It is challenging to include this space within the portal design but it was achievable. The current assumption and design assumes two TBMs which may increase the cost slightly but reduce construction timeframes.

2. s 9(2)(ba)(ii)

3.1.5 s 9(2)(ba)(ii)

s 9(2)(ba)(ii)

3.2 PARKING LOT - ITEMS FOR FUTURE CONSIDERATION

The team working on the design identified several options that were not investigated further due to time/budget restrictions. These should be considered at future stages.

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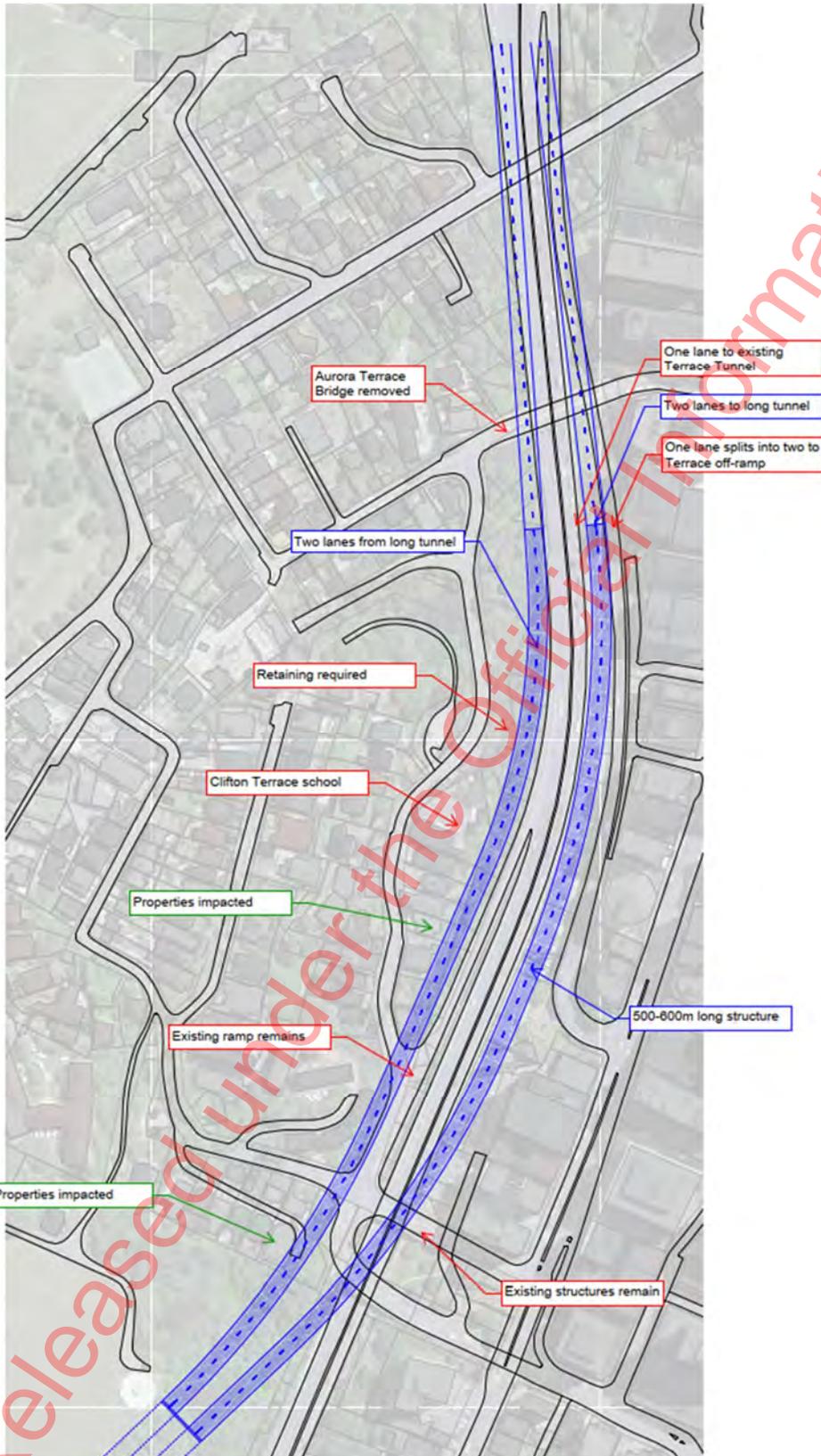
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3.2.2 LONG TUNNEL PORTAL LOCATION

Earlier work (2020) considered an alternative portal location north of the Terrace Tunnel. This option would increase the length of the TBM tunnel to approximately 4km. It would not include the construction of the Terrace Tunnel Duplication. This option would require a section of cut and cover tunnel through Kelburn Park. It would align with the need to start any TBM operations from

Kilbirnie Park. This change in portal location would not result in any changes at Adelaide Road or in Kilbirnie. There are a number of variants that would need to be considered for this option but one option is shown in **Figure 3.1**.

Figure 3.1. Alternative Portal location (north of Terrace Tunnel)



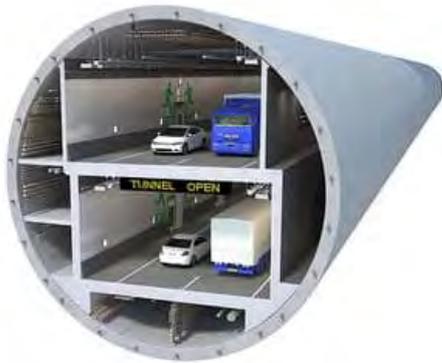
This option was the subject of a discussion amongst the project team on June 6, 2024, the following observations were agreed:

1. Cost was unlikely to be cheaper.
2. There would be increased impact on the town belt.
3. Kelburn Park would need to be used for construction purposes for an extended period.
4. There would be significant earthworks and structures required in Kelburn Park and further north, adjacent to the state highway, through to Bowen Street.
5. Geotechnical conditions for the tunnel portal are likely to be better at this location.
6. Less property would need to be purchased. The overall property footprint (including town belt and Kelburn Park) may or may not be less.
7. The options considered at this alternative portal location have differing impacts/outcomes:
 - a. Clifton Terrace School might be impacted, potential loss of connection from Karo Drive to Tinakori Road limiting potential for realising Wellington City outcomes, right hand on/off ramp safety concern, visual and noise impact on adjacent property,
 - b. Short or permanent impact on connections across the state highway (Boulcott St, Aurora Tce, Everton Tce).
8. This option would not include the Terrace Tunnel duplication and the ability to:
 - a. Start construction early providing property impact can be minimised.
 - b. Phase Long Tunnel construction with the Terrace Tunnel duplication starting early.
 - c. Identify benefits from the early delivery of the Terrace Tunnel Duplication and increased capacity into the City.
9. Construction disruption associated with this portal location would be different. Less construction areas would be required within the city, but there may be more direct impact on street access.

3.2.3 SINGLE BORE STACKED TUNNEL

An alternative tunnel arrangement could be the use of a single rather than dual bored tunnel. This could be something similar to the tunnel used on State Route 99 in Seattle, USA (see **Figure 3.2**). A single stacked bored tunnel has been considered for many projects in Australia but not progressed. The only existing stacked tunnel in Australia is the Eastern Distributor in Sydney which was constructed using a road header construction approach.

Figure 3.2. State Route 99 Tunnel Cross-Section

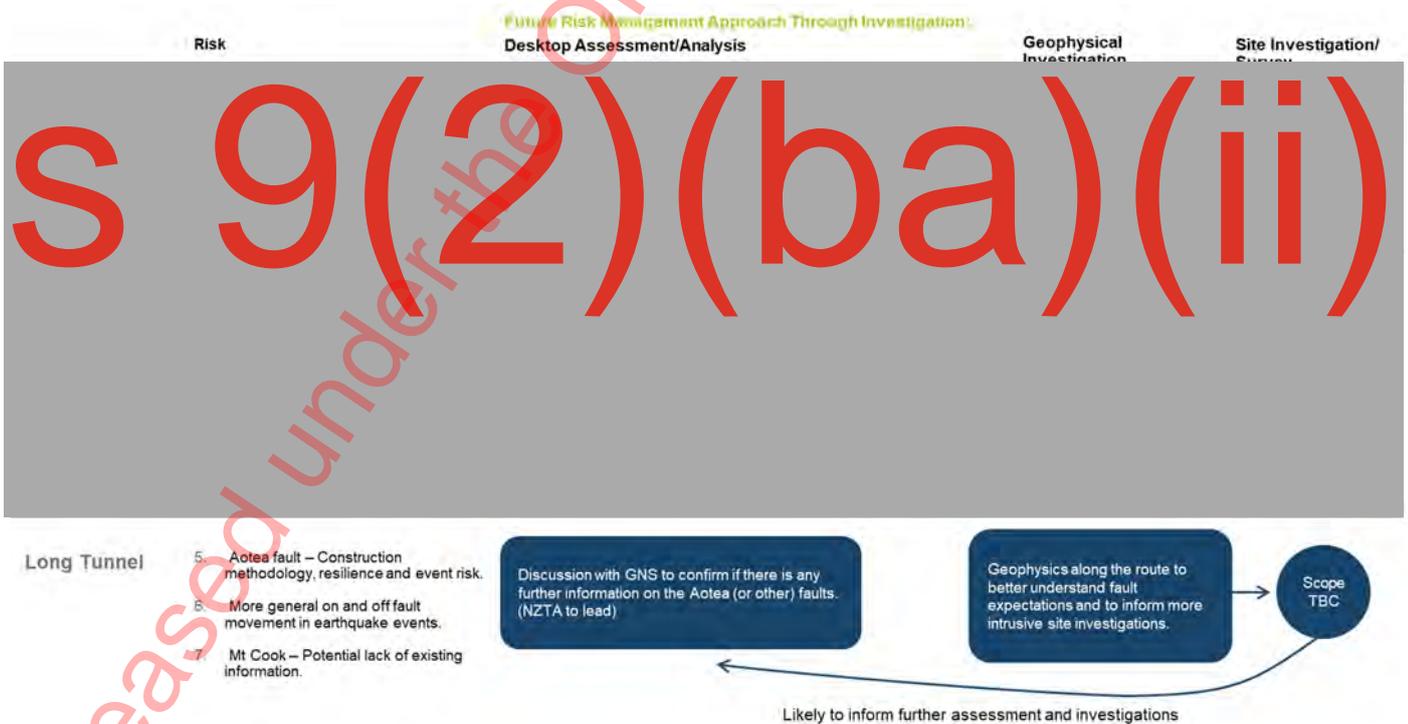


Source: Washington State Department of Transportation.

3.2.4 DESIGN BASED ON ADDITIONAL GEOTECHNICAL DATA

There are many opportunities to reduce risk in the design through improved geotechnical understanding and topographical survey in critical areas. The areas of highest risk in the design or areas of greatest uncertainty are shown in **Figure 3.3**.

Figure 3.3. Identified Areas of Geotechnical Risk



An improved understanding in these areas will better inform cost and property needs. Current assumptions for property needs are conservative and would hopefully be reduced with this improved understanding.

Further discussion on geotechnical understanding is included within the Geotechnical Feasibility Assessment.

3.2.5 TRAFFIC LAYOUT

There is potential to save cost and project footprint by reconsidering some of the lane provisions. Examples of this could include:

1. s 9(2)(ba)(ii) [Redacted]
2. **Kilbirnie Crescent Bridge.** A reduction of the lanes on Kilbirnie Crescent and Hamilton Road.

3.2.6 OTHER ITEMS

Areas of further design consideration should include:

1. **Stakeholder Input.** To look at design improvements to address areas of concern from stakeholders, e.g. Mana Whenua, Wellington City Council and Greater Wellington Regional Council that have not been included in the current design process.
2. **Specialist Input.** To look at design improvements to address areas of concern from specialists, e.g. urban design, heritage, noise, air quality etc that have not been included in the current design process.
3. **Geometric Optimization.** Several improvements to the geometric design can be made including avoiding St Pats College land and not having the alignment traverse under hospital buildings.
4. **Other Modes.** To further consider access and connectivity of other modes including walking and cycling.

4 LIMITATIONS

This report ('Report') has been prepared by WSP New Zealand Limited ('WSP') exclusively for NZTA ('Client') in accordance with the Short Form Agreement 10331 SH1 Wellington Corridor Upgrades – Traffic Engineering, Design, Geotechnical and tunnel Services ('Agreement').

Permitted Purpose

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APPENDIX A

NORTH APPROACH (TERRACE TUNNEL) WORKING DRAWINGS

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

APPENDIX B

TERRACE TUNNEL DUPLICATION WORKING DRAWINGS

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

APPENDIX C

LONG TUNNEL, NORTHERN CONNECTION (TERRACE) WORKING DRAWINGS

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s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

s 9(2)(ba)(ii)

Released under the Official Information Act 1982

APPENDIX D

LONG TUNNEL WORKING DRAWINGS

Released under the Official Information Act 1982

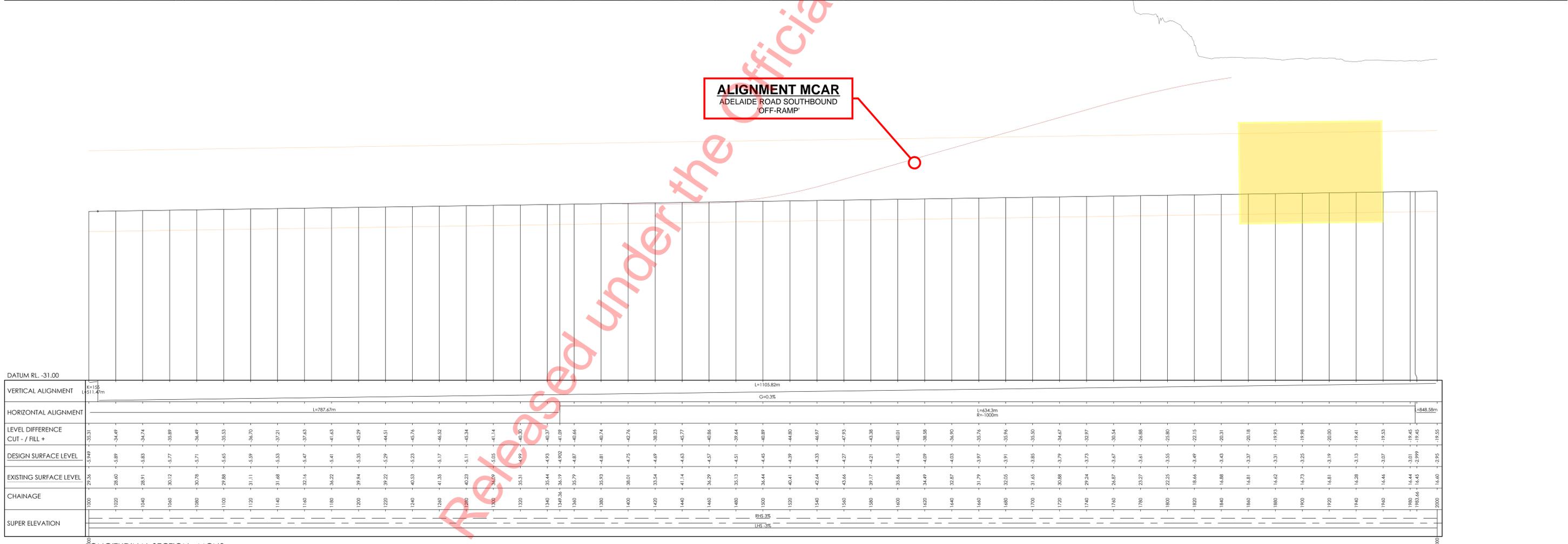
s 9(2)(ba)(ii)

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ADELAIDE ROAD EXIT
REFER: FIGURE E

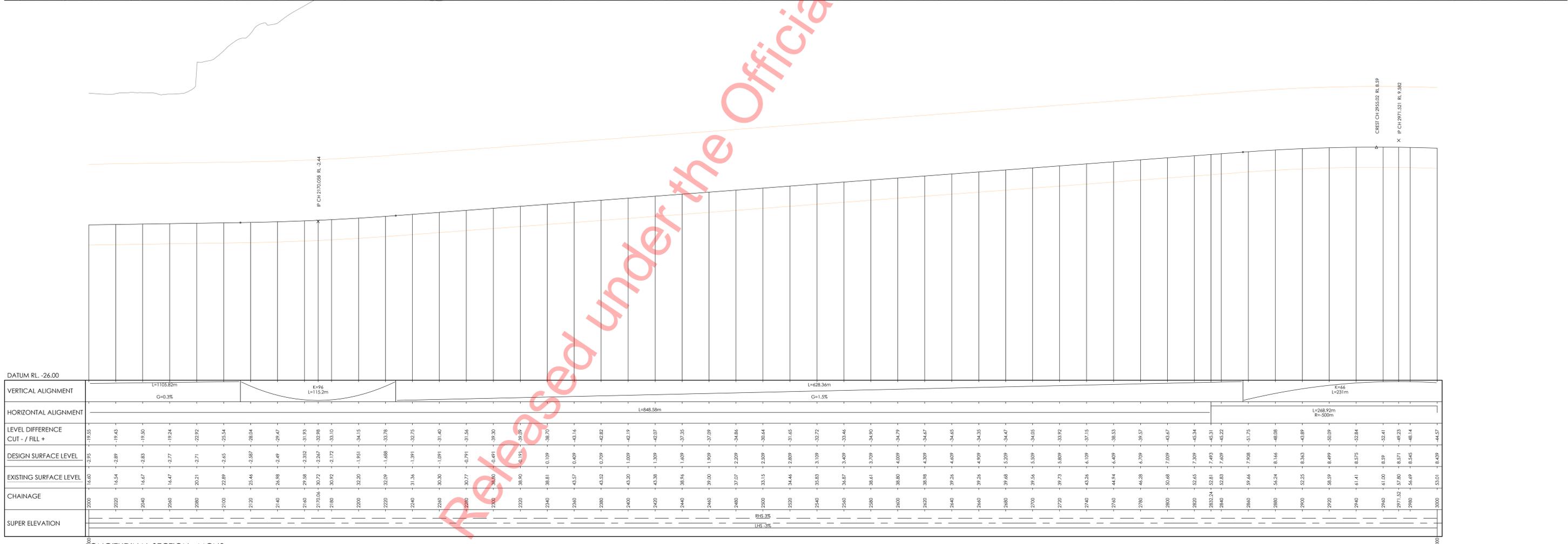
ALIGNMENT MCAR
ADELAIDE ROAD SOUTHBOUND
OFF-RAMP



LONGITUDINAL SECTION - MCN0
HORIZ 1:1000 VERT 1:200

LONGITUDINAL SECTION
TUNNEL ALIGNMENT MCN0 (NORTH-BOUND LANES)

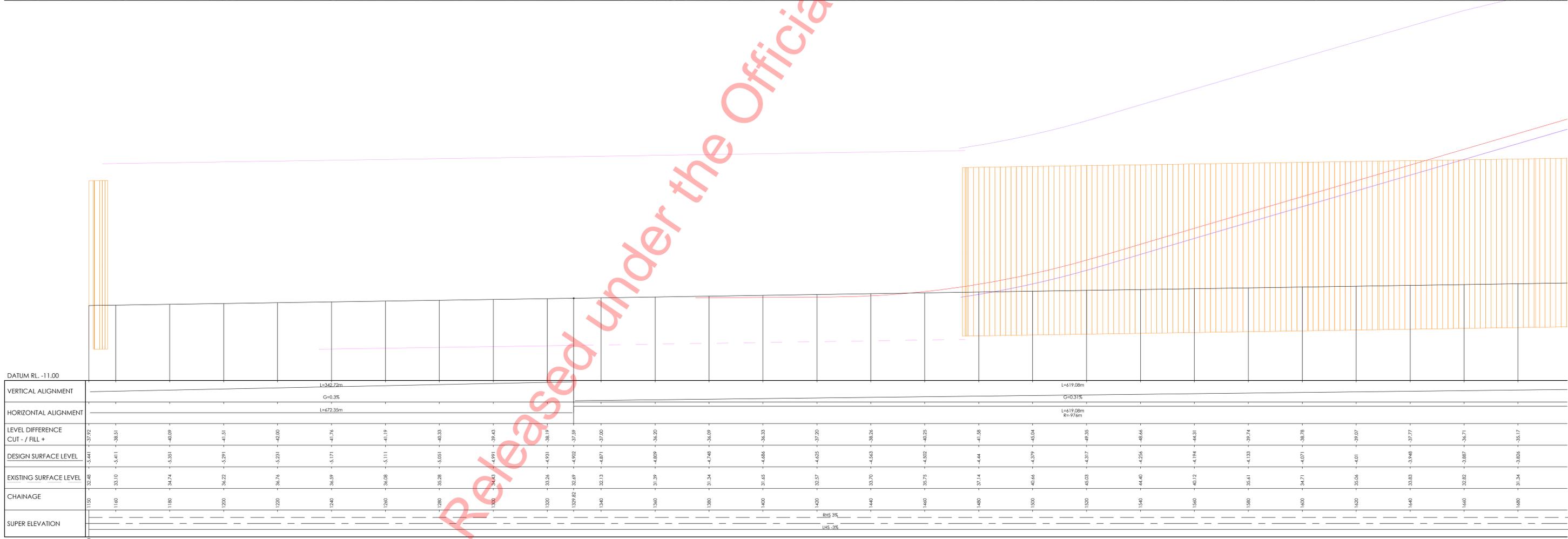
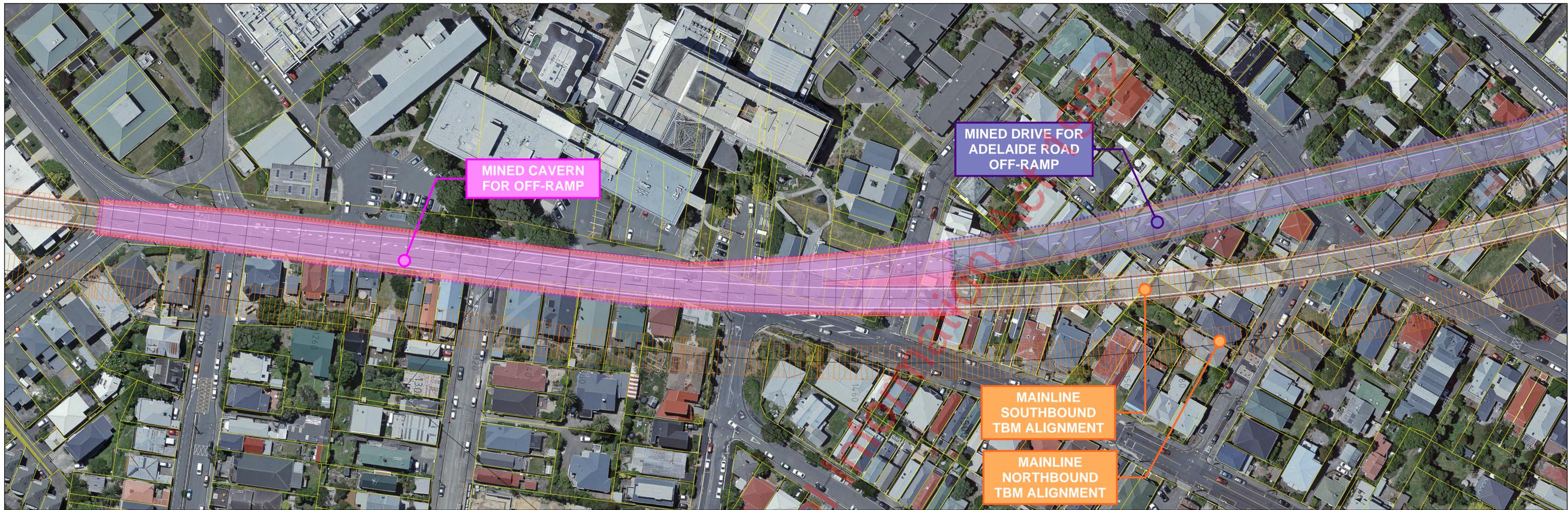
CONFIDENTIAL
WORK IN PROGRESS



APPENDIX E

ADELAIDE ROAD RAMP WORKING DRAWINGS

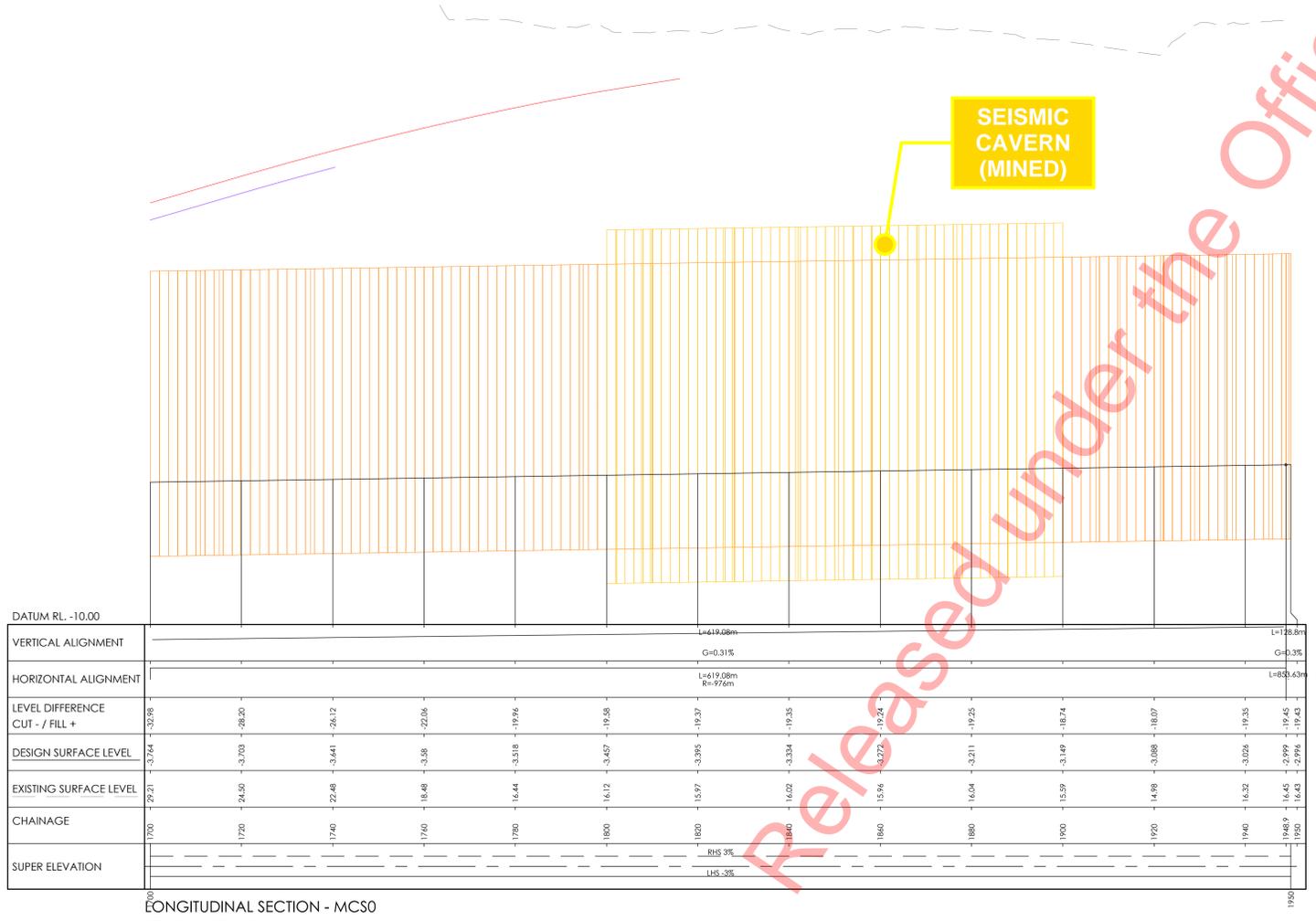
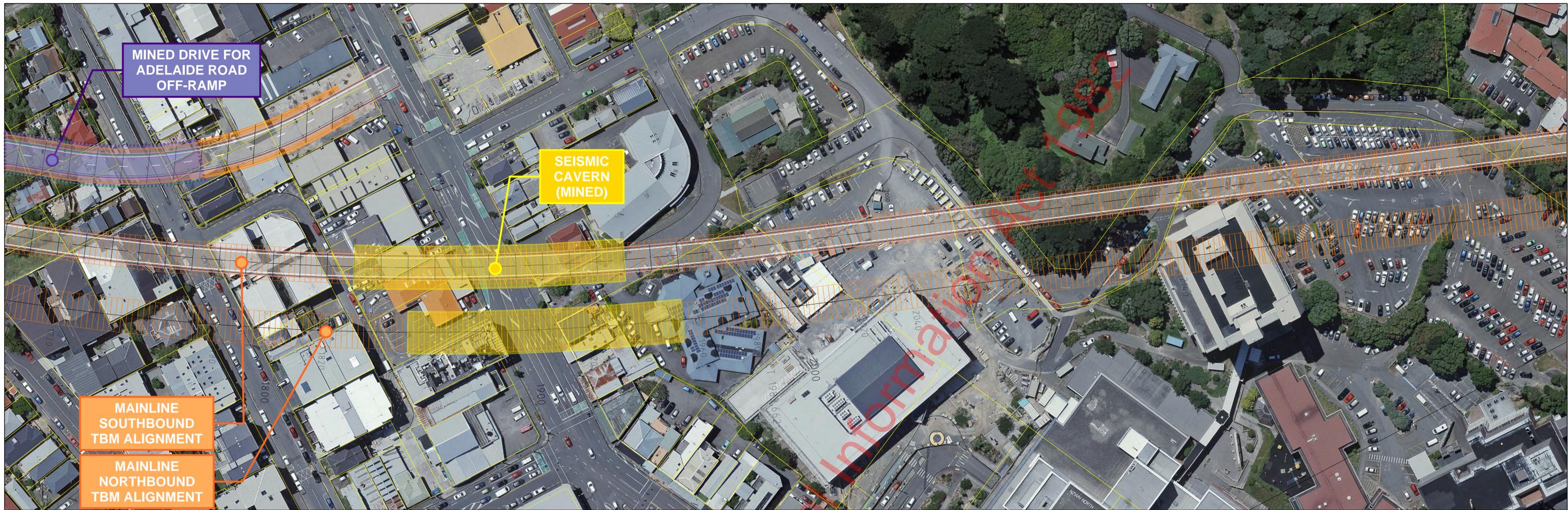
Released under the Official Information Act 1982



LONGITUDINAL SECTION - MCS0
 HORZ 1:500 VERT 1:100

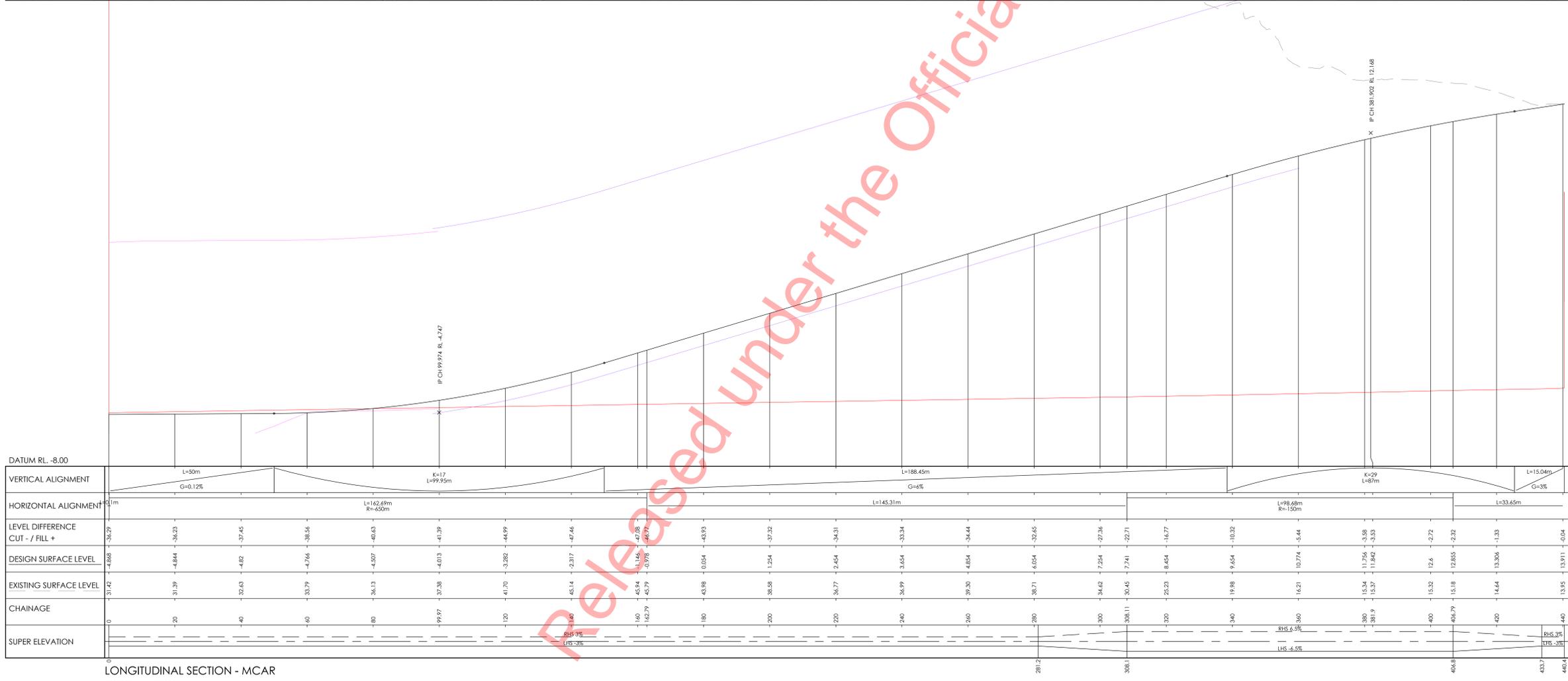
LONGITUDINAL SECTION
 TUNNEL ALIGNMENT MCS0 (STH-BND EXIT - ADELAIDE RD)

**CONFIDENTIAL
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LONGITUDINAL SECTION - MCS0
TUNNEL ALIGNMENT MCS0 (STH-BND EXIT - ADELAIDE RD)

CONFIDENTIAL
WORK IN PROGRESS



LONGITUDINAL SECTION - MCAR
 TUNNEL ALIGNMENT MCAR (STH-BND EXIT - ADELAIDE RD)

**CONFIDENTIAL
 WORK IN PROGRESS**

DATUM R.L.-11.0

DESIGN	DEPTH TO DESIGN CUT / FILL +	EXISTING SURFACE	OFFSET
-7.55	36.33	-37.654	0.727
-7.653	36.32	-41.654	-5.403
-7.653	36.33	-41.624	-5.293
-3.751	36.54	-41.010	-5.274
-3.501	36.54	-41.211	-5.368
-0.001	36.64	-41.633	-5.261
0.000	36.64	-41.253	-5.261
3.000	36.76	-41.891	-5.134
4.500	36.63	-41.897	-5.104
6.350	37.76	-49.653	-4.899
6.450	38.02	-51.024	-4.999
24.000	40.27	-45.533	-5.261

CH. 1210.000

MAINLINE NORTHBOUND TBM ALIGNMENT

MINED CAVERN FOR OFF-RAMP

DATUM R.L.-11.0

DESIGN	DEPTH TO DESIGN CUT / FILL +	EXISTING SURFACE	OFFSET
-9.459	36.60	-39.623	0.726
-7.860	36.53	-41.977	-5.249
-7.269	36.50	-41.977	-5.249
-4.751	36.49	-49.034	-5.244
-3.501	36.74	-46.241	-5.268
-0.001	36.74	-41.241	-5.201
0.000	36.74	-41.241	-5.201
3.000	36.58	-41.628	-5.026
4.500	36.72	-41.721	-5.004
4.550	36.72	-41.721	-5.004
6.350	37.42	-44.522	-4.929
6.450	38.40	-38.822	-1.021
24.000	41.72	-46.920	-5.201

CH. 1230.000

DATUM R.L.-11.0

DESIGN	DEPTH TO DESIGN CUT / FILL +	EXISTING SURFACE	OFFSET
-7.683	36.18	-38.455	0.779
-7.583	36.18	-41.401	-5.221
-7.483	36.23	-41.252	-5.266
-5.751	36.53	-41.440	-5.314
-3.501	36.41	-41.458	-5.246
-0.001	36.58	-41.317	-5.141
0.000	36.58	-41.317	-5.141
3.000	36.28	-41.317	-5.034
4.500	36.53	-41.355	-5.014
4.550	36.41	-41.357	-4.944
6.350	38.42	-45.322	-4.899
6.450	38.42	-45.322	-4.899
24.000	40.56	-46.105	-5.141

CH. 1250.000

DATUM R.L.-11.0

DESIGN	DEPTH TO DESIGN CUT / FILL +	EXISTING SURFACE	OFFSET
-8.276	36.84	-35.202	0.652
-7.276	36.90	-41.222	-5.203
-6.726	36.57	-41.116	-5.293
-3.501	36.98	-41.433	-5.284
-0.001	36.22	-41.302	-5.221
0.000	36.22	-41.302	-5.221
3.000	36.49	-41.248	-5.184
4.500	36.58	-41.271	-5.094
6.350	38.77	-41.388	-5.019
6.450	38.72	-33.822	-1.021
24.000	39.20	-44.624	-5.221

CH. 1200.000

DATUM R.L.-11.0

DESIGN	DEPTH TO DESIGN CUT / FILL +	EXISTING SURFACE	OFFSET
-9.302	36.58	-35.884	0.699
-7.276	36.51	-41.285	-5.224
-7.162	36.53	-41.274	-5.246
-4.251	36.73	-42.085	-5.339
-3.501	36.77	-42.102	-5.338
-0.001	36.76	-41.296	-5.231
0.000	36.76	-41.296	-5.231
3.000	36.68	-41.807	-5.126
4.500	36.79	-41.265	-5.034
4.550	36.79	-41.265	-5.034
6.350	38.57	-45.323	-4.929
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24.000	40.51	-45.242	-5.231

CH. 1220.000

DATUM R.L.-11.0

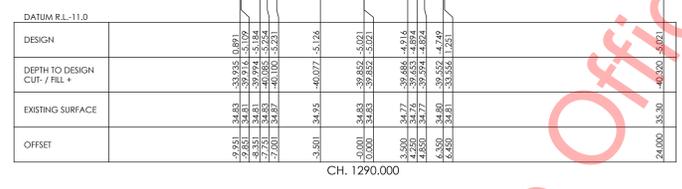
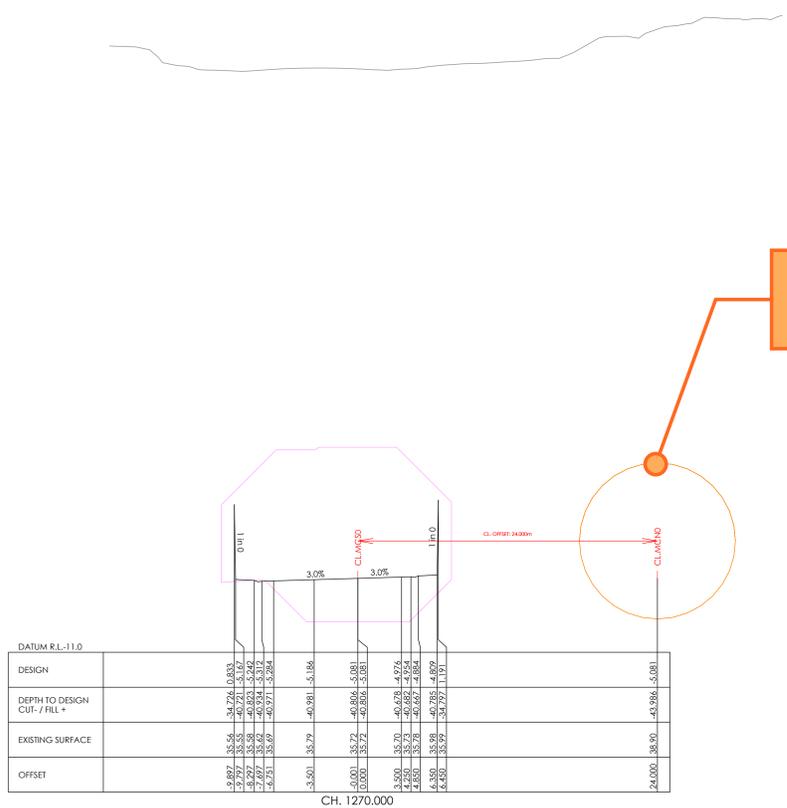
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-7.216	36.47	-41.213	-5.233
-5.251	36.53	-41.458	-5.322
-3.501	36.59	-41.467	-5.276
-0.001	36.59	-41.263	-5.171
0.000	36.59	-41.263	-5.171
3.000	36.49	-41.538	-5.044
4.500	36.53	-41.576	-5.014
4.550	36.61	-41.381	-4.974
6.350	37.49	-42.160	-4.899
6.450	37.42	-35.242	-1.031
24.000	41.45	-46.018	-5.171

CH. 1240.000

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**MAINLINE
NORTHBOUND
TBM ALIGNMENT**

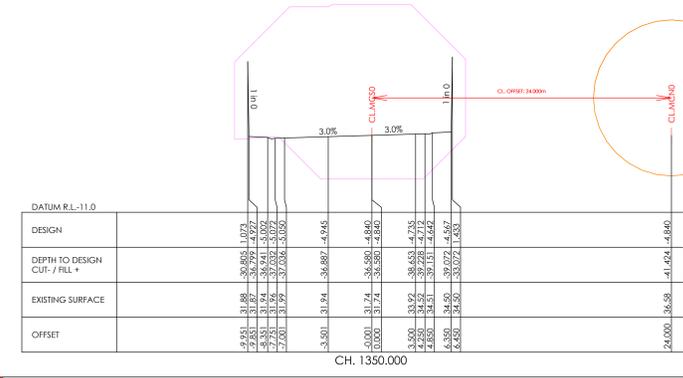
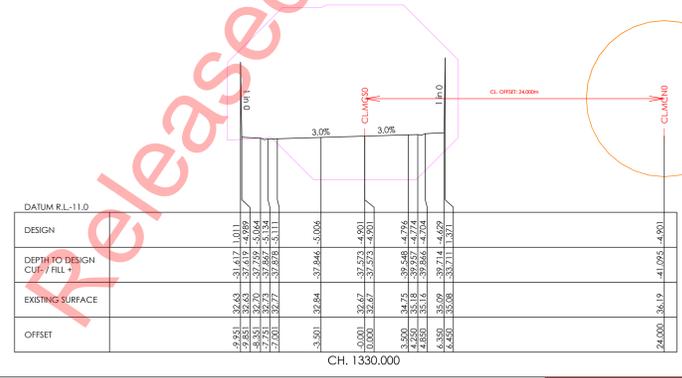
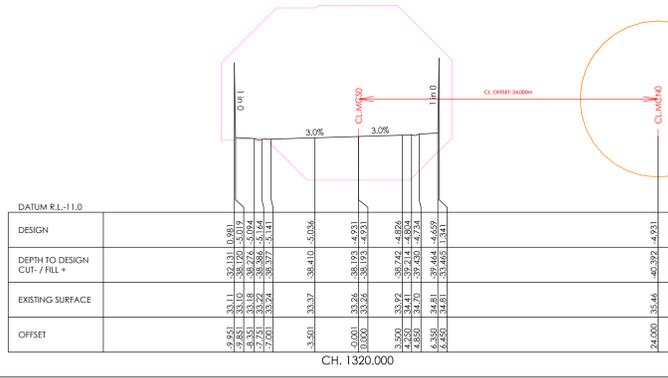
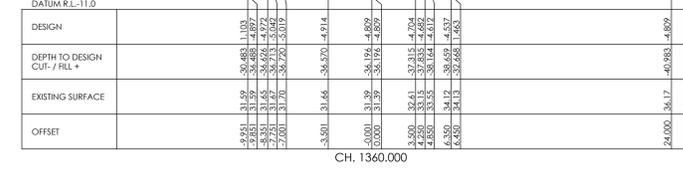
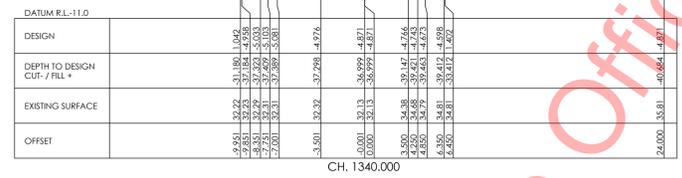
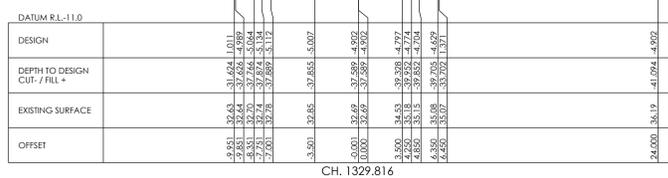
**MINED CAVERN
FOR OFF-RAMP**



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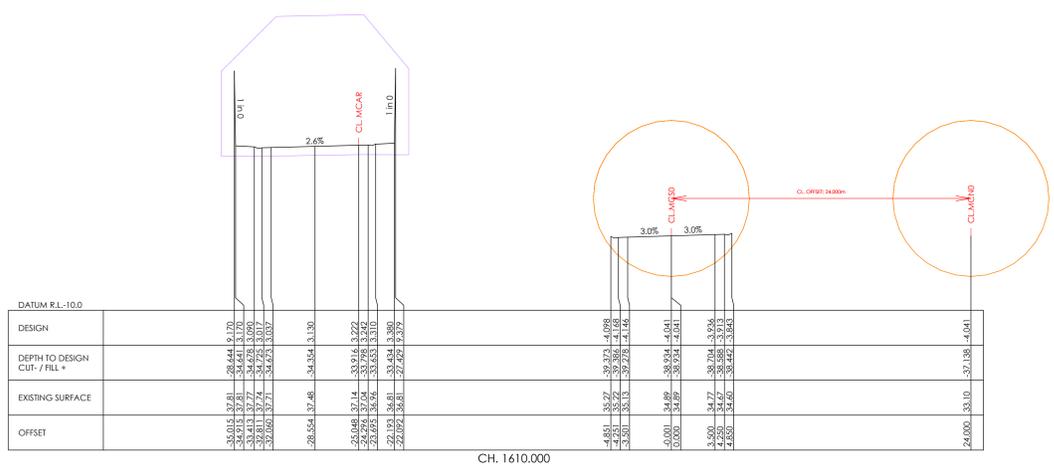
**MAINLINE
NORTHBOUND
TBM ALIGNMENT**

**MINED CAVERN
FOR OFF-RAMP**

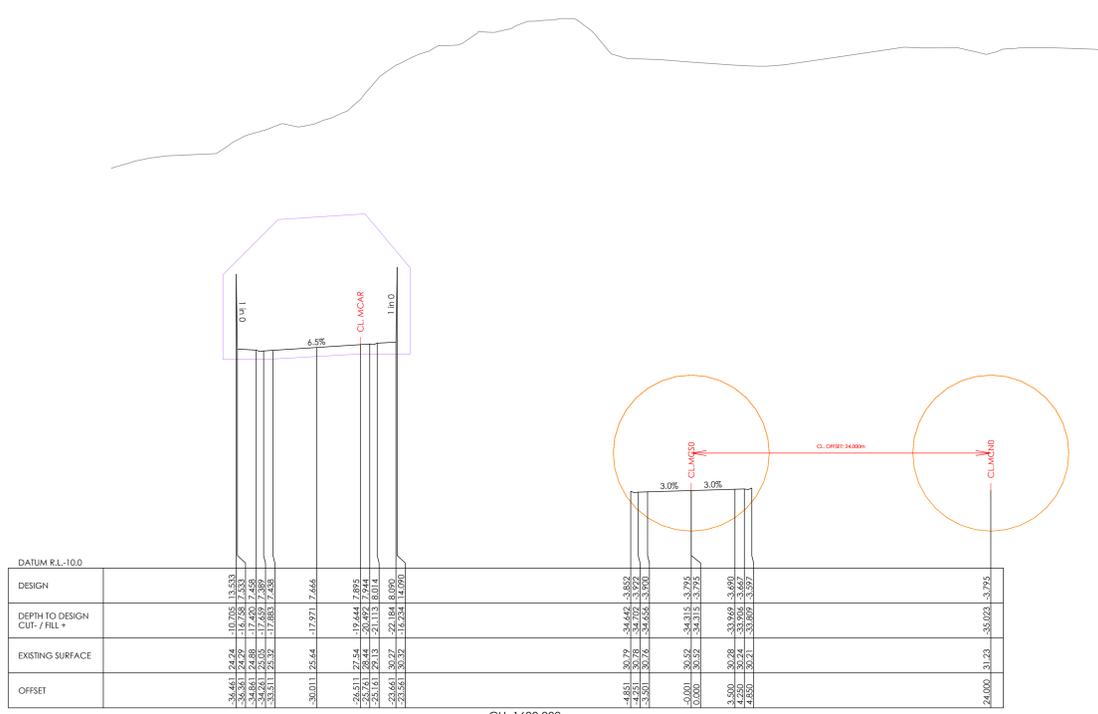


CROSS SECTIONS
ADELAIDE RD EXIT - ALIGNMENT MCS0

**CONFIDENTIAL
WORK IN PROGRESS**



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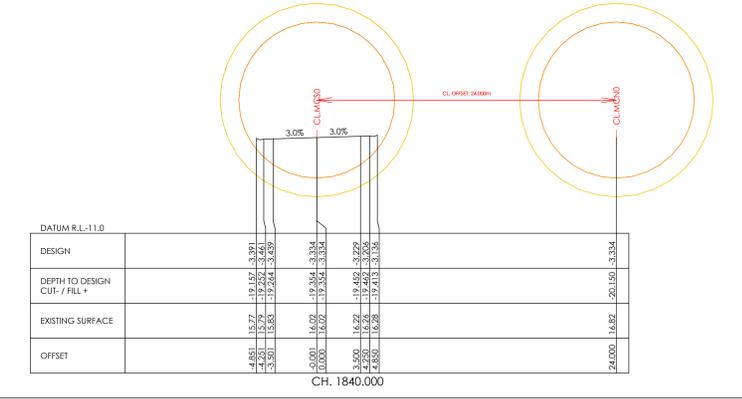
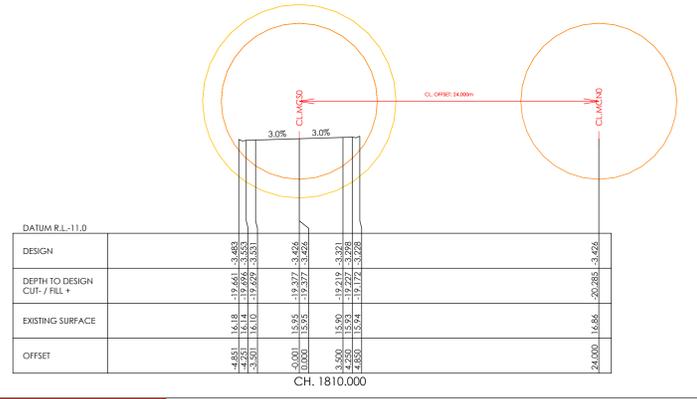
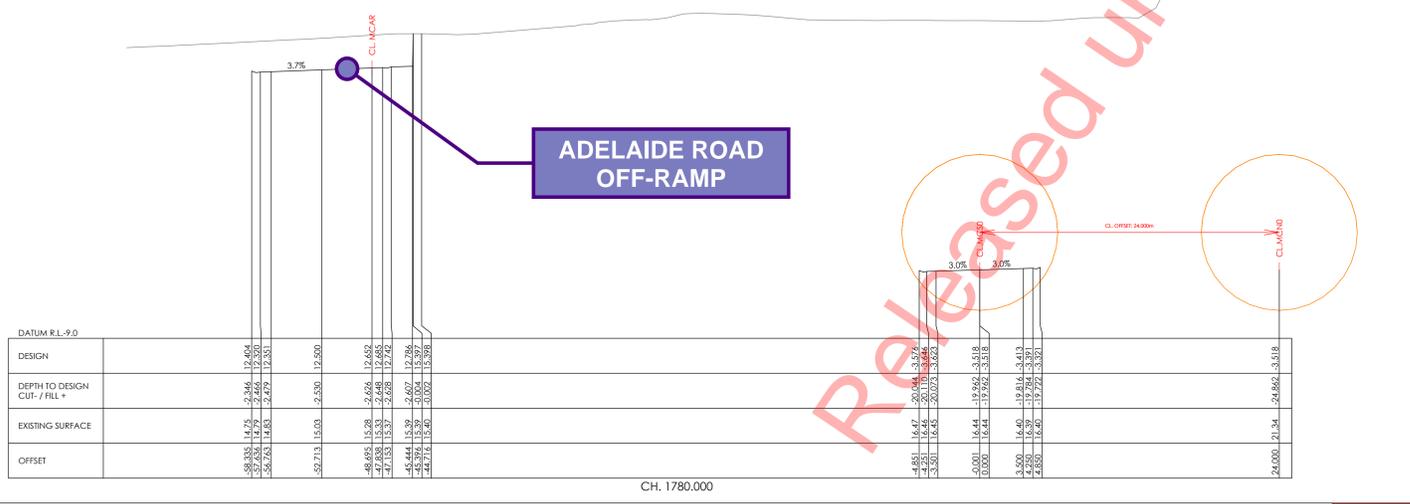
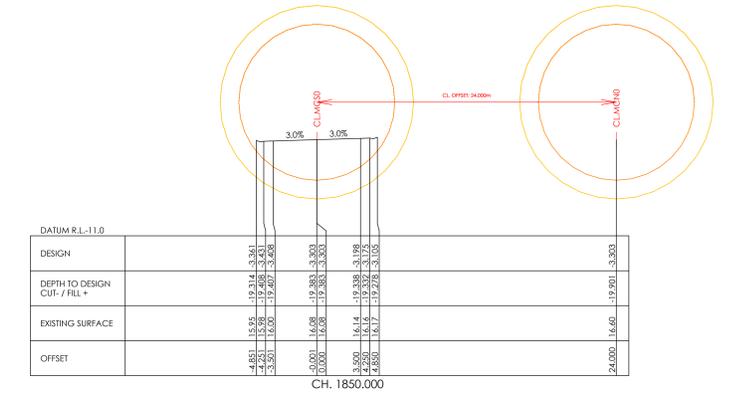
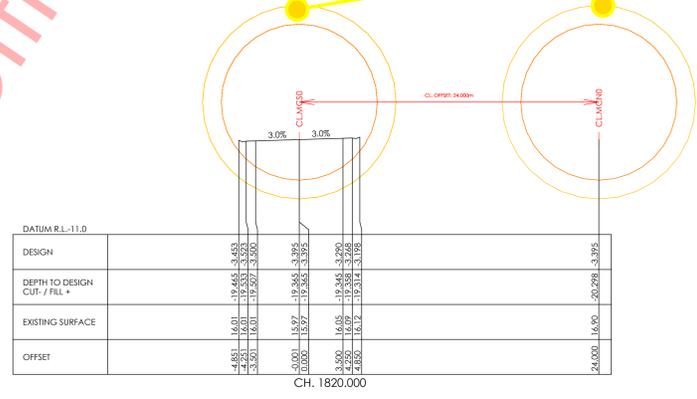
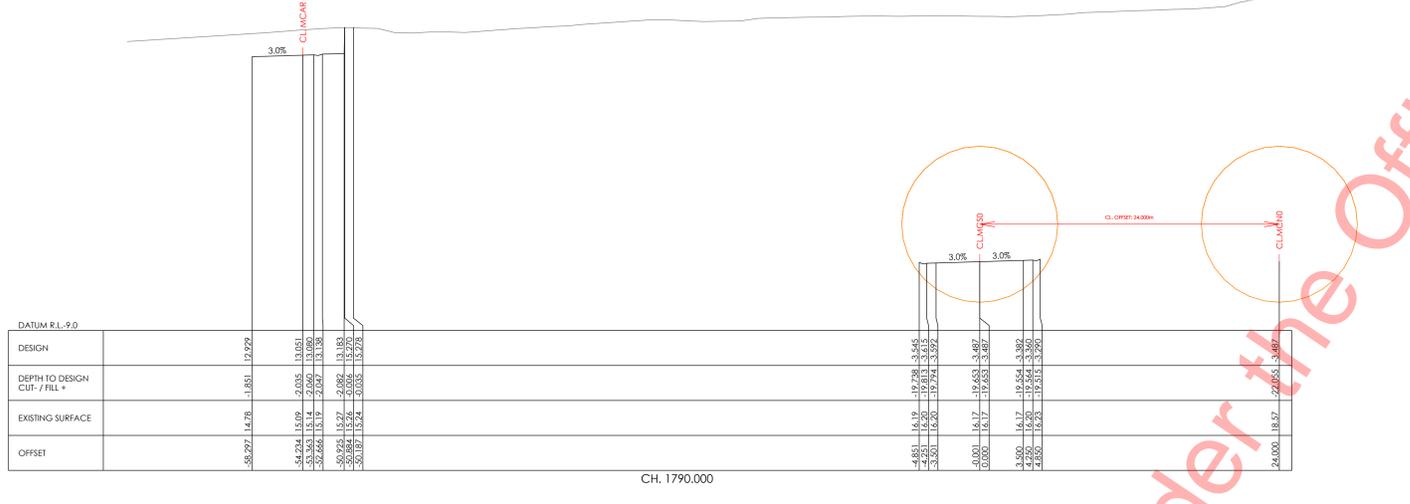
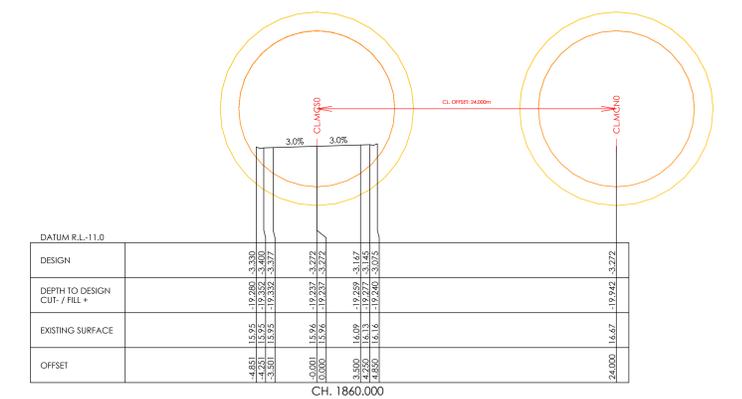
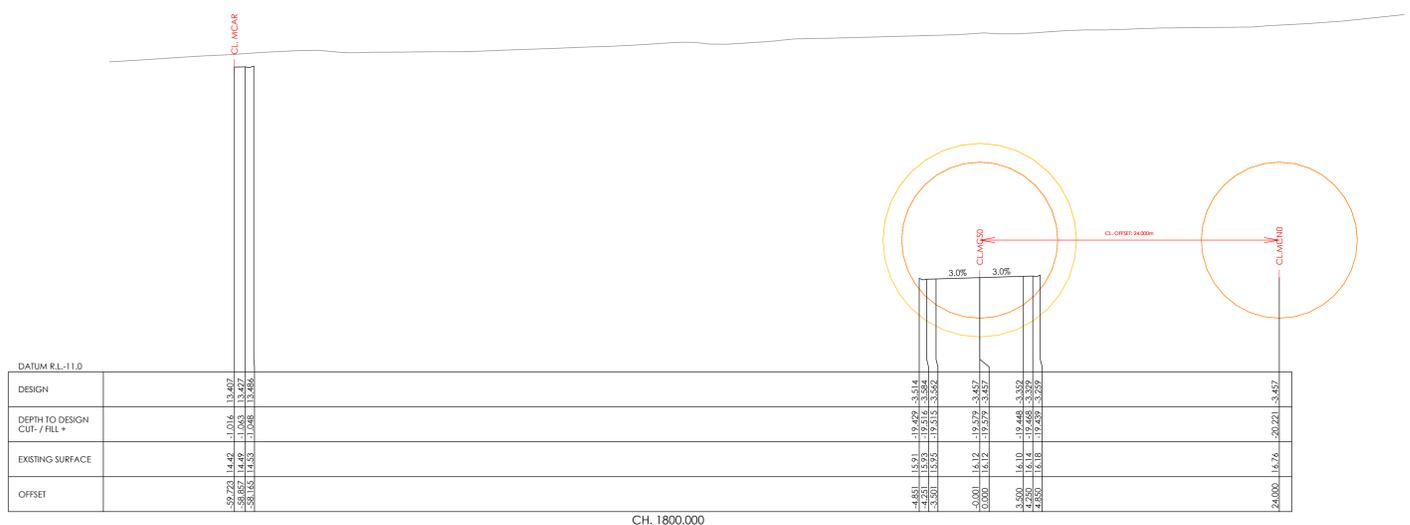
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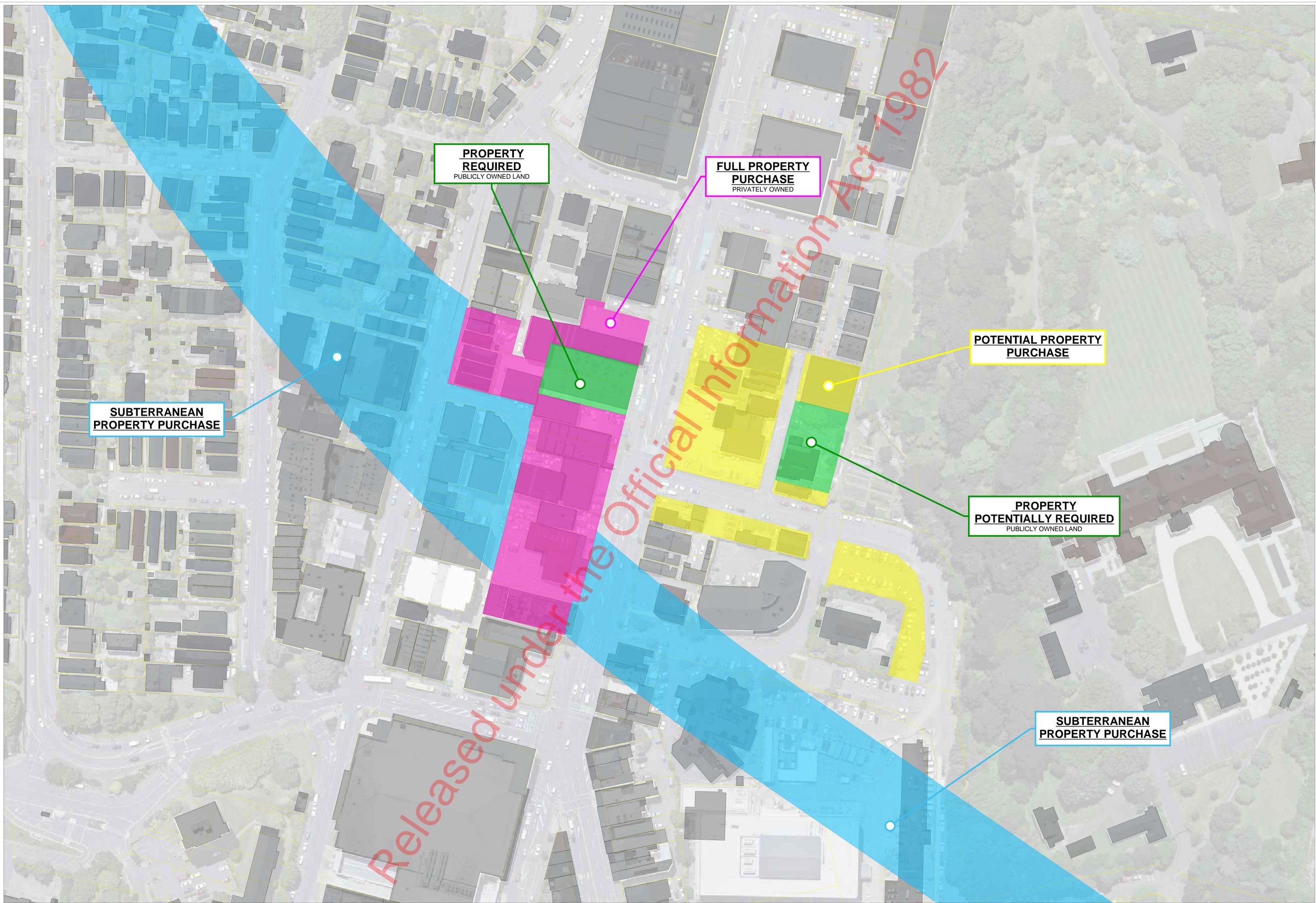
MAINLINE SOUTHBOUND TBM ALIGNMENT

MAINLINE NORTHBOUND TBM ALIGNMENT

SEISMIC CAVERN (MINED)

ADELAIDE ROAD OFF-RAMP





**PROPERTY
REQUIRED**
PUBLICLY OWNED LAND

**FULL PROPERTY
PURCHASE**
PRIVATELY OWNED

**POTENTIAL PROPERTY
PURCHASE**

**SUBTERRANEAN
PROPERTY PURCHASE**

**PROPERTY
POTENTIALLY REQUIRED**
PUBLICLY OWNED LAND

**SUBTERRANEAN
PROPERTY PURCHASE**

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APPENDIX F

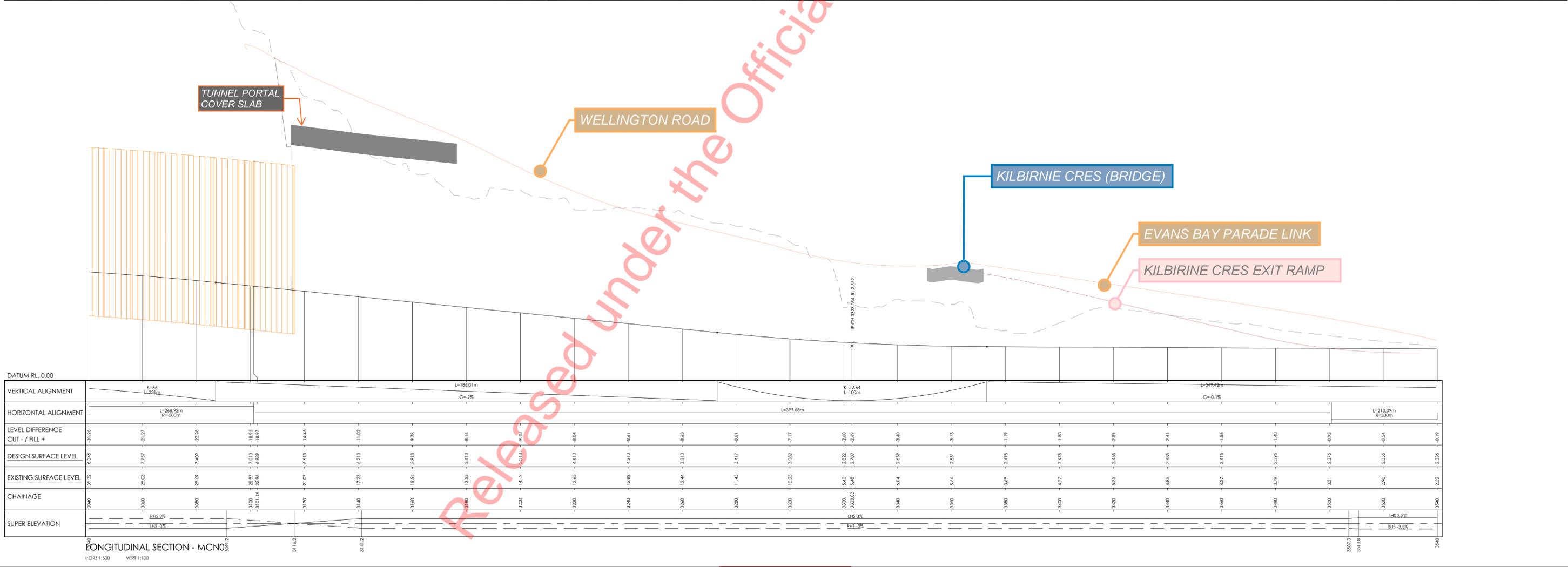
LONG TUNNEL, SOUTHERN CONNECTION (KILBIRNIE) WORKING DRAWINGS

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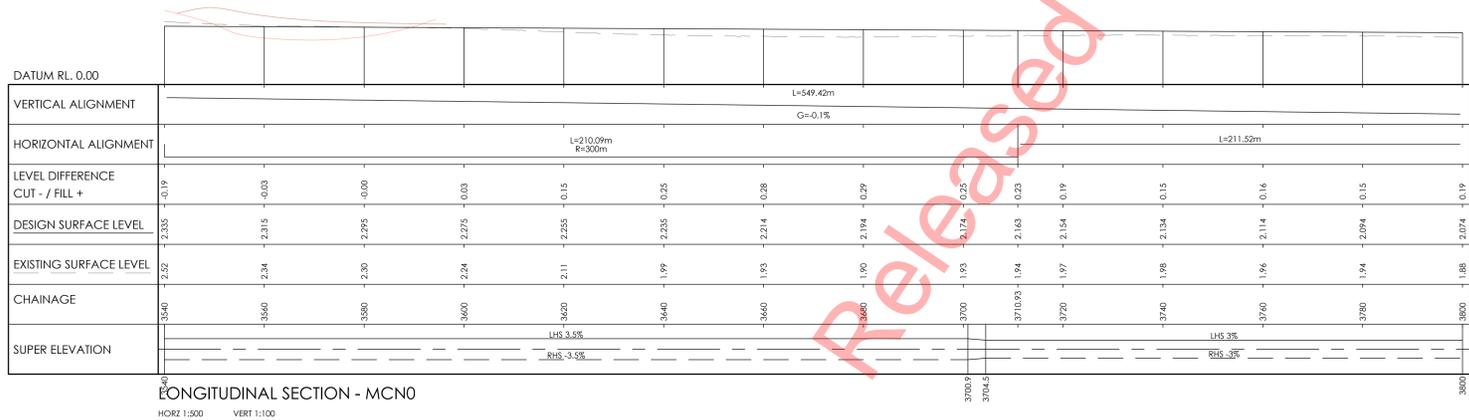


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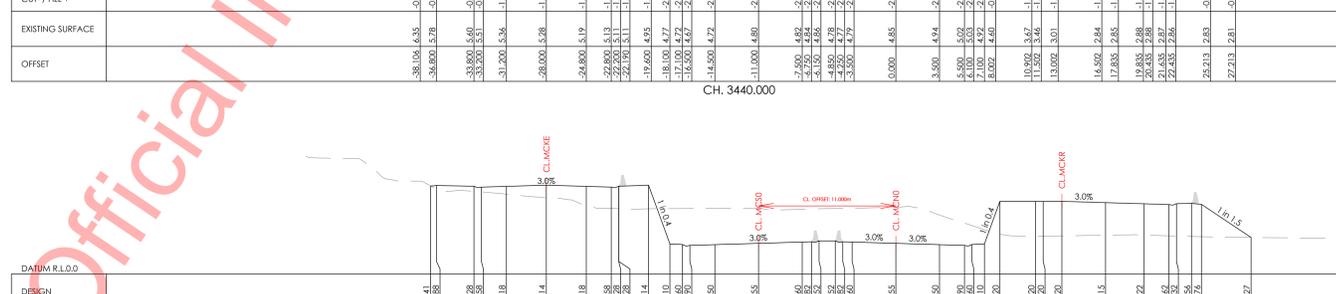
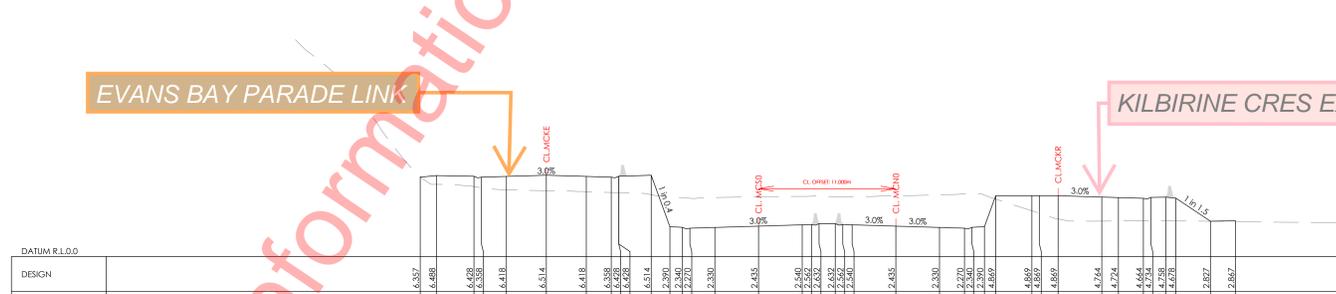
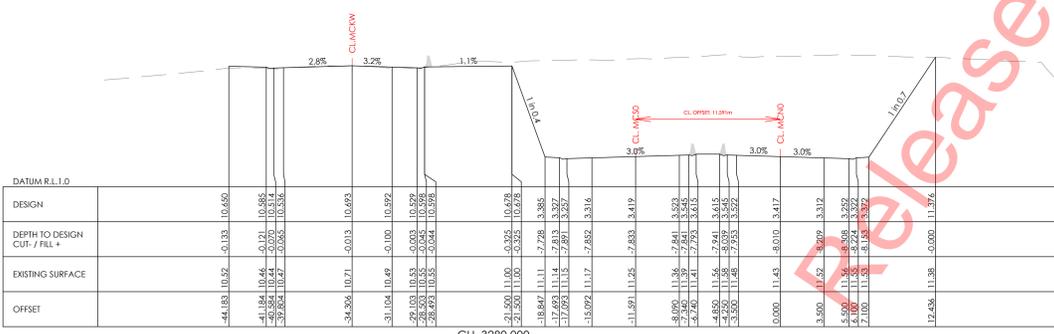
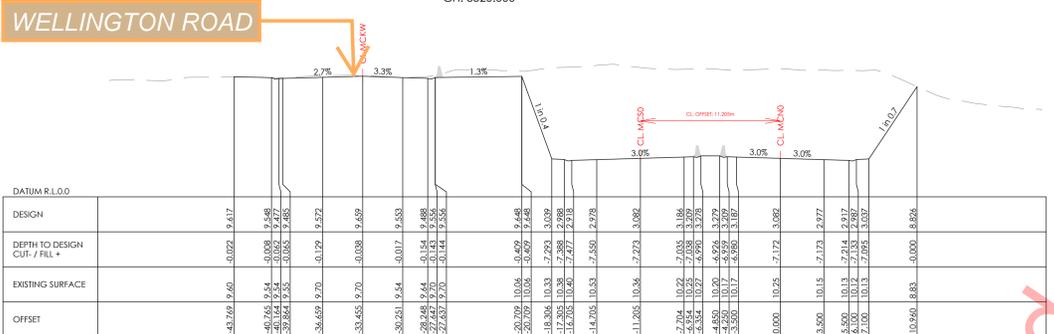
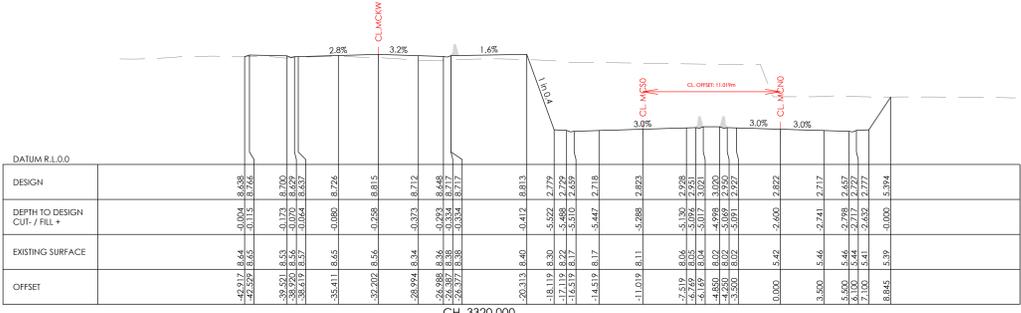
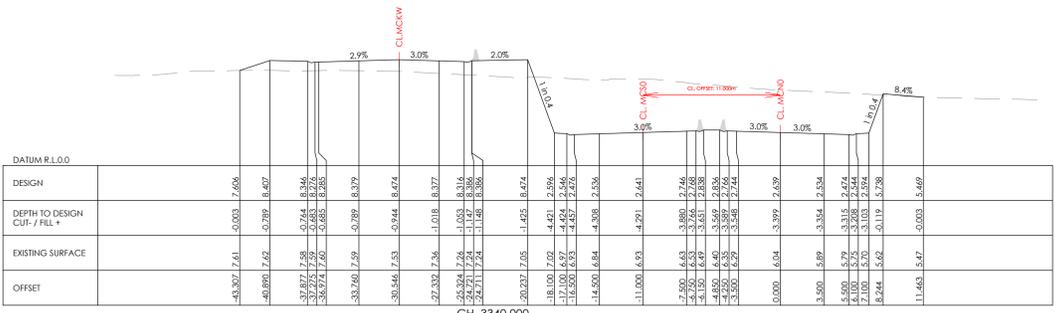
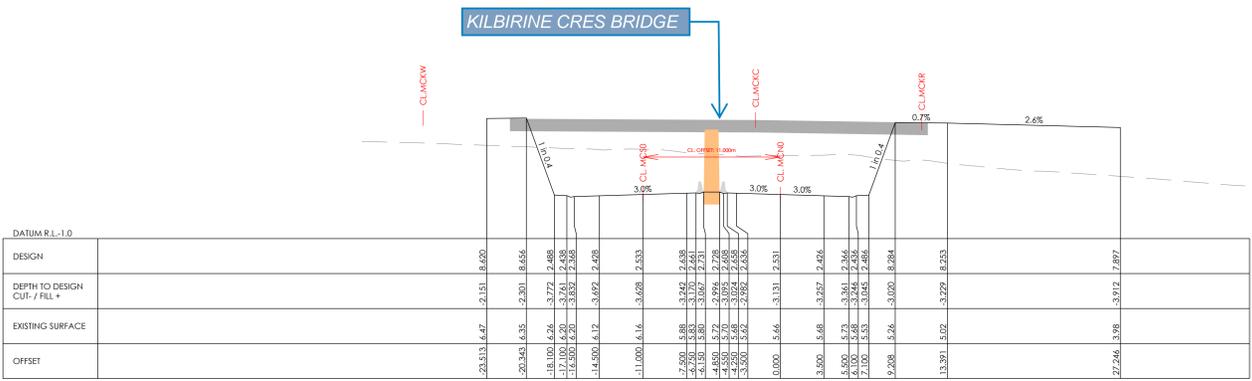
LONGITUDINAL SECTION
ALIGNMENT MCN0 (KILBIRNIE SECTION)

**CONFIDENTIAL
WORK IN PROGRESS**



LONGITUDINAL SECTION - MCN0
ALIGNMENT MCN0 (KILBIRNIE SECTION)

CONFIDENTIAL
WORK IN PROGRESS



**SUBTERRANEAN
PROPERTY PURCHASE**

**PARTIAL PROPERTY
PURCHASE**
FUTURE PHASES TO IDENTIFY
OPPORTUNITIES TO AVOID PROPERTY

**POTENTIAL PROPERTY
PURCHASE**

**POTENTIAL PROPERTY
PURCHASE**

**FULL PROPERTY
PURCHASE**
PRIVATELY OWNED

**FULL PROPERTY
PURCHASE**
PRIVATELY OWNED

**PROPERTY
REQUIRED**
PUBLICLY OWNED LAND

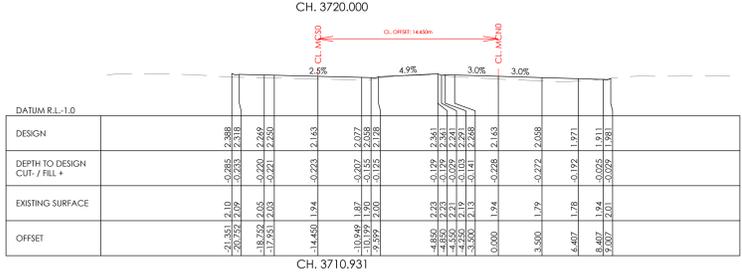
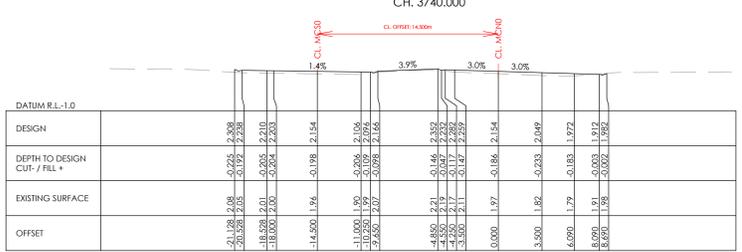
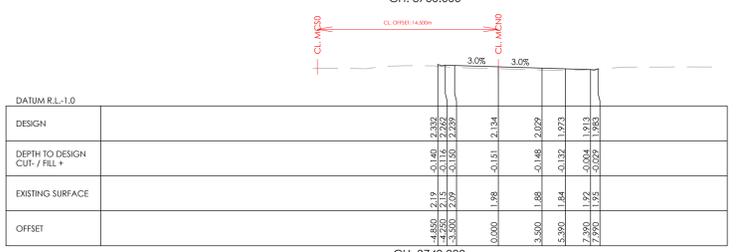
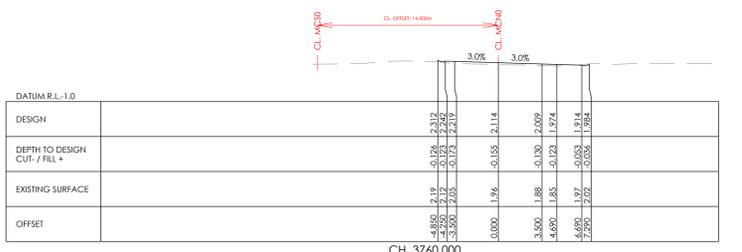
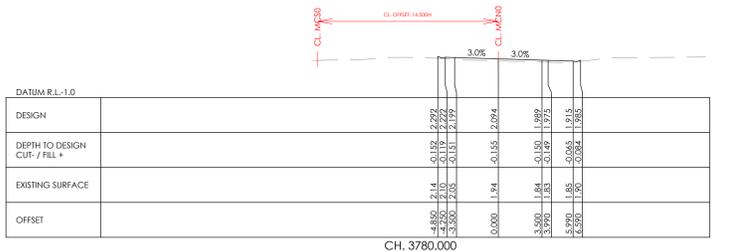
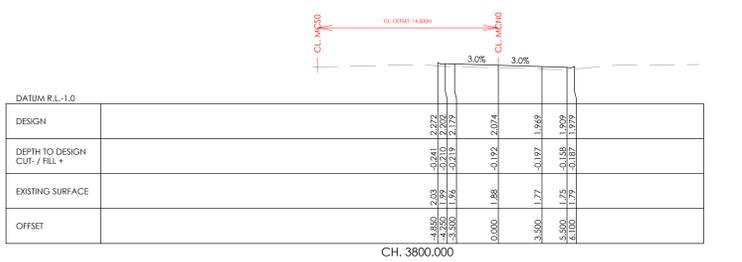
**POTENTIAL PROPERTY
PURCHASE**

**PROPERTY
REQUIRED**
PUBLICLY OWNED LAND

**PARTIAL PROPERTY
PURCHASE**
FUTURE PHASES TO IDENTIFY
OPPORTUNITIES TO AVOID PROPERTY

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Released under the Official Information Act 1982



APPENDIX G

DESIGN AND CONSTRUCTION CHALLENGE SESSION

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Memorandum

To	s 9(2)(a)
Copy	
From	s 9(2)(a)
Office	Wellington
Date	May 30 th 2024 30 May 2024
File/Ref	5-C4800-00-DES-GEN-MEM-0001
Subject	SH1 Wellington Improvements Design & Construction Challenge Session minutes

Attendees:

s 9(2)(a)	s 9(2)(a)	Andrew Stephens (NZTA)
		Will Peet (NZTA)
		Glen Prince (NZTA)
		Adam Nicholls (NZTA)
		Peter Spies (NZTA)
		Simon Prosee (NZTA)
		Nadia Gorodniakova (NZTA)
		Darren Godden (NZTA)

Introduction and Agenda:

This memo documents the minutes of the design and construct challenge session held on 27 May 0900-1200 at NZTA offices on Bowen Street and via teams.

Session Purpose: To review and test constructability to give confidence in the estimate assumptions for the following schemes:

- Basin
- Parallel Tunnel
- Diagonal Tunnel
- Long Tunnel

Attached to the memo is:

1. Background slide deck.

1 ALL SCHEMES

ITEM	ASSUMPTION	RISK/OPPORTUNITY	PARKING LOT
<h1>s 9(2)(ba)(ii)</h1> <p>Released under the Official Information Act 1982</p>			

2 BASIN RESERVE

S 9(2)(i)

3 PARALLEL/DIAGONAL

S 9(2)(i)

s 9(2)(i)

4 LONG TUNNEL

ITEM	ASSUMPTIONS	RISKS	PARKING LOT
Alignment		Opportunity to avoid going under the hospital	Further refinement in future phases.
Alternative Off-ramp location	Current ramp is at Adelaide Road. Ramps at other locations likely to have increased footprints.		
Combine mined caverns for fault and on-ramp/off-ramp		Opportunity to simplify mined tunnel works.	To be considered once further geotechnical details on fault available.
Fault methodology	Mined cavern	Costly and time consuming to construct	To be considered once further geotechnical details on fault available.
Early Works Packages	Terrace tunnel Mined sections of the long tunnel	Construction sequences and programme doesn't have	Consider early works packages in future phases.

	Southern interchange	<p>enough float to allow separation of packages.</p> <p>Interfaces complex to manage.</p>	
Property	New property take proposed of Massey Hall Building for Vivian 2 lanes and construction of Karo on ramp and retaining walls	Opportunity to reduce the design constraints and requirements at the Northern interchange.	
Power during construction	Move and upgrade substation at Kilbirnie early	Sub-station upgrades take time; potential upgrades to HV transmission even more.	Consider for Early Works Package
TBM transport to site	Assumed via road from the main Port.	Delivery route for bridge clearances / bypass and load ratings. Parts of the TBM are heavy / wide loads that require careful planning – and cost Opportunity is temp barge at Evans bay	
Futureproofing with Utility Providers		Opportunity to spaceproof in a utilities culvert for future services in collaboration with Providers	Consider at next stage of design
Workforce requirements	Current workforce can meet the demands of the scheme	Delay in mobilising workforce to support the project	Develop strategy for workforce accommodation and mobilisation.

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Wellington SH1 Corridor Improvements

Design & Construction Challenge

27 May 2024



Te Kāwanatanga o Aotearoa
New Zealand Government

1

Agenda

- Introductions
- Purpose: To review and test constructability to give confidence in the estimate assumptions.
- Scheme Review
 - Basin
 - Parallel Tunnel
 - Diagonal Tunnel
 - Long Tunnel
- Summary / Actions

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Long Tunnel

DBC Option	Long Tunnel
Core Option	No intermediary connectivity
Plus downstream improvements	Improvements along Cobham Drive (SH1)
Plus southbound off-ramp to Adelaide Road	Southbound off-ramp into Adelaide Road (Hospital)



Basin Reserve

Scheme Review

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Long Tunnel

Scheme Overview

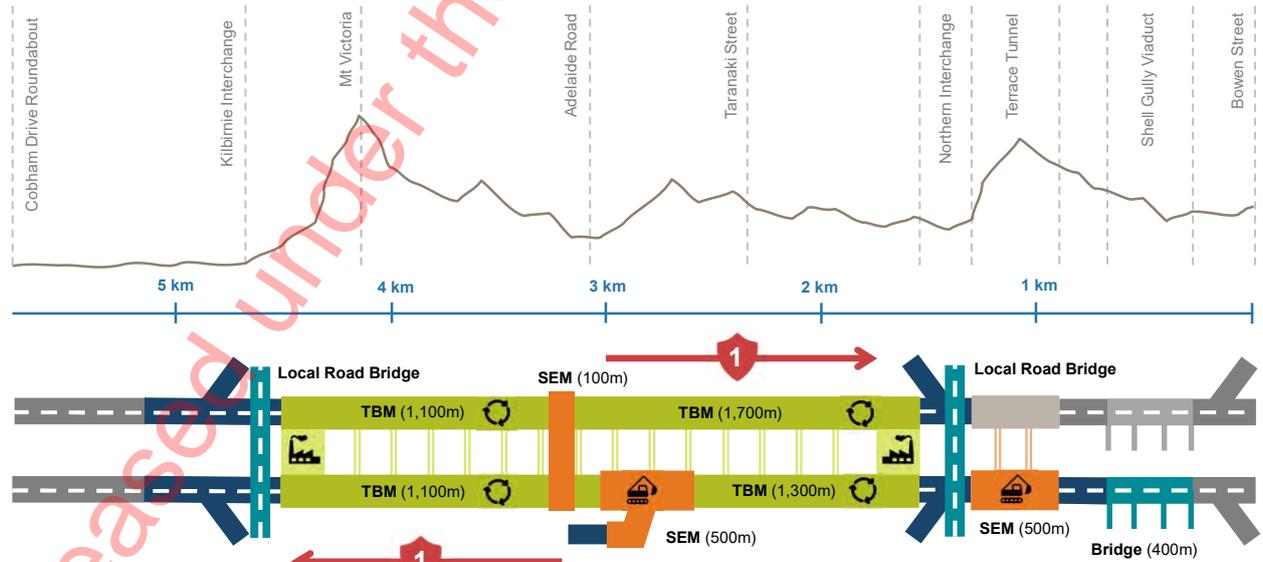
Scheme

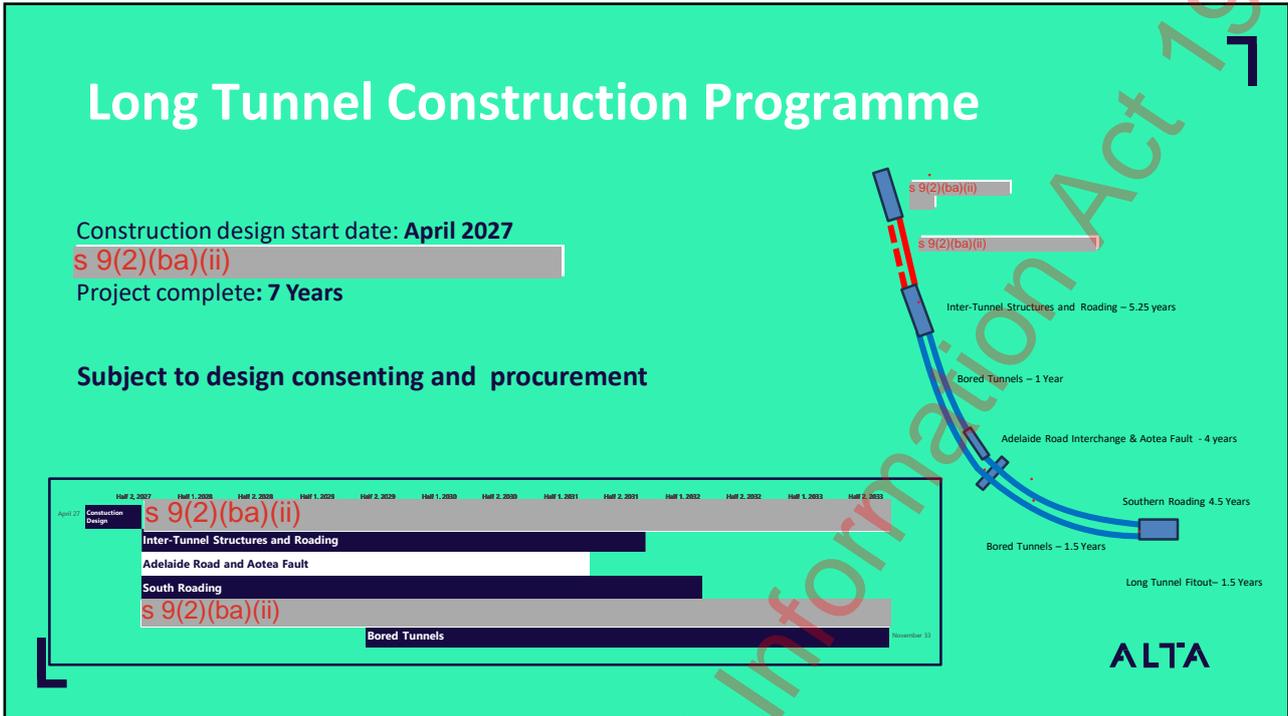
Long Tunnel

- Terrace Tunnel Duplication
- Long Tunnel

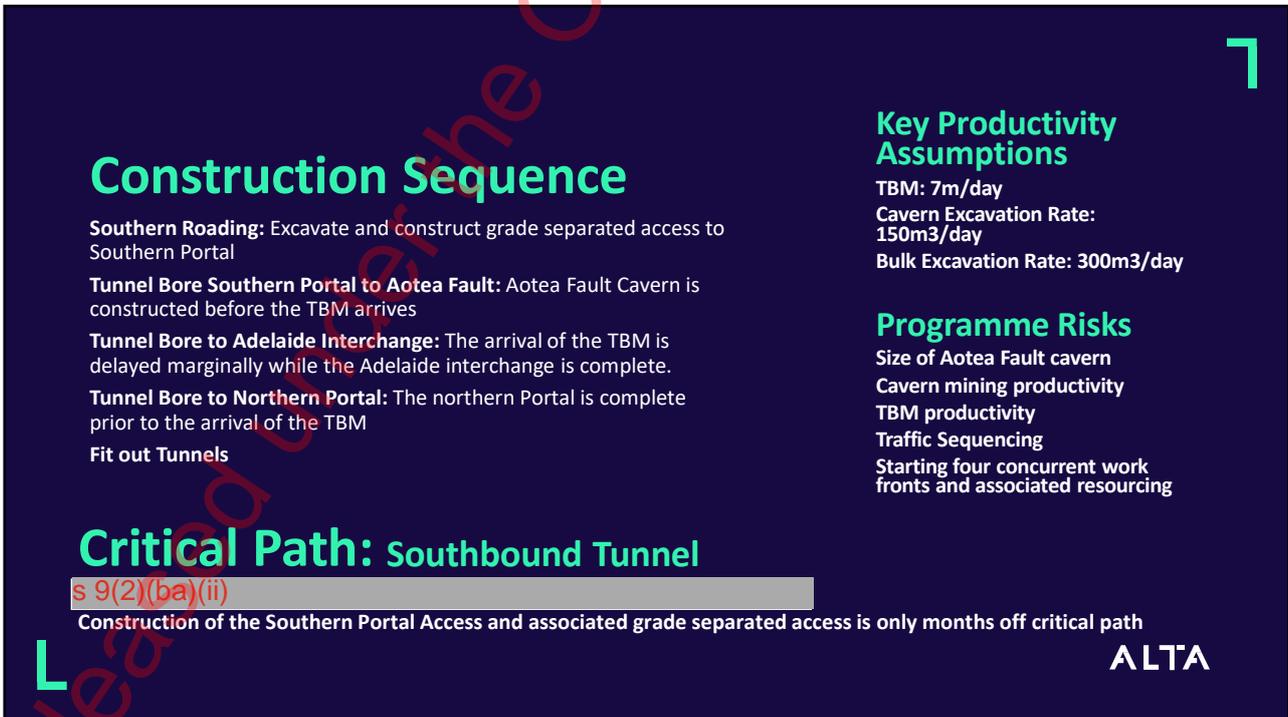


Long Tunnel Scheme – Long Section



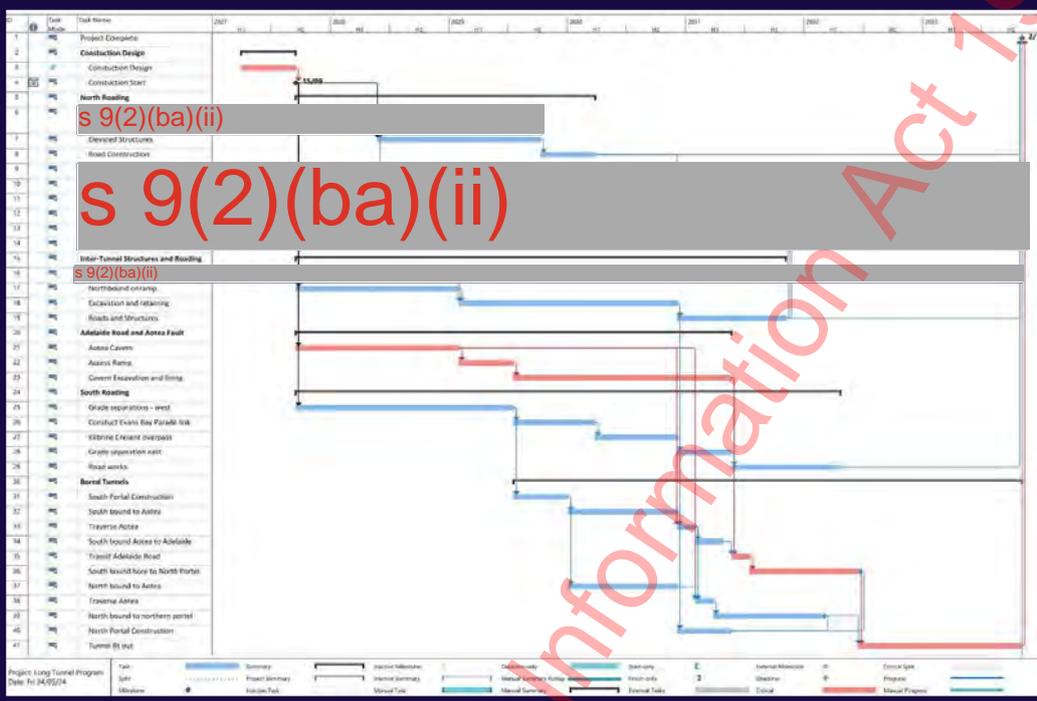


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Long Tunnel Programme

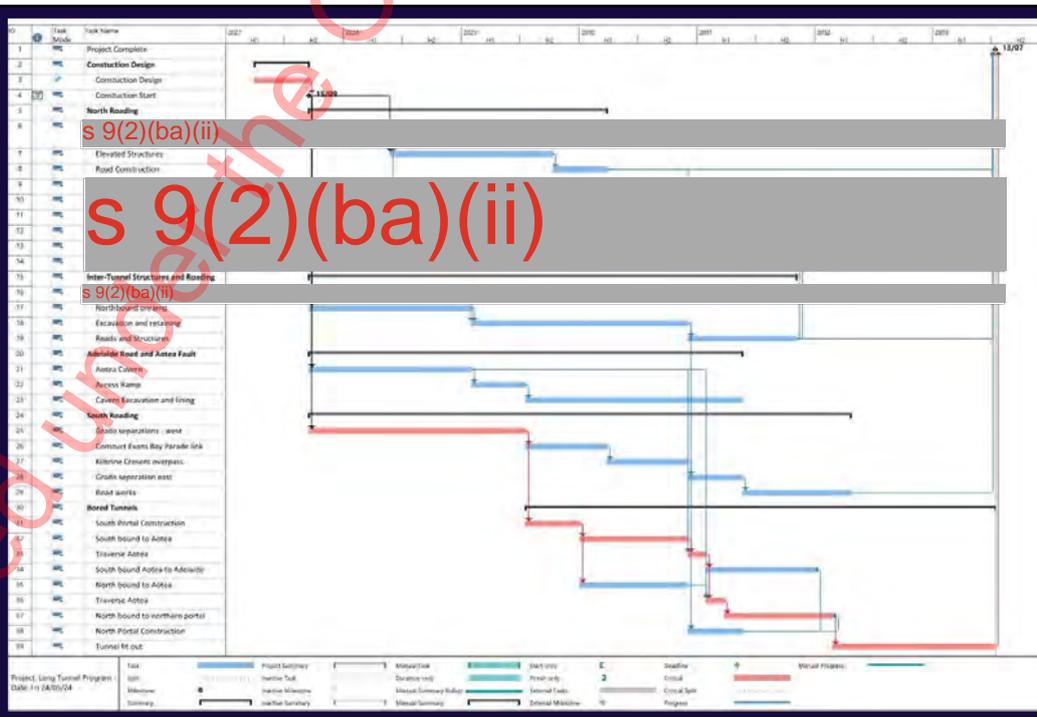


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Long Tunnel Programme

No Adelaide Off Ramp

(Only 4 month reduction in overall programme)



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Long Tunnel

Northern Interchange

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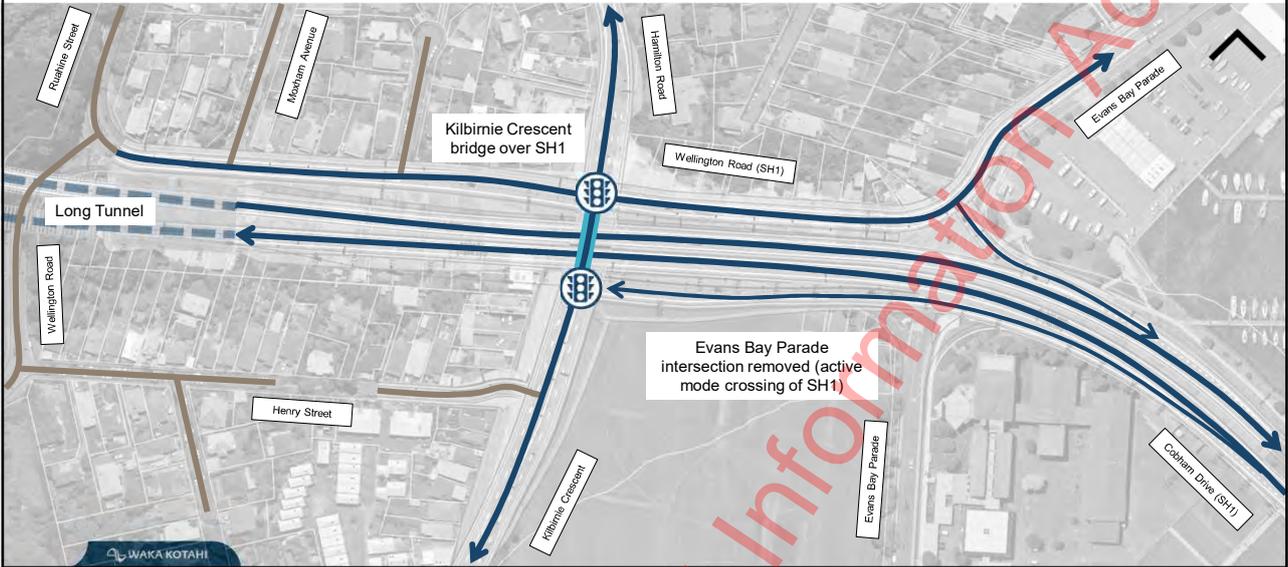
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Long Tunnel
Kilbirnie Interchange

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LT01 – Long Tunnel

Kilbirnie Interchange



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LT01 – Long Tunnel. Construction Phases

Kilbirnie Interchange – Phase 0 Existing Demolition



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LT01 – Long Tunnel. Construction Phases

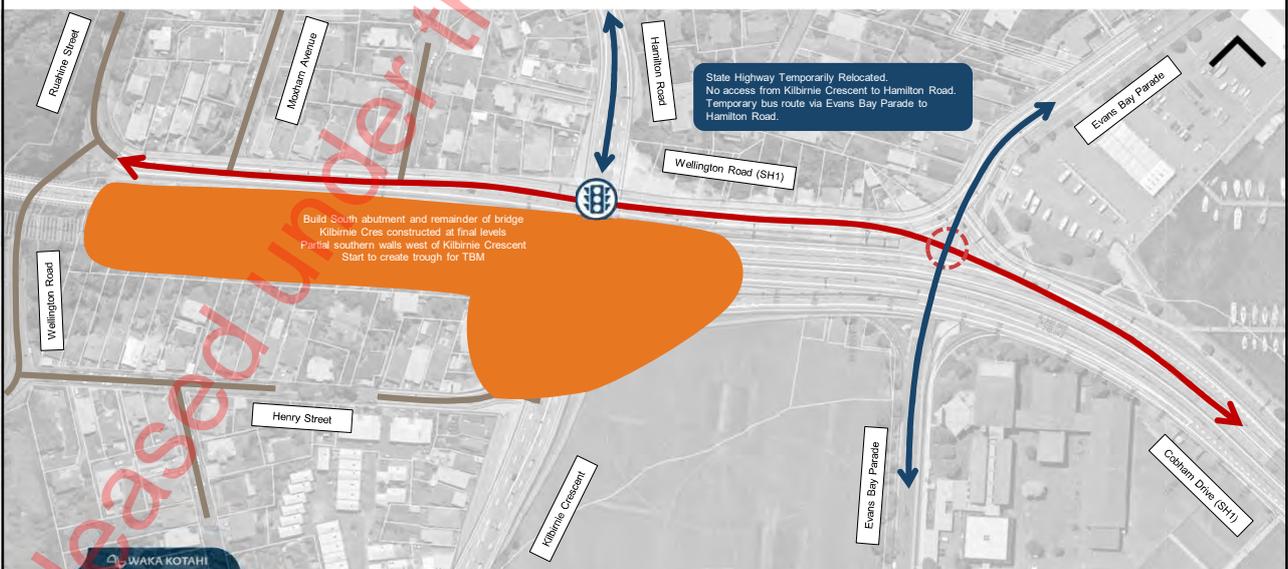
Kilbirnie Interchange – Phase 1 Construct North Facing T



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LT01 – Long Tunnel. Construction Phases

Kilbirnie Interchange – Phase 2 Construct South Facing T

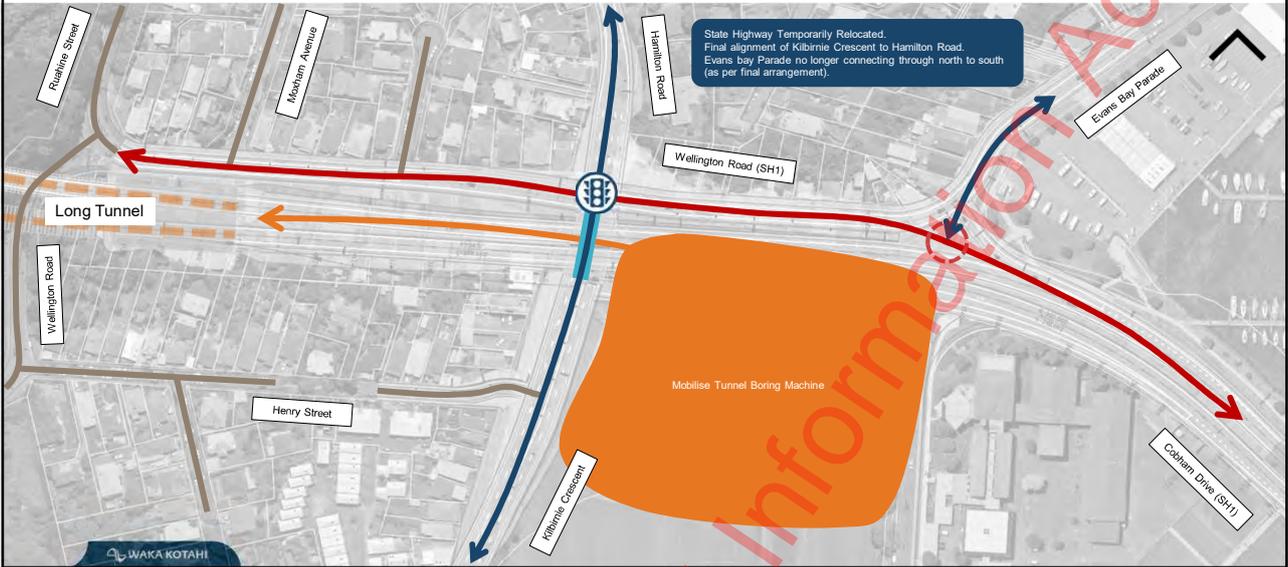


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LT01 – Long Tunnel. Construction Phases

Kilbirnie Interchange – Phase 3 Tunnel Construction



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LT01 – Long Tunnel. Construction Phases

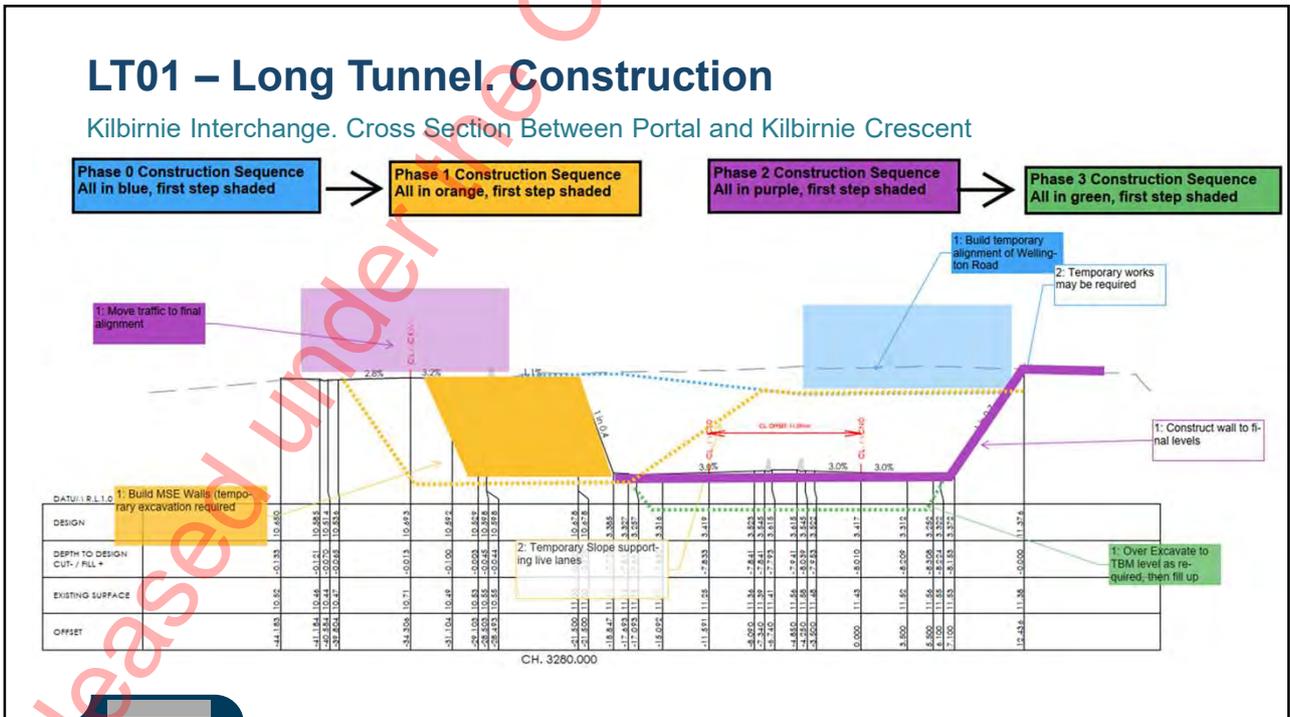
Kilbirnie Interchange – Phase 4 Complete Tie Ins



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LT02B – Long Tunnel

Adelaide Road Southbound Off-ramp



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LT02B – Long Tunnel

Adelaide Road Southbound Off-ramp

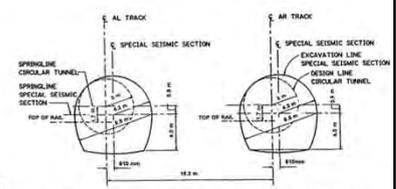


Figure B. LA Metro Rail Line - Show/Hide Zone Equi-Crossing Colors (Rev02) et al. 1/2011



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