WAKA KOTAHI
NZ TRANSPORT AGENCY

PAPAKURA TO BOMBAY STAGE 2

DESIGN CONSTRUCTION REPORT

Reference: 506207-0590-REP-NN-0191
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New Zealand Government

More information

NZ Transport Agency
xxx 2022

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Document Control

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Abbreviations

Abbreviation	Term
AEE	Assessment of Effects on the Environment
AEP	Annual Exceedance Probability
ARI	Annual Recurrence Interval
AUP:OPOP	Auckland Unitary Plan (Operative in Part 2016)
BPO	Best Practicable Option
CEMP	Construction Environment Management Plan
Ch	Chainage

CNVMP	Construction Noise and Vibration Management Plan
CTMP	Construction Traffic Management Plan
CVA	Cultural Values Assessment
EIMP	Electricity Infrastructure Management Plan
ESCP	Erosion Sediment Control Plan
km	Kilometres
LVA	Landscape and Visual Assessment
m	Metres
Manager	The Manager – Resource Consents, of Auckland Council, or authorised delegate.
NoR	Notice of Requirement
NoR 1	Alteration to the SH1 Designation 6706
NoR 2	Alteration to the SH1 Designation 6700
NoR 3	Alteration to the SH1 Designation 6701
NoR 4	Shared User Path between Quarry Road and Bombay Interchange
NoR 5	Drury South Interchange Connections
NUMP	Network Utilities Management Plan
NUO	Network Utility Operator
NZTA	NZ Transport Agency Waka Kotahi
P2B	SH1 Upgrades Project between Papakura to Bombay
RMA	Resource Management Act 1991
SGA	Supporting Growth Alliance
SH1	State Highway 1 Motorway, the Southern Motorway
Southern IIG	Southern Iwi Integration Group
SUP	Shared Use Path

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
the Project	Stages 2 of the P2B Project between Papakura to Bombay
Project Area	Area of land that is within the proposed designation boundary.

1 INTRODUCTION

This Report (Report) has been prepared as an appendix to the Assessment of Effects on the Environment (AEE) for five Notices of Requirement (NoR) being sought by NZ Transport Agency NZTA (referred herein as 'NZTA') under the Resource Management Act 1991 (RMA), for Stage 2 of the Papakura to Bombay Project (P2B), 'the Project'.

1.1 Purpose and Scope of this Report

This Report describes the indicative design, construction, and operation of the Project in order to provide a clear understanding of the Project components. This information will in turn assist in understanding the scale of the potential adverse effects on the environment as a result of the Project. This Report should be read alongside the AEE (**Appendix A**), which contains further details on the history and context of the Project.

1.2 Papakura to Bombay Project

The P2B is a NZTA led project to improve the transport capacity and functionality of the State Highway network and provide for long term growth in the South of Auckland. An indicative location plan of the P2B area is illustrated in **Error! Reference source not found.** (below).

For clarity and by way of summary we note that:

- The previous stages of the P2B, were approved under the Covid 19 Recovery (Fast Track Consenting) Act 2020 (FTA), as part of the Papakura to Drury South project (P2DS), this includes: Stage 1B1 and Stage 1B2; and,
- Stage 1B1 of the P2DS, was approved by the Expert Consenting Panel (EPA) in November 2022, Stage 1B2 was approved by the EPA in July 2023, both applications altered the existing SH1 Designation 6706 (Takanini to Drury Interchange), which is the subject of NoR 1.

SH1 Papakura to Bombay project

October 2023

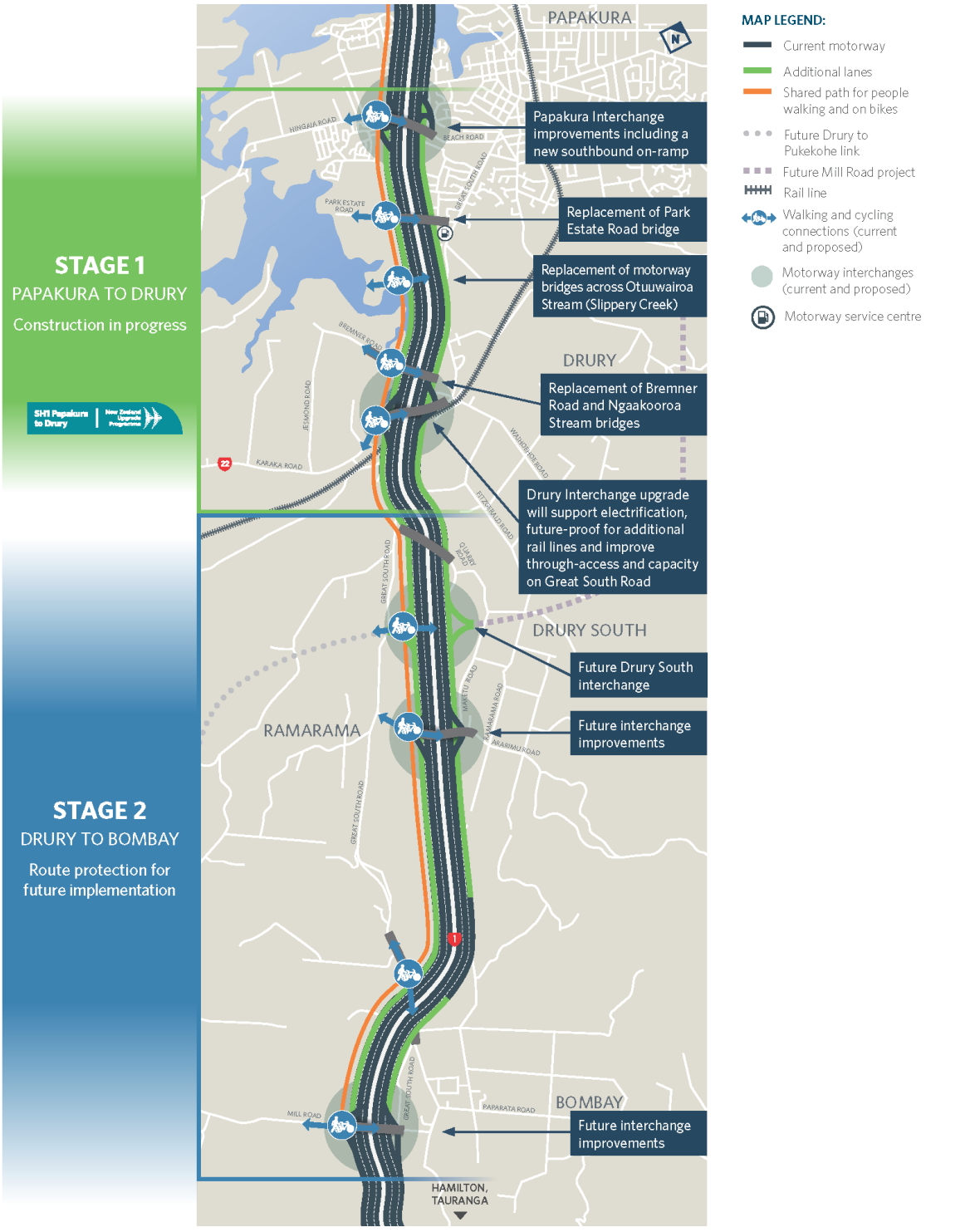

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Figure 1-1 Indicative location plan showing Stage 2 of the NZTA P2B Project

1.3 Stage 2

NZTA is seeking five NoRs for Stage 2 of the P2B, which are summarised in Table 1-1 (below).

For clarity and by way of summary we note that:

- The Project area, which was formally known as Stages 2 and 3 under the P2B, is now to be referred to as a single stage for route protection, this is referred herein as 'the Project'; and
- Stage 2 incorporates the remaining portion of the P2B Project area south of Quarry Road to the existing Bombay/Mill Road Interchange.
- The purpose of Stage 2 is to protect land and authorise aspects of the construction for the future upgrades of the SH1 corridor, including but not limited to the following works:
  - New interchange constructed at Drury South (one additional motorway lane in both directions of the proposed interchange);
  - Upgrades to existing Bombay Interchange (one additional motorway lane in each direction);
  - Upgrades to Ramarama Interchange (one additional motorway lane in each direction);
  - Continuation of a Shared User Path (SUP) from Quarry Road to Bombay Interchange; and,
  - Stormwater management devices.

Table 1-1: Stage 2 P2B Summary of the Project Notices

Notice	Project	Designation Purpose	Project Objectives	Extent	Lapse Period
NoR 1	Alteration to SH1 Designation 6706	Motorway between Takanini and Hamilton	▪ Improve the safety and resilience of the SH1 network between Papakura and Bombay. ▪ Increase transport choice and accessibility to support growth in the south of Auckland. ▪ Support national and regional economic growth and productivity; and, ▪ Support the inter and intra-regional movement of people and freight.	SH1 CH 15160 to CH 15500 State Highway 1 from north of Takanini Interchange to south of Quarry Road, Drury	No Lapse Period
NoR 2	Alteration to SH1 Designation 6700	Motorway		SH1 CH 15500 to CH 22740 State Highway 1 from south of Quarry Road, Drury to Bombay Road, Bombay	
NoR 3	Alteration to SH1 Designation 6701	Motorway		SH1 CH 22740 to CH 24600 State Highway 1 from Bombay Road to Mill Road, Bombay	
NoR 4	Shared User Path	For the construction, operation and maintenance of a shared path and associated infrastructure		SH1 CH 15160 to CH 24580 State Highway 1 from Quarry Road, Drury to Bombay Interchange/Mill Road.	20 years
NoR 5	Drury South Interchange Connections	For the construction, operation, and maintenance of a State Highway		CH 300 to CH 1750 Adjacent State Highway 1 at Drury South Interchange, linking to Quarry Road to the east, and Great South Road to the west.	20 years

2 PROJECT CONSTRAINTS

The Project considerations include physical constraints which predominantly affect the development of the design solution, and time constraints which may impact the anticipated construction staging and methodology.

2.1 Physical Constraints

The Project physical constraints are summarised as follows:

- Maintaining two lanes of traffic, both southbound and northbound, operational during construction;
- Working in close proximity to the Transpower infrastructure (including overhead lines, pylons and station);
- Avoid undertaking works within Bishop Selwyn Cairn (AUP:OPOP Historic Heritage Extent of Place);
- Crossing an existing flood plain to the west of the motorway (adjacent to proposed Drury South interchange);
- Maintaining continuity of existing utility services during construction; and,
- Tying into the Stage 1B1 works at Drury Interchange, and Supporting Growth Projects at Mill Road and Great South Road.

2.2 Time Constraints

The Project is a route protection exercise with no established funding for construction at the time of writing this Report. Based on the staged delivery of the P2B, construction of Stage 2 is expected to occur within a 15-20 year timeframe.

3 APPROACH TO DESIGN

The design of the Project has focused on developing an indicative design that is sufficient to inform the proposed NoR footprints and to assess an envelope of effects whilst recognising the need for flexibility required due to the uncertainty of the future urban environment.

The proposed design is included for information in the drawings contained at **Appendix B** of the AEE (**Appendix A**) supporting NZTA's application for the Project NoRs:

- Designation Plans: 506207-0530-DRG-NN- Sheet 5201 to 5241.

These have informed the proposed NoR footprint and include ancillary components, such as construction areas and stormwater requirements. The detailed design will be undertaken before construction and an Outline Plan or Plans (as the Outline Plans may be staged to reflect Project phases or construction sequencing) will be submitted to Council as set out in s176A of the RMA. Resource consents will also need to be applied for in the future.

It is understood that the final design of the Project (including the design and location of associated works including bridges, culverts, stormwater management systems, soil disposal sites, signage, lighting at interchanges, landscaping, realignment of access points to local roads, and maintenance facilities), will be refined and confirmed at the detailed design stage.

3.1 Geometry

3.1.1 Alteration to the State Highway 1 Corridor

Both capacity and safety improvements are proposed along the SH1 corridor. Widening from four to six lanes is proposed from Quarry Road to Bombay Interchange. Safety improvements, namely: upgraded interchanges, wider shoulders, new barriers and improved lighting are proposed along the full extent of the Project.

3.1.2 Shared User Path

The Project will continue a 3.0 m wide SUP from the P2DS project south from Drury Interchange to the existing Bombay/Mill Road Interchange. This SUP is to be located on the western side of the motorway and will require a new designation between the Drury and Bombay interchanges, which in some locations overlaps NoR 1-3.

Refer to Figure 3-1 below for a typical section of SH1showing the SUP on the western side of the road.

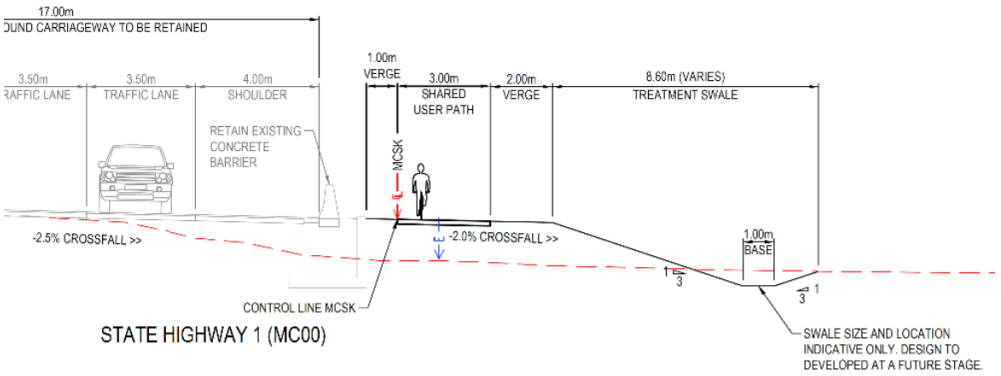

Figure 3-1: Typical cross section of State Highway 1 with a Shared Use Path on the western side

3.1.3 Drury South Interchange

A new dumbbell interchange design is proposed at Drury South, linking the SH1 with Maketu Road to the east, and the proposed Pukekohe arterial to the west. The interchange will feature direct on/off ramps, designed with Level of

Service (LOS) D or higher, and be situated ~2800m south of Drury Interchange and ~2000m north of Ramarama Interchange. Grade separated shared use paths (beneath the interchange roundabouts) have been provided.

3.1.4 Drury South Interchange Connections

As outlined above link roads to the adjacent network (Maketu Road and proposed Pukekohe arterial) are proposed either side of and crossing over the Drury South interchange. These connections are proposed to have four traffic lanes, and cycle lanes and footpaths either side.

3.1.5 Ramarama Interchange

3.1.5.1 Existing Situation

The western side of Ramarama Interchange provides for a single 3.5m traffic lane in each direction with a right turning slip lane for at the interchange ramp. There are existing access ramps in each direction of the motorway corridor (Figure 3-2).

The eastern side of Ramarama Interchange provides has a large 5 leg roundabout connecting the existing access ramps in each direction to the local road network.

There is currently limited active mode facilities existing at Ramarama Interchange. There is a footpath on Ararimu over-bridge, but there is no connection between the footpath and surrounding local road network. Currently pedestrians and cyclists are expected to informally cross the existing motorway on/off ramps to access local road network.

Figure 3-2: Existing layout of Ramarama Interchange (Google, 2023)

3.1.5.2 Proposed Works at the Ramarama Interchange

The Project will upgrade the eastern extent of the interchange to incorporate a roundabout accessing the motorway ramps, while the western intersection with on and off ramps will be largely maintained.

The existing Ararimu Road over-bridge will be replaced, with a new over-bridge to be constructed offline from the SH1, allowing the interchange to operate during construction. The upgraded interchange will include enhancements to active mode facilities.

3.1.6 Bombay Interchange

3.1.6.1 Existing Situation

The Bombay interchange currently includes north and south bound off ramps and a northbound on ramp. There is an existing southbound on ramp that is provided from Great South Road further to the south (Figure 3-3). The existing overbridge accommodates a single lane in each direction, with a median turning lane. Narrow substandard footpaths are provided on each side.

Figure 3-3: Existing layout of Bombay Interchange (Google, 2023)

3.1.6.2 Proposed Works

The proposed interchange includes signalised intersections to connect on and off ramps with four through lanes and shared use paths either side across the bridge. The widened bridge is proposed to be built to the north of the existing bridge.

3.2 Stormwater Design and Management

As regional resource consents are not being sought at this stage, the stormwater design approach for the Project has focussed on identifying an indicative and feasible treatment methodology and proposed designation footprint required for appropriate stormwater management. The design of specific stormwater treatment features will be further developed at the future detailed design stage for each Project and regional resource consents sought at that time.

The indicative stormwater design and associated designation footprint has been developed taking into account existing stormwater infrastructure and stormwater management requirements, as well as future stormwater discharge and diversion, stormwater runoff quality, and flood hazard requirements. The AUP:OP and other industry standards,

regulations and guidelines have been used to direct the indicative stormwater management footprint as described in the sections below.

3.2.1 Stormwater Quality

The proposed designation footprints have allowed for indicative stormwater quality treatment in accordance with Auckland Council Guideline GD01 for all existing and proposed impervious areas, except where a Project only consists of a pedestrian or cycle path. Generally, the indicative designs adopt treatment swales or wetlands, depending on which best fits the local conditions and topography. These devices have been selected on the basis that they are proven good practice, green infrastructure methods well suited to road corridors and the contaminants generated within them.

3.2.1.1 Stormwater Wetlands

Stormwater wetlands are proposed in four locations within the Project. One at the southwestern corner of the NoR 5 at the intersection with Great South Road, a second at the northeastern corner of NoR 5 at the intersection with Quarry Road, a third St Stephen's School (1832 Great South Road) approximately Chainage 22900, and forth located near Bombay Interchange.

The design has adopted the use of stormwater wetlands where swales are not sufficient to mitigate stormwater volume increases and/or provide the intended water quality treatment. The wetlands have been sized to store the difference between pre- and post-development flood volumes from the roads. Indicative locations for wetlands were identified where topography was considered appropriate and where they were needed as part of the state highway stormwater management system. Confirmation of the use stormwater wetlands will be decided through the detailed design phase of the Project.

3.2.2 Stormwater Quantity

3.2.2.1 Hydrological mitigation

With awareness that flooding issues exist in both the lower Ngaakooroa and Hingaia catchments, the Project has made an allowance for hydrological mitigation as to not increase discharge flowrates resulting from the increase of impervious areas.

3.2.2.2 Flooding

Where required, hydrological mitigation will be provided to match pre-Project peak flows to post-Project peak flows, due to the increase in impervious areas, for either or both the 10- and 100-rainfall events has been provided.

Resilience to flooding was applied through:

- Setting the corridor vertical alignment above the 100-year ARI flood plain where practicable; and
- Providing freeboard to bridges in accordance with the NZTA Bridge Manual requirements.

3.2.3 Stream Crossings

All existing streams and stream crossings will be maintained through either culverts or bridges. Bridges and culverts are proposed within the indicative design where appropriate to manage environmental effects. However, the final form of stream crossings with consideration to upstream ponding, erosion protection and fish passage will be confirmed during the future detailed design and resource consenting phase.

3.3 Structures

The subsections provided below outline the proposed bridge structures that form part of Papakura to Bombay – Stage 2. The structural extents and characteristics provided below are high-level and provided for information only – optimisation of these components will take place during the detailed design phase.

3.3.1 Drury South Interchange Connection Link over Hingaia Stream Flood Plain

The newly proposed Drury South Interchange Connection Link bridge over the Hingaia Stream flood plain is shown in Figure 3-4 (below). The proposed structural form and associated characteristics of the bridge structure are shown in Table 3-1 (below). The required length of the proposed bridge structure is dictated by the extents of the Hingaia Stream flood plain including the gas line located below span 1 as shown in Figure 3-4 (below). It is worth noting geotechnical conditions are recognized as being poor, likely resulting in extensive pile lengths to reach adequate load carrying capacity strata layers. The Flood Impact Assessment attached at **Appendix J** of the application AEE, has recommended that bridge deck is constructed above the 1% AEP flood level.

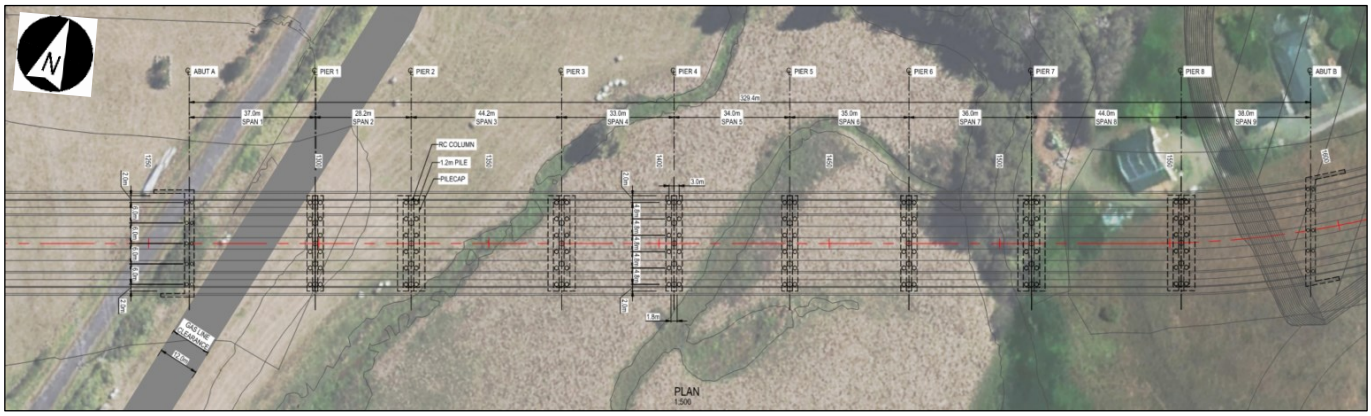

Figure 3-4: Drury South Interchange Connection Link – Plan View

Table 3-1: Drury South Interchange Connection Link – Characteristics

COMPONENT	DESCRIPTION
Number of traffic lanes	2no. lanes per carriageway (4no. in total)
Number of footpaths / cycleways / shared use paths	2no. cycleways (1no. per carriageway) 2no. footpaths (1no. per carriageway)
Deck width	~30m
Skew	~10° (Abutment B only)
Number of spans	9
Length	~330m
Superstructure form	Prestressed super-T girders
Abutment form	Reinforced concrete headstock
Pier form	Reinforced concrete headstock (with/without table pier head)
Abutment foundation type	Reinforced concrete piles
Pier foundation type	Reinforced concrete pile caps and piles

3.3.2 Drury South Interchange Bridge over SH1

The newly proposed Drury South Interchange Bridge over State Highway 1 is shown in Figure 3-5 (below). The proposed structural form and associated characteristics of the bridge structure are shown in Table 3-2 (below). With reference to Figure 3-5 (below), multiple box type culvert underpass structures will be required, each side of the main bridge structure, to facilitate for pedestrian movements below the trafficable roundabout lanes.

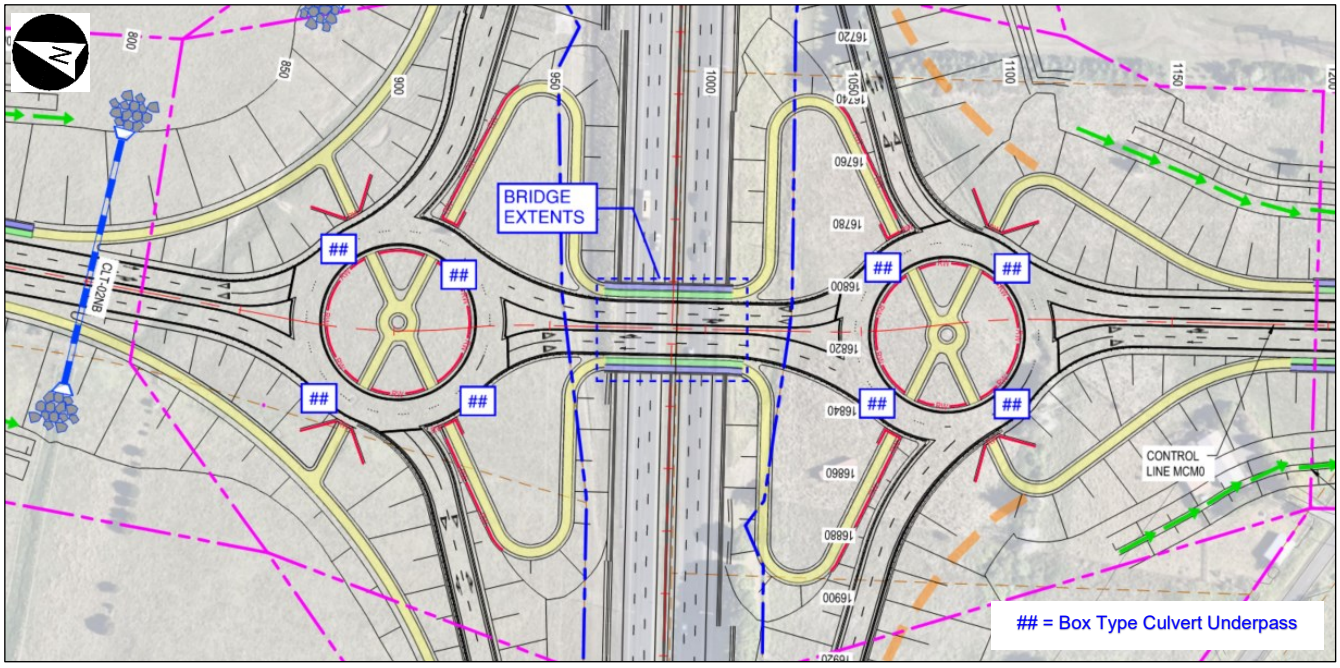

Figure 3-5: Drury Road South Interchange – Plan View

Table 3-2: Drury Road South Interchange Bridge – Characteristics

COMPONENT	DESCRIPTION
Number of traffic lanes	2no. lanes per carriageway (4no. in total)
Number of footpaths / cycleways / shared use paths	2no. cycleways (1no. per carriageway) 2no. footpaths (1no. per carriageway)
Deck width	~30m
Skew	None
Number of spans	2
Length	~55m
Superstructure form	Prestressed super-T girders
Abutment form	Reinforced concrete headstock
Pier form	Reinforced concrete headstock
Abutment foundation type	Reinforced concrete piles
Pier foundation type	Reinforced concrete pile-columns

3.3.3 Mill Road Bridge over SH1

The proposed Mill Road Bridge replacement over SH1 is shown in Figure 3-6 (below). The proposed structural form and associated characteristics of the bridge structure are shown in Table 3-3 (below).

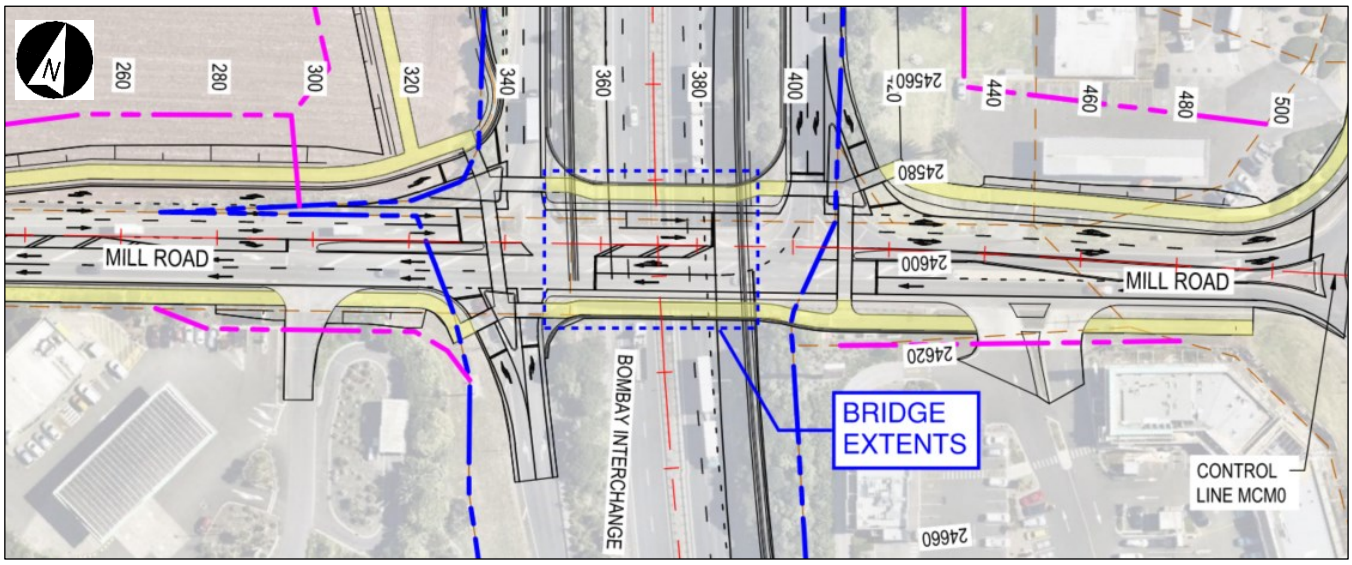

Figure 3-6: Mill Road Bridge – Plan View

Table 3-3: Mill Road Bridge – Characteristics

COMPONENT	DESCRIPTION
Number of traffic lanes	2no. lanes per carriageway (4no. in total)
Number of footpaths / cycleways / shared use paths	2no. cycleways (1no. per carriageway) 2no. footpaths (1no. per carriageway)
Deck width	~28.2m
Skew	None
Number of spans	2
Length	~55m
Superstructure form	Prestressed super-T girders
Abutment form	Reinforced concrete headstock
Pier form	Reinforced concrete headstock
Abutment foundation type	Reinforced concrete piles
Pier foundation type	Reinforced concrete pile-columns

3.3.4 Ararimu / Maketu Road Bridge over SH1

The newly proposed Ararimu / Maketu Road Bridge replacement over SH1 is shown in Figure 3-7 (below). The proposed structural form and associated characteristics of the bridge structure are shown in Table 3-4 (below). With reference to Figure 3-7 (below), multiple box type culvert underpass structures will be required to facilitate for pedestrian movements below the proposed on/off-ramp lanes.

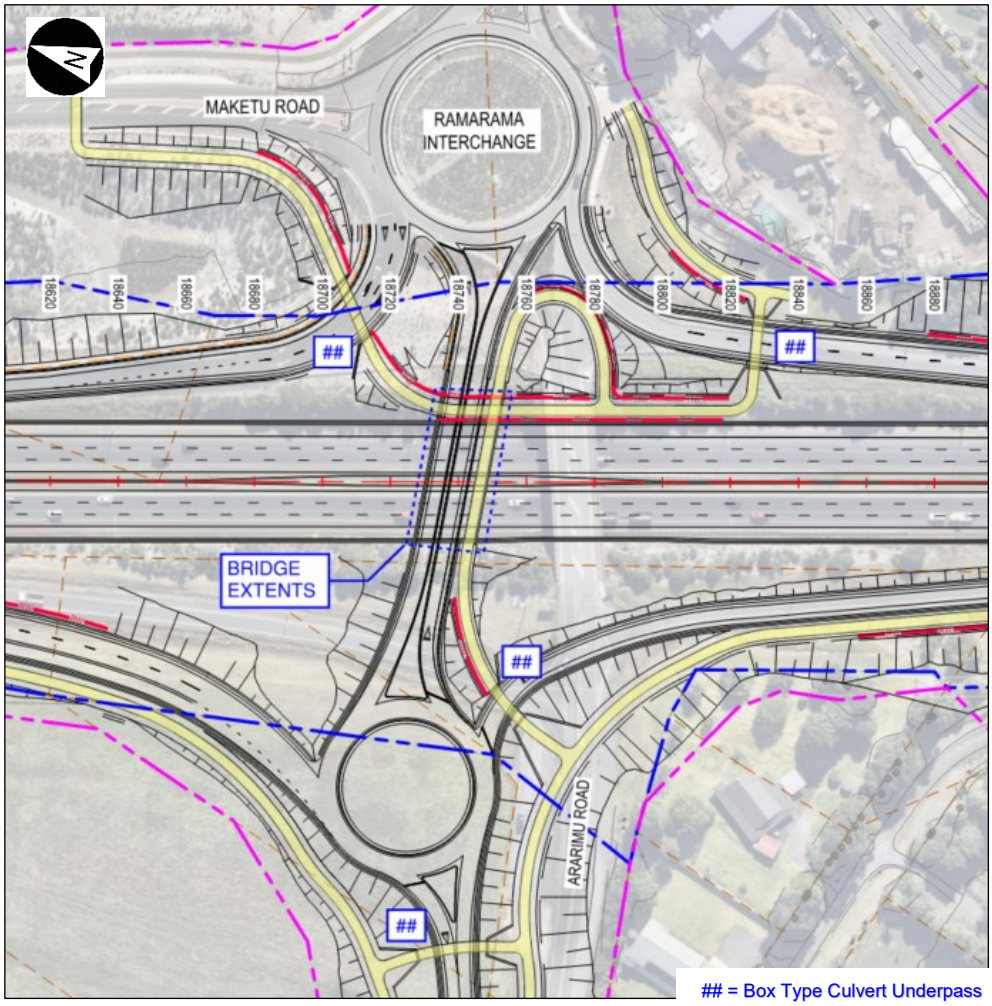

Figure 3-7: Ararimu Road Bridge - Plan View

Table 3-4: Ararimu Road Bridge – Characteristics

COMPONENT	DESCRIPTION
Number of traffic lanes	2no. traffic lanes
Number of footpaths / cycleways / shared use paths	1no. shared use path
Deck width	~17m
Skew	~10°
Number of spans	2
Length	~60m
Superstructure form	Prestressed super-T girders
Abutment form	Reinforced concrete headstock
Pier form	Reinforced concrete headstock
Abutment foundation type	Reinforced concrete piles
Pier foundation type	Reinforced concrete pile-columns

3.3.5 SH1 overbridge Great South Road – Widening

The newly proposed SH1 overbridge Great South Road widened structure is shown in Figure 3-8 (below). The proposed structural form and associated characteristics of the widened bridge structure are shown in Table 3-5 (below). The widened southbound structure facilitates for the provision of an additional southbound traffic lane as well as a Shared Use Path accommodating for various modes of pedestrian transport.

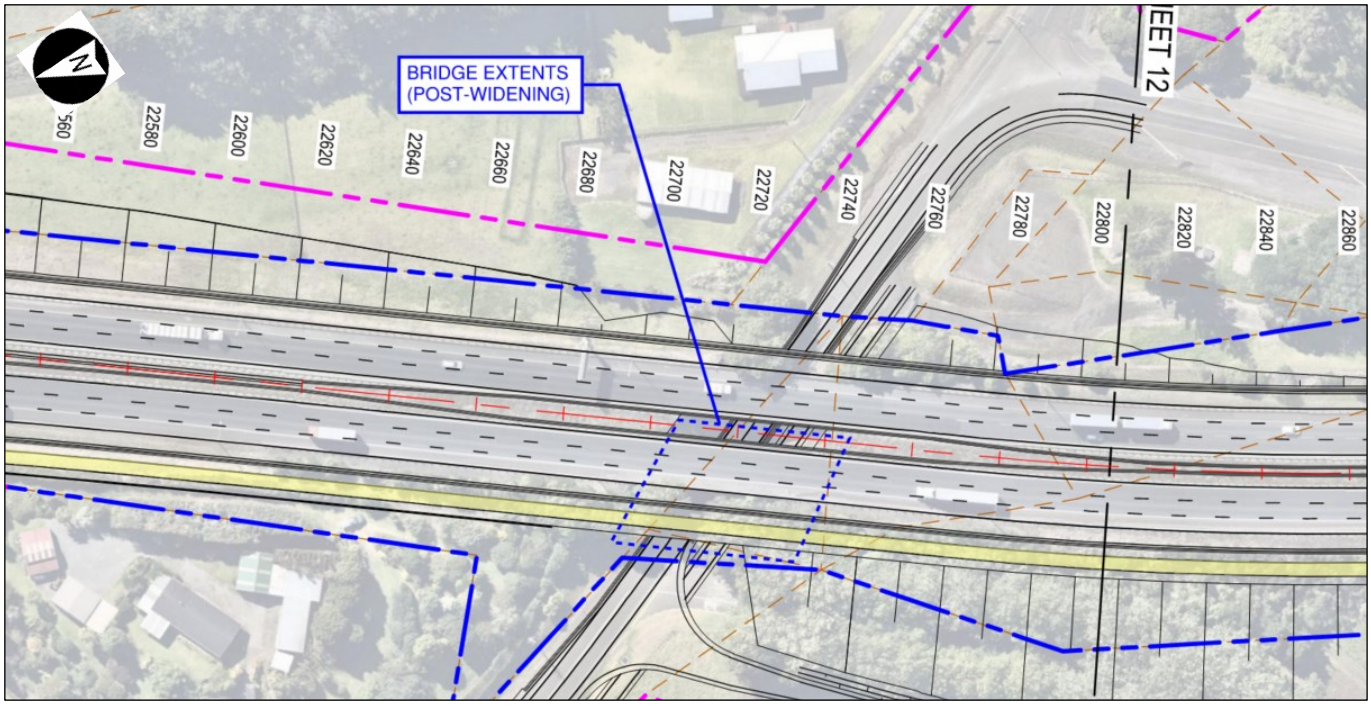

Figure 3-8: SH1 overbridge Great South Road (Widening) – Plan View

Table 3-5: SH1 overbridge Great South Road (Widening) – Widened Bridge Characteristics

COMPONENT	DESCRIPTION
Number of traffic lanes	3no. southbound lanes
Number of footpaths / cycleways / shared use paths	1no. shared use path
Deck width	~20-25m
Skew	~20-30°
Number of spans	TBC at detailed design
Length	~30-35m
Superstructure form	Prestressed super-T girders
Abutment form	Reinforced concrete headstock
Pier form	Reinforced concrete headstock
Abutment foundation type	Reinforced concrete piles
Pier foundation type	Reinforced concrete pile-columns

3.4 Utility Services

A number of Network Utility Operators (NUOs) are being consulted to discuss the potential impacts of the proposed works on the existing utilities and any future works they have planned in the area, which are identified in Table 3-6 (below). The consultations with NUOs will be on-going throughout the design development.

Table 3-6: Network Utilities engaged with to identify existing and proposed assets

Organisation	Utility Type
Transpower	Pylons and Overhead Transmission Lines
Watercare	Wastewater pipelines, Watermains and Fibre Optic Cables
Counties Energy	Electricity Lines and Fibre Optic Cables
Vector Gas	Gas Transmission Lines
First Gas	Gas Transmission Lines
Chorus	Communication Cables
Spark	Cell Tower and Communications cables
2 degrees / Vocus	Communications Cable
One NZ	Communications Cable
Veolia	Watermains and Wastewater pipelines
Tuatahi First Fibre	Communications Cable

As part of the initial engagements with the NUOs, a number of critical existing assets were identified that may be impacted by the design, including:

- Transpower overhead pylons approaching the existing substation located immediately north east of the proposed Drury South interchange.
- A number of Vector Gas and First Gas pipelines that fall within the proposed designation boundary
- Counties Energy have identified the construction of a Counties Energy Zone Substation at 201 Quarry Road.
- Counties Energy also highlighted that they have a number of overhead lines in this area that may require relocation depending on the proposed road alignment.

The construction methodology as it relates to works around NUOs is discussed in Section 4.7 below. Further details regarding the consultation undertaken with, and assessment of the potential adverse effects on NUOs as a result of the Project are discussed in further detail in the application AEE, Sections 9 and 10, at **Appendix A**.

3.5 Lighting

3.5.1 Lighting Design

It is proposed that the existing lighting columns and luminaries be upgraded, replaced and/or relocated as required to comply with NZTA M30: 2014 for the new road layout.

Road lighting will be designed to comply with following category of AS/NZS 1158.1.1:2005 Lighting for Roads, as shown in Table 3-7 (below).

Table 3-7: Road Lighting Category

Road Type	Lighting Category
SH1 Motorway	V2
Local Roads	V3
Shared Path (where separate lighting is required)	P3

3.5.2 Lighting Columns

The preferred location of lighting columns on the motorway is within the central median on the median barrier. In addition to this, the below design philosophy will be used for lighting columns:

- Any lighting columns located behind a barrier but within the working width shall be of a frangible design, shear base lighting columns are not to be used in these locations.
- All lighting columns in locations where operating speeds of >60 and <80km/h are expected shall be barrier protected.
- Any unprotected lighting columns used on a carriageway with a design speed ≥80km/h are to be of a shear base design.
- Any unprotected lighting columns used on a carriageway with a design speed ≤60km/h are to be of a frangible design and not shear base.

4 CONSTRUCTION METHODOLOGY

4.1 Overview

An indicative construction methodology has been developed for the Project and has been used to inform the proposed designation footprints, assess potential effects on the environment, and to identify measures to avoid, remedy or mitigate those effects, as appropriate and relevant to the NoRs.

The indicative construction methodology has been developed based on the concept design and current land use/landform in which the Project is located. However, it is noted that the actual construction methodology will need to be confirmed through the detailed design phase, and will consider, measures required to mitigate construction effects as required by the designation and any resource consent conditions. Importantly, timing of implementation of the Project will dictate what level of mitigation is required given development present along the corridors at the time and will inform the final constructionmethodology. As such, NZTA is seeking flexibility in each of the NoRs construction methods to accommodate these factors and retain opportunities to reduce the impact and duration of adverse construction effects at delivery.

A condition requiring a Construction Environmental Management Plan (CEMP) is therefore proposed for each NoR.

4.2 Sequencing of Main Construction Works

The programme assumes a generally staged construction process, with exact staging to be determined at detailed design. The construction sequence for works with the Project Areas are outlined below:

- Enabling works, including site investigation and service relocation;
- Site establishments for main contractor;
- Establish traffic management to enable access and establish construction areas;
- Earthworks, establishment of environmental controls, topsoil stripping and cut to fill activities;
- Structures work, including bridges, retaining walls and culverts;
- Network drainage;
- Pavement construction; and
- Finishing works, including line marking, landscaping and disestablishment.

4.3 Identification of land required for construction works

Typical areas required for construction have been identified and applied to the Project. These have informed the extents of the Project and proposed designation boundaries. Refer to drawings in **Appendix B** for the location and application of construction elements. The typical construction area requirements are summarised in Table 4-1 (below).

Table 4-1 Summary of land requirements for construction works

Construction element	Description of typical construction areas
Construction of batter slopes	For larger earthworks areas, the construction areas will differ significantly to account for the larger plant and equipment likely to be used, construction methodology and temporary works such as haul roads and sediment retention ponds. Between 2m and 20m is required for construction access and environmental controls.

Bridge construction: • Abutments • Piers • Deck	Generally, the design has provided either a bridge or culvert to be constructed, with the form to be determined at detailed design and regional consent stage, unless identified in the AEE as necessary to address effects on the environment. For construction, 20m is required either side of the bridge, and a minimum 40m behind each abutment ends for construction access.
Retaining wall construction	Retaining structures are generally located near the project boundary to overcome overspill of earthworks batters or at the bridge abutments. Typically, retaining walls are constructed of MSE walls to contain fill embankments and piled retaining walls and soil nails to retain cut batters. The working area required to construct the retaining walls will largely depend on the design and size of the wall.
Stormwater treatment construction: • Wetlands • Swales • Overland flow path • Culvert headwalls and scour protection	Stormwater treatment may consist of stormwater drains discharging to stormwater wetlands. The size of the working area will vary depending on the size of culvert being installed, the topography of the area, and volume of water being diverted. Works on the new culvert construction may require flow diversion or over pumping. Further investigations will be required to confirm the flow volumes and ecological requirements for the diversions. Regional consents (including for earthworks and stream works) will be sought in the future before construction commences.
Temporary Works: • Sediment retention ponds • Haul roads and construction access roads	Surface water running through the earthwork sites will need to be treated prior to discharge. The typical method for doing this is to contain the water from the earthworks areas and channel it into temporary sediment retention ponds. Locating the ponds at the low point of the zones and outside of the permanent works area is ideal so it can be operational and maintained throughout the construction works. Where possible temporary and permanent ponds have been co-located, so that at the end of construction the pond can be reinstated as a permanent device. Haul roads are typically required for large earthworks projects for the movement of people, plant and materials along the proposed alignment. These haul roads provide access and connectivity to critical work sites such as the culverts, bridge sites, and main cut and fill sites. These are best constructed outside the earthwork's extent to avoid clashes with the permanent works.
Site Facilities: • Main site compound (project office) • Additional/satellite site compound • Construction yards for laydown/stockpile • Construction yards for intersection works	Site compounds and laydown areas are required to support construction along the proposed corridor alignments. The proposed compound site locations identified for each NoR enable easy access to key construction zones and arterial routes. The use of these compounds will only be required during the construction period and will be reinstated upon completion of the works. The space required is dependent on the scale of the project and the nature of the intersection (e.g. rural vs urban).
Reconnecting property access: • Service lanes • Access roads / driveways	Vehicle access will be provided to private properties during construction and reinstated after works where required. However, there may be temporary disruptions to access. Where this is proposed, it will be discussed in advance with the affected user/owner. As required, accesses are designated to enable reintegration to the permanent corridor. Where it has been determined that legal safe access cannot be reinstated after construction (e.g., due to gradient, angle, proximity), the property in its entirety is included in the proposed designation. 4 – 6m is required to provide for reconnecting property access.

4.4 Structures

Large bridge structures will typically require piling rigs and cranes on site. The following typical construction sequence is anticipated for bridges:

- Stage 1: Construct pile foundations, MSE wall and piers.
- Stage 2: Construct abutments and pier headstocks up to bridge beam bearing level.
- Stage 3: Install beam bearings, erect precast bridge beams and cast pier headstocks above bearing level.
- Stage 4: Erect precast barriers, cast deck slab, cast abutment backwall.
- Stage 5: Construct settlement slabs, construct road pavement above settlement slab, complete surfacing on bridge and finishing works.

Special attention will also be required for construction activities, such as piling, near overhead power lines and sensitive environmental areas. The erection of the bridge beams is likely to be undertaken during night-time under closures.

4.5 Environment and Stakeholder Management

Potential adverse effects from construction activities will be managed through the implementation of a suite of management plans or plans (where required to manage adverse effects of each NoR) including:

- Cultural Monitoring Plan
- Construction Environmental Management Plan (CEMP)
- Stakeholder and Communication Management Plan (SCMP)
- Network Utilities Management Plan (NUMP)
- Construction Noise and Vibration Management Plan (CNVMP)
- Construction Traffic Management Plan (CTMP)
- Urban and Landscape Design Management Plan (ULDMP)
- Historic Heritage Management Plan (HHMP)
- Ecological Management Plan(s)
- Tree Management Plan (TMP)

The management of any potential or actual effects rising from construction activities that relate to resource consenting matters will be provided for when these consents are sought.

4.5.1.1 Sediment Control

An Erosion and Sediment Control Plan will be prepared by the contractor as part of future applications for resource consent. During construction, surface water will be managed in accordance with the applicable resource consent conditions and Auckland Council Erosion and Sediment Control Guidelines.

While subject to detailed design and resource consents, it is anticipated the Project sites will be managed through standard sediment control measures including, but not limited to:

- Silt fences, including around pond and lower batter of earthworks.
- Clean and dirty water diversion bunds.
- Sediment retention ponds and decanting systems.
- Flocculant chemicals.

- Stabilisation measures, mulching, grass seeding.
- Wheel wash station for trucks carting spoil.
- Stormwater diversion to minimise overland flows on earthworks.

4.6 Temporary Traffic Management and Access

The Project requires works on and around the live transport corridors of SH1, Quarry, Ararimu, Great South, Bombay, and Mill Road. As a result, there will be a temporary disruption to the existing transport network operations running along these corridors.

All construction works for the Project will be under temporary traffic management in accordance with the New Zealand guide to temporary traffic management (NZGTTM). The following assumptions for the operation of the temporary traffic management during construction have been made:

- Provision for two lanes of traffic in both directions on SH1 for the duration of the Project.
- Provision for full access in all directions to and from Ramarama and Bombay Interchanges for the duration of the Project.
- The speed limit on SH1 will be maintained at 100km/h whenever safe to do so. It is anticipated that speed limit reductions will be necessary for some of the construction period.
- Lane widths on SH1 may be reduced to 3.25m under temporary traffic management with closure of the shoulders.
- Provision for continued safe access for pedestrians and cyclists along local roads (Quarry, Ararimu, Great South, Bombay, and Mill Road) for the duration of the Project.

Site Access Points (SAPs) will be required to access the nominated construction zones and work areas. Each construction zone may require several access points to ensure adequate access and flexibility for the construction works. Access for construction vehicles, plant and materials will be via the designated SAPs.

The SAPs and temporary traffic management controls will be in accordance with the NZGTTM , and Temporary Traffic Management Plans will be developed by the contractor for the various stages and requirements of each of the Projects construction activities.

4.7 Earthworks

Earthworks will comprise cutting and filling to achieve the proposed design alignment. Cut slopes are primarily to tie design levels into swales within the existing designation. Fill slopes are primarily to form up new traffic lanes or support the SUP, again within the existing designation.

Standard earthworks practises will be followed in accordance with the specifications and guidelines of NZTA. The general earthwork strategy will be developed in more detail by the contractor. However, the general earthwork strategy assumed for works currently is to import fill (from local quarries where possible) for all fill embankments.

Site won materials may need an area to be able to manage moisture contents via disking and air drying or through the use of cement or lime stabilisation. If previous fill materials have been lime or cement treated this disking area will also allow these materials to be broken up into workable sizes for future compaction. The contractor will therefore need to identify these opportunities and integrate them within their construction program and site access constraints.

Larger fill embankments may undergo relatively significant settlements due to the underlying softer/organic soils and therefore either ground improvements or wick drains and/or time for consolidation will need to be allowed along with a final trim/fill before placing the final pavement surfacing makeup.

Embankments will also incorporate geogrids placed within the slopes as constructed as required to ensure slope or wall stability.

4.8 Utility Services

Further engagement with Network Utility Operators will be required to determine the appropriate methods of managing Project construction on utilities. A Network Utilities Management Plan is included in the NoR conditions to ensure this engagement is managed. Construction impacts on utilities will be managed as described to follow and confirmed through the detailed design process and with engagement with NUOs.

For the affected utilities within the Project extent, the proposed design will be developed to comply with the minimum cover and clearance requirements. Where the minimum requirements are not practical to achieve, a protection methodology such as either a slab over ducts or concrete encasement will be developed in coordination with the relevant utility operator as the do-minimum option. This is to reduce disruption of the respective utility operators and their customers in accordance with the relevant utility standards.

Where it is not practical or feasible to protect utilities in-situ, then relocation of utilities will be considered. All underground utilities that require relocation works will be grouped together where possible and installed in a common service trench. The use of common service trenches will promote reduction in the services corridor during relocation which may provide economic savings during construction. The services arrangements within a common service trench will be discussed and agreed with the relevant utility operators.

Where utility relocations underneath the carriageways are required, these are proposed to be perpendicular with the road centre line. Longitudinal relocations will be generally proposed under the SUP which will be located as close to the motorway corridor boundary as possible.

Any utility works within the State Highway or Motorway and local road reserves will comply with the Utility Identification and protection minimum standard as well as the National Code for Utilities' Access to the Transport Corridors guidelines to avoid, or at least mitigate the potential adverse effects on the health and safety of people and on the surrounding environment.

In addition to above, the utility relocation works will be managed so that the installation, design, operation, maintenance and upgrade will be in compliance with the relevant standards, codes of practice or guidelines. All relocation works will take into account the relevant provisions in the Local Government Acts and Acts relevant to the statutory powers and responsibilities of NZTA and any other relevant legislation.

The utilities design for the Project will consider future proofing by prompting Utility Operators to undertake high level infrastructure assessment for future proofing their networks to meet the future developments and demands.

5 CONSTRUCTION SUPPORT AREAS

5.1 General

Construction Support Areas (CSAs) will be required for the provision of contractor and welfare facilities, plant/material storage, and earthworks stockpiling as required.

5.2 Location and Establishment

5.2.1 Location

Specific Construction Support Areas will be confirmed prior to Resource Consent and Outline Plan of Work development. These areas will be located within the proposed designations.

5.2.2 Establishment

It is envisaged that the CSAs may be established in the above locations as follows:

- All CSAs will be fully fenced and made secure. Site establishment activities will include site clearance, ground preparation, and establishing erosion and sediment control measures prior to any construction activities occurring. Upon completion of the works, the CSAs will be disestablished, and the areas restored to at least their previous condition prior to construction.
- All CSAs are likely to be provided with water, telecommunications and power connections, and where required, sewer connections. In most cases, these services are able to be connected directly to the existing adjacent networks. Where there is no existing network adjacent to the CSA, a temporary connection will be made. These connections will be removed after the completion of the Project.
- All CSAs are likely to be established on compacted hard fill unless impervious areas exist.

5.3 Likely amenities

The CSAs are likely to require some or all of the following amenities:

- Project offices.
- Welfare facilities including:
  - Toilets
  - Dining areas
  - First Aid equipment
- Employee car parking
- Steel shipping containers for small tools/equipment storage

Satellite welfare facilities are likely to also be required in addition to any welfare facilities provided within the CSAs. These will typically include provision of the following temporary facilities for workers in closer proximity to their immediate working area:

- Toilets
- First aid
- Break out / dining areas

5.4 Likely storage and site activities

Activities likely to occur within the CSAs include but is not limited to:

- Site offices and construction personnel amenities, including car parking
- Construction vehicle and machinery parking and maintenance
- Loading and unloading of construction materials
- Storage of construction materials
- Fabrication, reinforcement cutting and bending
- Storage of plant and equipment and building materials
- Storage of ground improvement plant and materials
- Storage of hazardous construction materials (if any)
- Construction vehicle wheel washing areas (where necessary)
- Stormwater and groundwater treatment facilities where required
- Waste storage and collection
- Spoil handling and storage
- Storage of supplanted trees / shrubs

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