Hamilton City Council

Peacocke - Whatukooruru Drive

Job number: 146000

Transport Network Management Plan

03 June 2022

BLOXAM BURNETT & OLLIVER

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Hamilton City Council
Te kaunihera o Kirikiriroa

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1. Introduction

1.1 Report Purpose

Bloxam Burnett & Olliver Ltd has prepared this Transport Network Management Plan (TNMP) for the Peacocke - Whatukooruru Drive project (the Project) in accordance with the Southern Links Designation Condition 24 (SLDC 24). This TNMP follows and builds upon the findings in the TNMP that was prepared for the Peacocke – Waikato River Bridge (PWRB) project.

Together with the PWRB and recently completed State Highway (SH) 3 (Ohaupo Road) roundabout projects, this Project forms part of the early stages of road network in the Peacocke Structure Plan (PSP) and the wider Southern Links network. This designation condition requires the submission of a TNMP for certification by the Territorial Authority Chief Executive or nominee.

SLDC 24 states that the objective of the TNMP is to:

"Provide a framework to ensure that any adverse effects associated with the operation of the project can be avoided, remedied or mitigated".

This is about ensuring that the operation of the Project, as one of the early stages of the PSP and Southern Links network integrates with the wider existing transport network environment in such a way that ensures a safe and connected "interim" transport network that causes no significant and unexpected adverse effects.

The Project adopts a new approach to multi-modal transportation provision for Hamilton, with the prime focus on safety for all users, then quality of amenity and connectivity regarding active and public transport modes for future residents of Peacocke growth cell. A step change will be observed through prioritising safety and connectivity of alternatives to private vehicle transport, including accessibility to future public transport over general traffic flow efficiency. This approach to the infrastructure design will be the catalyst for the area enjoying long term environmental benefits and the new active mode opportunities being available to all user abilities.

This document is not intended to provide technical engineering guidelines. Those are presented in the Project Design Philosophy Statement. Rather, it is to describe the key transport management and design objectives and principles, and identify any effects and mitigation required on the external network due to the staged development of the Peacocke Strategic Transport Network project.

This report considers the likelihood and potential significance of traffic changes resulting from the addition of this piece of the network, the adequacy of the affected network sections to cater for the travel demands of all modes, the potential duration of the effects based on planned network changes and areas where intervention may be required.

1.2 Peacocke Structure Plan

The Peacocke area, south of the Waikato River, was incorporated into Hamilton City from Waipa District Council (WDC) in 1989 as part of the city's long-term urban development plan.

The existing Peacocke area is characterised by a mixture of rural activities and rural/residential lifestyle blocks. Peacockes Road is predominantly a narrow country road with low traffic volumes, no walking and cycling infrastructure and basic intersection layouts with no-exit side roads. The network is insufficient for providing a safe and efficient urban transportation environment to support the planned residential development.

In 2007, Hamilton City Council (HCC) produced a Structure Plan for the Peacocke area (the PSP) to serve as a strategic framework to guide future urban development. This includes a new strategic transportation network of roads and off-road walking and cycling paths. The key objective of the PSP transport network is to deliver improved safety, accessibility, and multi-modal connectivity for the future transportation of people, goods, and services.

The Peacocke Structure Plan was reviewed in 2012, in full public consultation processes. But a lot has changed since then. With funding for key infrastructure confirmed, and construction under way, the Peacocke Structure Plan now needs to be updated to reflect the outcomes we want for our newest neighbourhood. This includes environmental and urban design best practice and will bring our plan in line with the National Policy Statement for Urban Development and the National Policy Statement for Freshwater Quality, Government's directions for how they want councils to develop well-functioning communities and healthy rivers.

Hamilton City Council publicly notified Plan Change 5 - Peacocke Structure Plan under the Resource Management Act on 24 September 2021 and submissions closed on Friday 5 November 2021. A summary of submissions and copies of the original submissions are available at HCC website.

The PSP transportation network, sourced from the HCC website is attached in Appendix A of this report.

1.3 The Hamilton Southern Links Arterial Network (HSL)

The Project is essentially part of the long term HSL network, which is illustrated in **Figure No. 1**. The Project extents are identified within the black dashed area. The road network in pink dashed area is under construction now. The light green sections of HSL network have been designated but the design and construction phases remain unfunded and without timing certainty.

Figure No. 1: The Southern Links Network (courtesy of Waka Kotahi NZ Transport Agency's Southern Links project website)

1.4 Project Design Philosophy Objectives

This TNMP provides an overview of the key design objectives and requirements. Greater detail related to the design elements can be found in the *Peacocke - Whatukooruru Drive Design Philosophy Statement Report* which is attached as Appendix B.

1.4.1 Geometric Design

The Project design aims to follow and build upon the design philosophies developed and adopted for the PWRB project. It adopts a number of relatively new concepts which seek to change the focus from designing for cars towards designing for an improved human-centric outcome (rather than traffic flow efficiency) by prioritising active modes and passenger transport over car-dependant travel. These concepts have previously been presented to and supported by HCC and associated key stakeholders as part of the PWRB project.

In summary, the key concepts and objectives governing the geometric design for mid-block sections (i.e. between intersections) include:

- Adopting road safety Vision Zero: A transportation system where no one is killed or seriously injured on New Zealand roads.
- Promotion of public transport and encouraging active (and alternative) modes, if necessary, at the expense of reduced performance of the network from the point of view of (low occupancy) private car users.
- Optimising the people moving capacity of the road, by enabling efficient use of the network by buses and high occupancy vehicles.
- Providing flexibility in the design to cater for evolutionary and step changes in the transportation system.
- Working within the designation boundaries secured as part of Southern Links project, without alterations (unless pursued under non-notified processes).

1.4.2 Intersection Design

As with the geometric design for mid-block sections, HCC has provided clear direction on the philosophical approach to design for the Peacocke Strategic Transport (PST) intersections, which is described and documented below.

Intersection forms shall respond to the following requirements (most important to least important):

- Alignment with Vision Zero safety objectives, through Safe System design principles.
- Prioritising and encouraging the use of active transport modes for short trips.
- Public transport prioritization.
- Car efficiency.

This design approach leads to a logical hierarchy (discussed in the following section) as a starting point for determining the intersection forms along the major and minor arterial roads, although there may be constraints that modify the preferred form at particular sites.

1.5 Hierarchy of Intersection Forms

A hierarchy of intersection forms were discussed and agreed between HCC and relevant stakeholders to guide the design philosophy. These are listed below from highest order and preference to the least, based on achieving the key design objectives described in Section 1.4.

Of utmost importance is consideration of personal harm. Therefore, grade separation of all vehicle conflicts and conflicts between modes is most desirable. Where full grade separation is not practicable, then the most vulnerable users should be grade separated and the number of remaining conflict points should be minimised. Lastly, the risks from the remaining conflicts should be minimised.

This approach leads to the following intersection form hierarchy. The starting point for selecting the form of an intersection should be at the highest level, with decisions about practicability being made before moving to the next (lower) level in the hierarchy:

1. Grade separation of all movements.
2. Roundabouts with grade separation for active modes.
3. Signalised intersections with grade separation for active modes. Vehicle speeds to be managed through use of raised platforms on the approaches, or tables across the whole intersection.
4. Signalised intersections with signalised crossings for active modes. Vehicle speeds to be managed through use of raised platforms on the approaches, or tables across the whole intersection.
5. Roundabouts with "build-outs" (or similar) provided for active mode crossings being made at-grade.
6. Signalised intersections with signalised crossings for active modes. No physical control of vehicle speeds.
7. Priority-controlled (Give-Way) intersections.

In all cases above, public transport will be given priority at intersections, such as advanced start at signals, bus lane prioritisation at roundabout approaches, or via bus stop design/positioning at preceding stops.

2. Project Overview

The Peacocke – Whatukooruru Drive project involves the extension of Whatukooruru Drive, a Minor Arterial transport corridor, from the newly constructed roundabout at SH3/ Ohaupo Road through to Peacocke Road and the upgrade of 600 m of the existing Peacockes Road from a rural to an urban transport standard. A general arrangement plan for the Project is shown below in Figure No. 2.

There presently exists a temporary constraint at the western end of Whatukooruru Drive, whereby Whatukooruru Drive cannot be constructed through to the recently completed SH3/ Ohaupo Road roundabout due to a property acquirement issue. Whilst relief from this property constraint is being actively managed by HCC, the current design philosophy expects for Whatukooruru Drive to require a temporary tie-in at Hall Road, via a temporary signal controlled intersection.

Accordingly, the Project is planned to be constructed in two separate stages as follows:

- "Stage 1" includes the construction of the section of Whatukooruru Drive between Hall Road and Peacockes Road, as well as the urbanisation of the 600 m of the existing Peacokes Road. The general overview plan for this stage of the Project is shown in Figure No. 3.
- "Stage 2", which is anticipated to be constructed a year or two after the completion of Stage 1 (and once the property constraint is resolved), involves extending Whatakooruru Drive from the western end of Stage 1 to the new roundabout on SH3.

Given that the design for Stage 1 is at an advanced stage, this TNMP will focus on the effects associated with implementing Stage 1 of the Project. Where relevant, commentary related to the Stage 2 works will be provided.

The scope of works and extent of works for Stage 1 is as follows:

- Upgrading approximately 600 m of the existing Peacockes Road from rural to urban form, complete with all utility services.
  - ➢ The northern end of the upgraded Peacockes Road ties in with the works currently being constructed as part of the PWRB project at a position approximately 500 m beyond the Peacockes Road/ Peacockes Lane intersection.
  - ➢ The southern end ties in with the existing Peacockes Road cross-section approximately 200 m south of the future intersection with Whatukooruru Drive.
  - ➢ The Project facilitates the ongoing urban upgrade of Peacockes Road to the south as residential development continues in future.
- Constructing an approximately 1.4 km section of Whatukooruru Drive from Peacockes Road to Hall Road.
  - ➢ The western end terminates at Hall Road, with a temporary three-leg signalised intersection constructed at the future Whatukooruru Drive/ Hall Road intersection.
  - ➢ The eastern end terminated at Peacockes Road, with a four-leg signalised intersection constructed at the future Whatukooruru Drive/ Peacockes Road intersection.
  - ➢ A road stub will be provided on the eastern approach to enable future connection.
- Construction of two major bridge structures on Whatukooruru Drive.
- Construction of several new signalised intersections on Whatukooruru Drive and Peacockes Road.
- Footpaths (2 m wide) and 2.3 m wide cycleways on both sides of the Peacockes Road and Whatukooruru Drive carriageways.

While the intersection of the North-South Arterial and Whatukooruru Drive is not intended to be constructed as part of this Project, the design of Whatukooruru Drive will progress on the assumption that the intersection will take the form of a roundabout and aim to develop a preliminary design of an intersection to a level to give HCC confidence that the final intersection, including grade, will be able to be constructed efficiently and with minimal disruption.

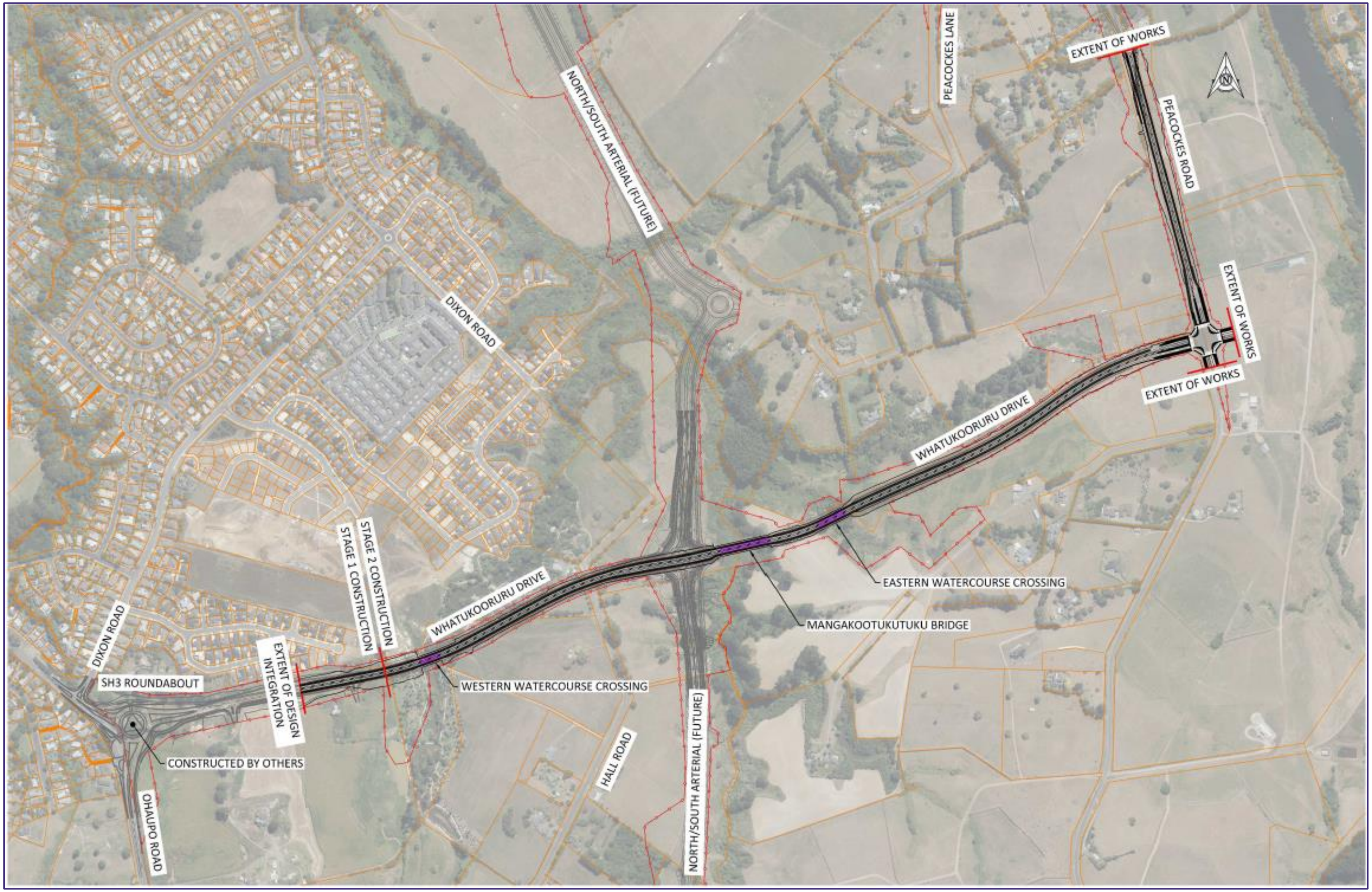


Figure No. 2: Extent and overview of the Peacocke – Whatukooruru Drive Project

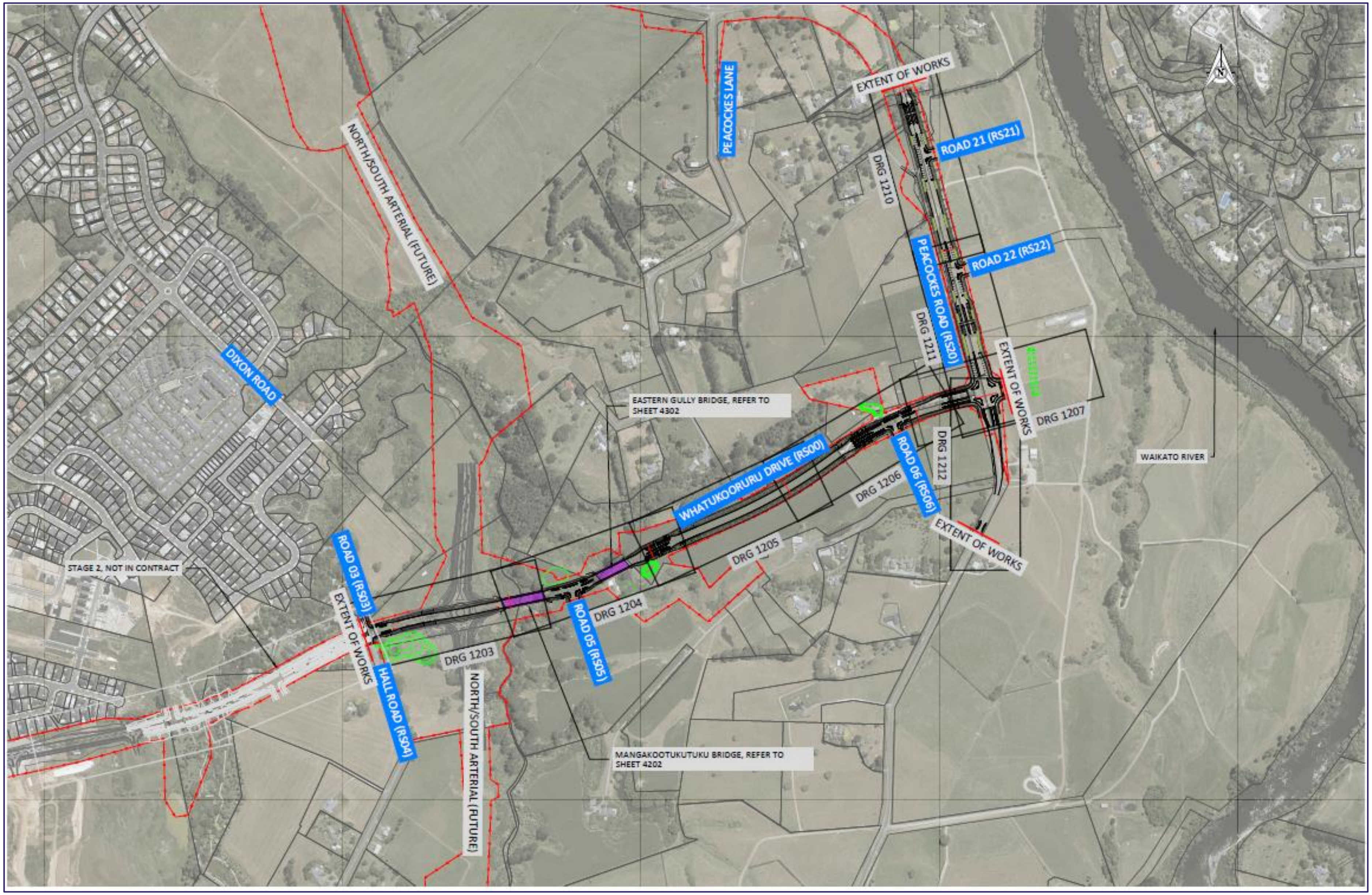


Figure No. 3: General overview plan for Stage 1 of the Peacocke – Whatukooruru Drive Project

3. Project Effects on the Network

3.1 The Existing Network

A key TNMP objective is to provide a framework to avoid, remedy or mitigate transportation related effects "associated with the operation of the Project". This is different to assessing the transportation effects of the future development on the performance of the Project network. Instead, it involves assessing how the existing transport network will be affected by the existence of the Project before the full network is completed and as residential development in Peacocke takes place.

The existing Peacocke transportation network shown in Figure No. 4 is from the latest Google Earth imagery[1]. It shows the network context for Peacockes Road, with northward connections to the city currently limited to just Bader Street (via Normandy Avenue and Cobham Drive) and Dixon Road (via SH3/ Ohaupo Road) due to the deep gully systems and the Waikato River.

To the south, Peacockes Road connects to Raynes Road where traffic either:

- Travels further south (towards Te Awamutu) via SH3,
- Accesses Hamilton Airport and surrounding via SH21, or
- Travels east towards SH1 via SH21.

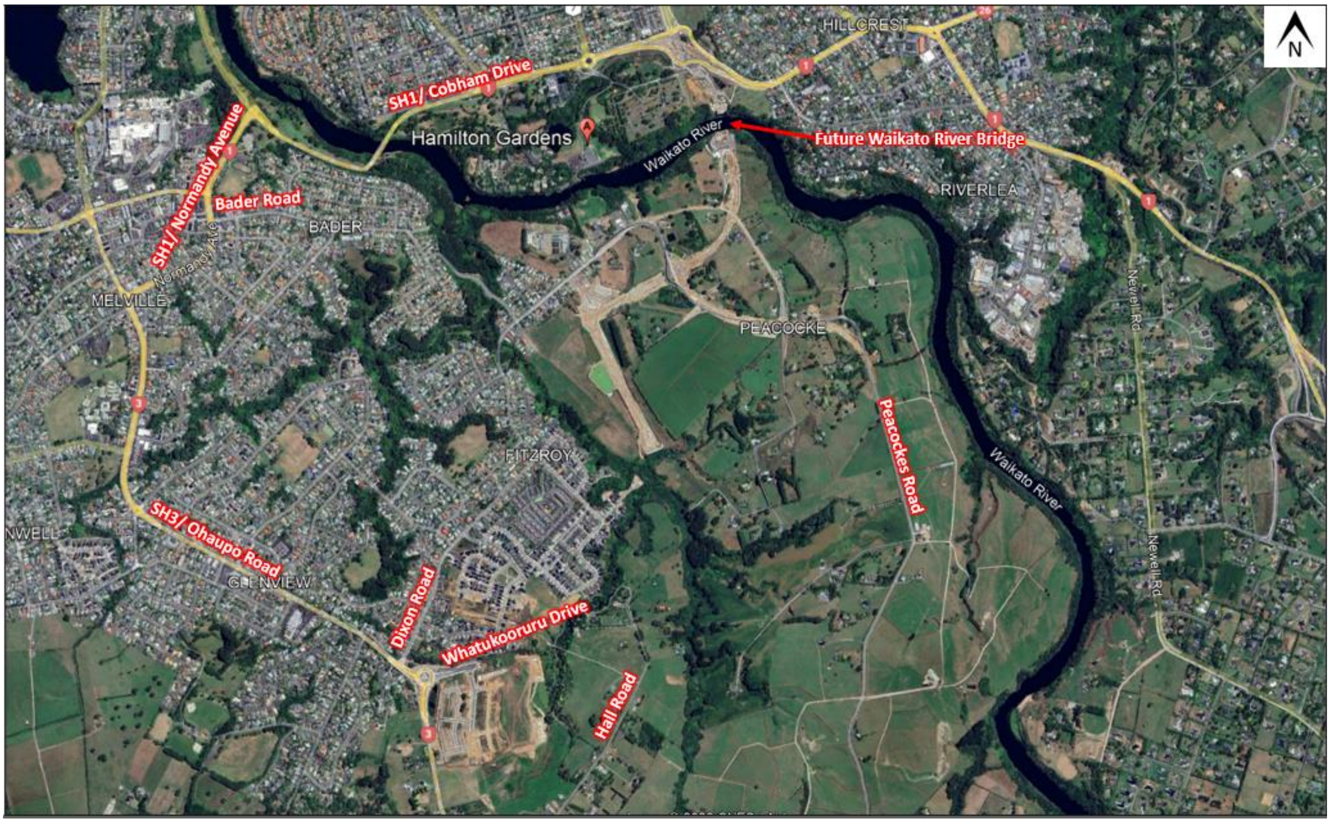


Figure No. 4: Peacockes Road Network (Google Earth Imagery, as at May 2022)

As shown in Figure No. 4, the following works within the Peacocke Structure Plan area have either recently been completed or are currently under construction:

- Works associated with the PWRB project are currently underway. Once completed, the new bridge connection over the Waikato River will provide much needed connectivity to Hamilton West and the

[1] As at May 2022

rest of the city via the future Wairere Drive/ Cobham Drive interchange, adding a third transportation access between Peacocke and the city.

- The SH3/ Ohaupo Road roundabout project has recently been completed. As shown in Figure No. 5 below, the project included the construction of an approximately 200 m section of Whatukooruru Drive. Additional local road works are currently underway to the south of the completed section of Whatukooruru Drive to enable access for Stage B of the Peacocke residential development.
- The intersection of Ohaupo Road (SH3) and Dixon Road has recently been modified to allow only left in, left out from Dixon Road and right-turn in movements from Ohaupo Road as shown in Figure No. 5. Right turn out traffic heading towards the CBD will use the new SH3/ Whatukooruru Drive roundabout located just south of Dixon Road. These works enabled the creation of a southern gateway access for the first stages of the Peacocke residential development and have also significantly improved the safety of the SH3 / Dixon Road intersection by reducing traffic volumes in and out of Dixon Road, and removing the critical right turn out movement.

Despite these recent network changes, only two options for connectivity between Peacocke and the city will remain during the construction of the Project network. A third connection (over the Waikato River) will only come online once the PWRB project is completed.

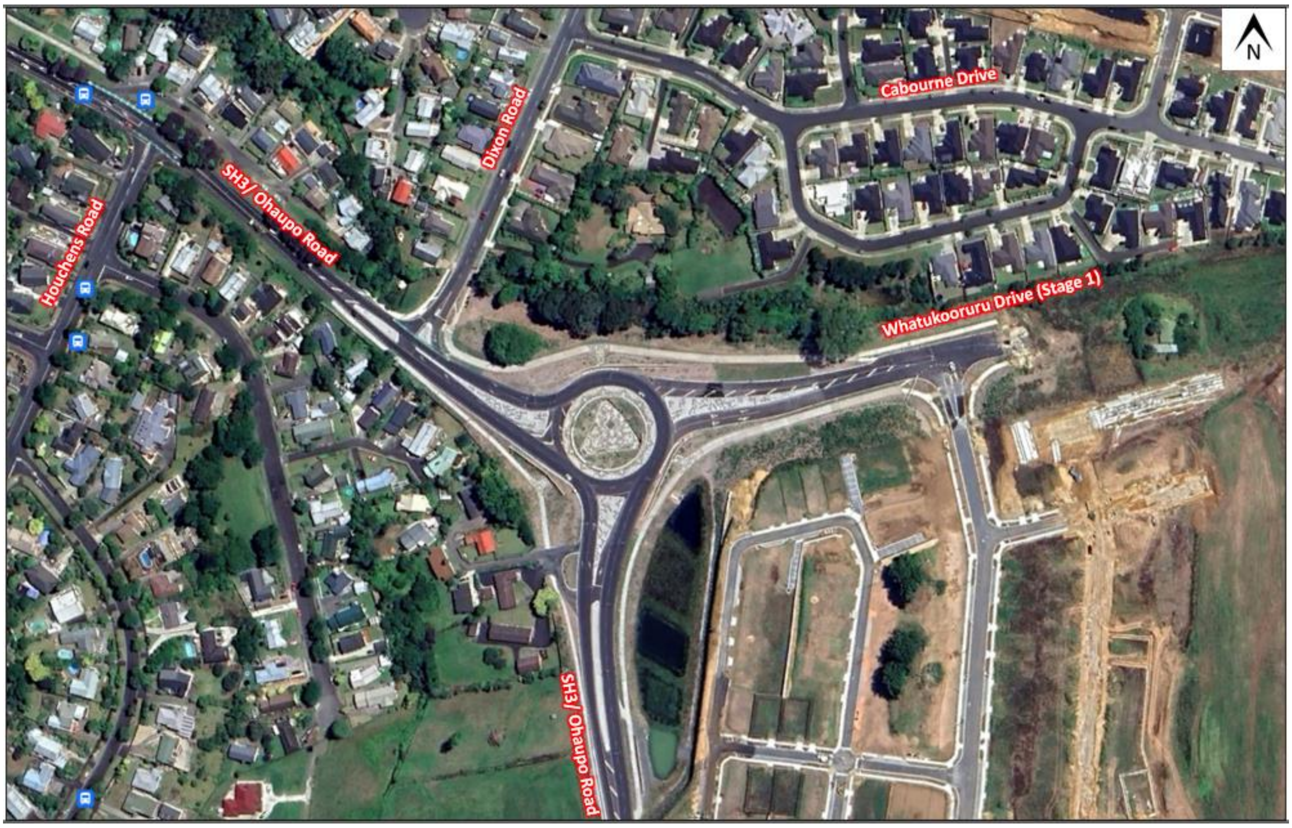


Figure No. 5: Recently upgraded SH3 (Ohaupo Road)/ Whatukooruru Drive and SH3 (Ohaupo Road)/ Dixon Road intersections

3.2 Construction Traffic and Construction Diversion Effects

Peacockes Road traffic will undergo various temporary diversions to allow construction of the new signalised intersection at Whatukooruru Drive. These will be local diversions with no long-term wider network effects expected to be generated. Temporary traffic management measures will be planned and implemented to avoid adverse impacts on safety during the diversion period.

Travel times increases can be expected but will be relatively small and only experienced by residents of the Peacockes Road (south) area. The Average Daily Traffic (ADT) volume of Peacockes Road affected by the works is just 660 vpd[2].

Construction of the Project is expected to extend over a 1.5-year period, with the peak construction period expected be in the summer of 2023/2024. At its peak, construction traffic is anticipated to be in the range of 80 heavy commercial vehicle (HCV) movements per day (in each direction) in addition to the approximately 70 worker vehicles per day.

There are only three (general) road network access points to the Peacocke - Whatukooruru Drive project area. These access corridors are not ideal and include:

- Through the rural area of Peacockes Road and Hall Road. The key issues of these access corridors include:
  - Low standard rural road with relatively narrow cross-section and areas where low sight distances are achieved.
  - For Peacockes Road, it is currently used by an increasing volume of rat-runners seeking to avoid existing roadwork activities on the State Highway network.
  - Existing pavement condition is very poor, with indication that the pavement will not be able to withstand the predicted HCV volumes.
  - Potential damage to new works on Peacockes Road completed during the PWRB project.
  - Potential safety issues associated with construction vehicles using the existing SH3/ Hall Road and SH3/ Raynes Road intersections.
- Through the urban area of Ohaupo/ Dixon Road. The key issues being:
  - Residential area with associated safety issues mixing HCVs with residential activities (such as school kids, regular access points, cyclists, etc).
  - Potential damage to new works at the Ohaupo Road/ Whatukooruru Drive roundabout and/or the development works at the western end of Whatukooruru Drive.
  - Restriction to HCV tracking.
  - Noise/dust/nuisance complaints by the nearby residential population.

Several potential solutions exist to mitigate the above-mentioned construction access related effects. These include:

- Public relations – information on effects being well publicised so no surprises to the general public.
- Tender documentation to ensure construction traffic effects are well considered in their submissions, with clear constraints and incentives being provided for construction methods that seek to minimise effects.
- Consider restriction of routes for construction related traffic.
- Further staging of works to limit peak construction traffic.
- Consider what improvements are needed to each corridor to manage effects and get those works either constructed in advance, or as part of the scope of works. Options include:
  - Speed limit changes.
  - Intersection improvements/restrictions/road closures.
  - Network signage.
  - Pavement rehabilitations (primarily Peacockes Road).
  - Additional safety improvements – particularly on residential roads

[2] The latest ADT estimate from the Mobile Road website

➢ Footpaths/cycleways built in advance.

Notwithstanding the above, construction traffic will be managed as part of the Construction Traffic Management Plan (CTMP) in accordance with Designation Condition 24.1e.

3.3 Operational Effects of the Project

Once the Project is completed (i.e. both Stages 1 and 2 are completed), Whatukooruru Road will add a fourth transportation access (via the new SH3 roundabout) between Peacocke and the city. However, with only Stage 1 completed, there will be no additional access created for the Peacocke area.

While it is likely that some land use development will proceed in Peacocke during the construction of the Project, the traffic volumes on Peacockes Road and Whatukooruru Road generated by the early stages of residential development will still be low in comparison to the eventual volumes generated by the growth cell land use development (i.e. housing development will be the major instigator of increased traffic on Peacockes Road and the Project network, not the Project itself).

Section 7 of this report identifies the future traffic demand with full residential build out and the Southern Links network completion. Based on traffic demand estimates provided in the 2013 Traffic Modelling Report by Opus/AECOM:

- The future traffic demand on Peacockes Road will be in the order of 13,000 vpd at the intersection with Whatukooruru Drive and 21,000 vpd at the Ring Road extension by 2041, corresponding to an approximate peak flow rate of approximately 700 to 1,100 vehicles per hour (vph) in each direction.
- The projected 2041 traffic volumes on Whatukooruru Drive are in the order of 9,600 vpd for the eastern section (i.e. the section between Peacocke Road and the new Road 06), 13,700 vpd for the central section (i.e. the section between Road 05 and Road 06) and up to 19,900 vpd in the western section (i.e. the section between Road 01 and SH3/ Ohaupo Road)). Traffic is proposed to be conveyed within a single lane in each direction with a LOS A to LOS B along the route. The cross section will also have a central median to facilitate turning movements.

The only transportation effects directly due to the Project relate to external traffic being potentially drawn through the area to connect to a destination outside of Peacocke. Given the network constraints and the limited city access points (only three accesses prior to the completion of Stage 2 of the Project), there are several potential through-route options created.

Four routes have already been identified and assessed as part of the TNMP for the PWRB project. These include (refer to Figure No. 6 for an illustration):

- Route 1: Hamilton East and Ohaupo Road, via the Ring Road extension.
- Route 2: Hamilton East and the Airport, via Peacockes Road
- Route 3: Waikato Hospital and the Airport, via Bader Street and Peacockes Road
- Route 4: Hospital/Bader/Glenview and Hillcrest/University, via Bader Street and Peacockes Road.

Discussions related to the attractiveness of each of the routes are provided in Section 3.3 of the PWRB Project TNMP. These are summarised as follows:

- Routes 1 and 4 are the most likely to attract diverted trips due to significantly shorter travel times through the PWRB project network than the corresponding existing routes.
- Routes 2 and 3 are less likely to attract diverted trips, however, a conservative percentage of trips has been assumed to be diverted for the purpose of that assessment.

Table 2 summarises the affected road sections and total traffic volumes (existing + potential through-traffic) that may be attracted to them upon completion of the PWRB network. The potential traffic has been based on a subjective assessment of attractiveness and the likely proportion of traffic that would divert.

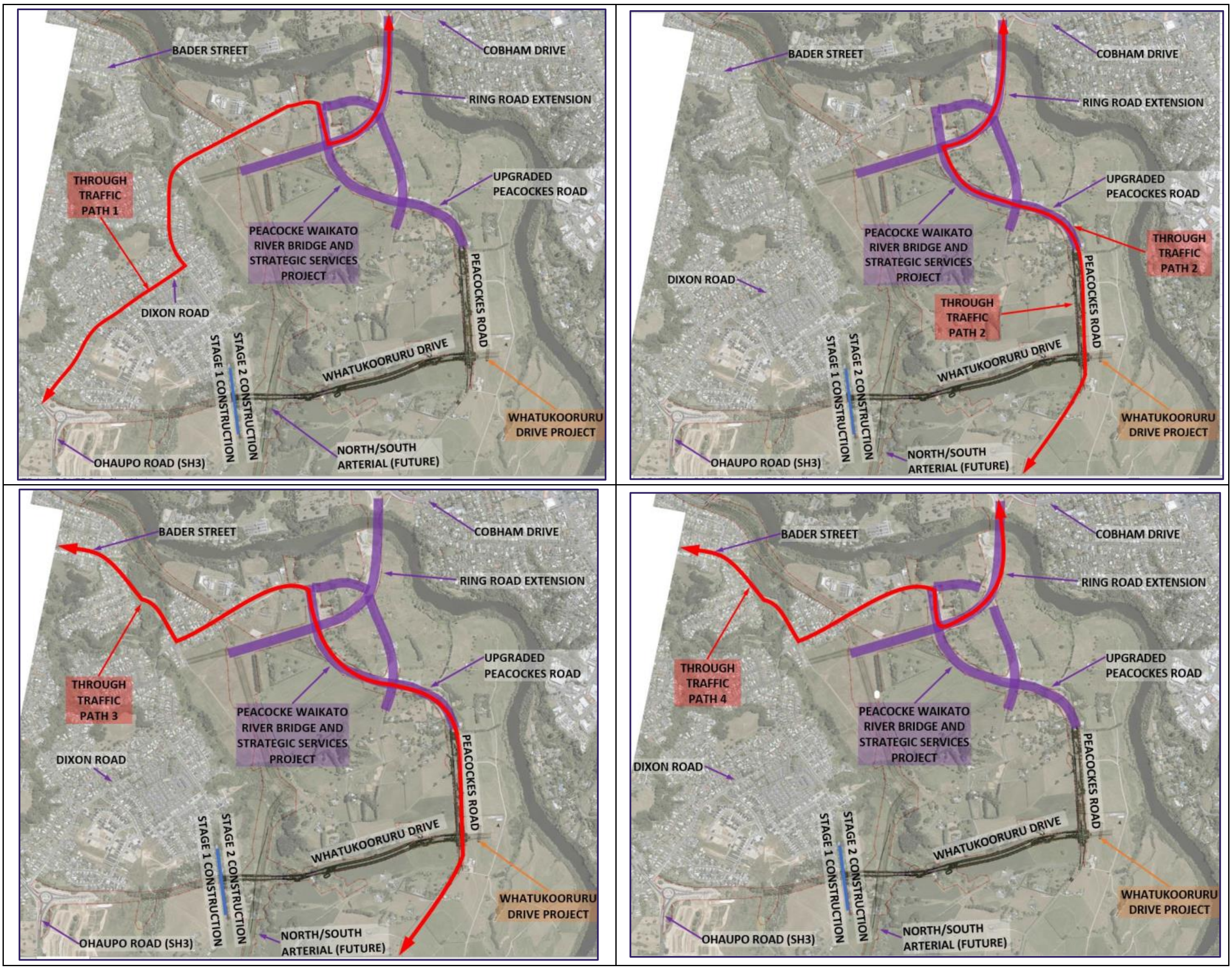


Figure No. 6: Potential through-routes created with the completion of the PWRB Project

Table 1: Summary comparison of attractiveness of each potential route (table from the PWRB TNMP)

Route	Road section	Existing ADT (vpd) [Obtained from HCC 2018 Traffic Counts and Mobile Roads]	Existing peak hour traffic (vph)	Possible diversion traffic per peak hour (vph)	Pedestrian / cyclist demand	Safety issues (Based on 5-year CAS data)	Conclusions /Suggested Actions
1	Dixon Road	2,800	420 (15% peak traffic)	11	Moderate	No obvious issues identified	• Monitor traffic volumes (predictions well within capacity of existing road) • Low speed management, if needed
1	Waterford Road	2,470	296 (12% peak traffic)	11	Moderate	No obvious issues identified	• Monitor traffic volumes (predictions well within capacity of existing road) • Low speed management, if needed • Consider upgrade to Peacockes Road / Waterford Road intersection
1, 3 & 4	Peacockes Road (btw Waterford Rd and Weston Lea Dr)	1,200	168 (14% peak traffic)	11 (Route 1) + 33 (Route 3) + 21 (Route 4) Total = 65	Moderate	No obvious issues identified	• Monitor traffic volumes (predictions well within capacity of existing road) • Temporary effect until North–South arterial is built
2 & 3	Peacocke Rd rural	693	104 (15% peak traffic)	15 (Route 2) + 33 (Route 3) Total = 48	No	1. Crash pattern identified with vehicles losing control at bends (9 crashes)	• Monitor traffic volumes (predictions well within capacity of existing road) • Consider speed reduction to 60 km/h in rural section especially at area where existing crash cluster occurs
3 & 4	Peacockes Road (btw Norrie St and Waterford Rd)	4,800	576 (12% peak traffic)	33 (Route 3) + 21 (Route 4) Total = 54	Moderate	No obvious issues identified	• Monitor traffic volumes (predictions well within capacity of existing road) • Low speed management, if needed • Review pedestrian / cycling connectivity • Investigate off-road connection along North-South corridor
3 & 4	Norrie Street	1940	233 (12% peak traffic)	33 (Route 3) + 21 (Route 4) Total = 54	Moderate	No obvious issues identified	• Monitor traffic volumes (predictions well within capacity of existing road) • Investigate upgrade to Peacockes Road / Norrie Street intersection in the long-term

Route	Road section	Existing ADT (vpd) [Obtained from HCC 2018 Traffic Counts and Mobile Roads]	Existing peak hour traffic (vph)	Possible diversion traffic per peak hour (vph)	Pedestrian / cyclist demand	Safety issues (Based on 5-year CAS data)	Conclusions /Suggested Actions
3 & 4	Bader Street	9,000	1,080 (12% peak traffic)	33 (Route 3) + 21 (Route 4) Total = 54	High	High Risk Corridor 1. 21 crashes identified in last 5 years (excluding cashes at SH3 intersection). 2. Crash pattern identified with vehicles losing control at Bader Street / Norrie Street bend (4 crashes) 3. Crash pattern identified with parked vehicles.	• Monitor traffic volumes • Safety improvements at SH3 / Bader Street intersection underway soon (prior to construction of Waikato River Bridge Project) • Adjust signal phasing to suit priority

The potential through-routes identified above (including measures identified to mitigate the effects of the potential traffic deviations) remain relevant for this Project.

The subsections to follow discusses the potential additional through-routes (in addition to those already assessed and addressed in the PWRB project TNMP) that will be created by this Project.

3.3.1 Potential through-route: Project Stage 1

Potential Through-Route

An additional through-route will be created as a result of "Stage 1" of this Project. The creation of the temporary signalised intersection with Hall Road at the western end of Whatukooruru Drive Stage 1 will provide an alternative route for traffic travelling between SH3 and Hamilton East via Whatukooruru Drive (refer to Figure No. 7 for an illustration of the route). The route is approximately 5.5 km long, starting from the SH3/ Hall Road intersection to the future Cobham Drive/ Wairere Drive Interchange via Hall Road (rural), Whatukooruru Drive and the urbanised section of Peacockes Road. It passes through several signalised intersections and the Peacockes Road/ Ring Road extension roundabout.

Travel times on this new route, which are presented in Table 2, have been estimated based on an average speed of 35 km/h on Whatukooruru Drive and Peacocke Drive during the AM and PM peak periods (and 45 km/h during the off-peak periods). Hall Road will continue to have an operating speed of 70 - 80 km/h based on the existing rural environment.

Existing Route

The corresponding existing route from the SH3/ Hall Road intersection to the future Cobham Drive/ Wairere Drive Interchange via Ohaupo Road, Normandy Avenue and Cobham Drive is approximately 6.8 km long. Posted speed limits on Ohaupo Road and Normandy Avenue are 50 km/h through Melville, while the posted limit on Ohaupo Road then changes to 100km/h just south of Dixon Road. Google Maps calculates the typical travel time to the future Cobham Drive/ Wairere Drive Interchange as 8 minutes for off-peak periods and 14 minutes during the AM and PM peak periods. This relates to an average speed of 29 and 51 km/h, respectively.

Alternative Route created by PWRB project

Once the PWRB project is completed, an alternative through route will be created (Potential Route 2 identified in the PWRB project TNMP). As discussed in the Section 3.3.2 of the PWRB project TNMP, the route is approximately 10.3km from SH21 / Raynes Road intersection to Cobham Drive/ Wairere Drive Interchange via Peacocks Road with an estimated travel time of 11 minutes during AM and PM peak periods and 10 minutes during off-peak. The potential Route 2 travel time was based on an average speed of 55 km/h during the AM and PM peak hours and 60km/h during off-peak period and taken into consideration the intersections and the narrow / winding country roads.

A summary comparison of the attractiveness of each route is presented in Table 2.

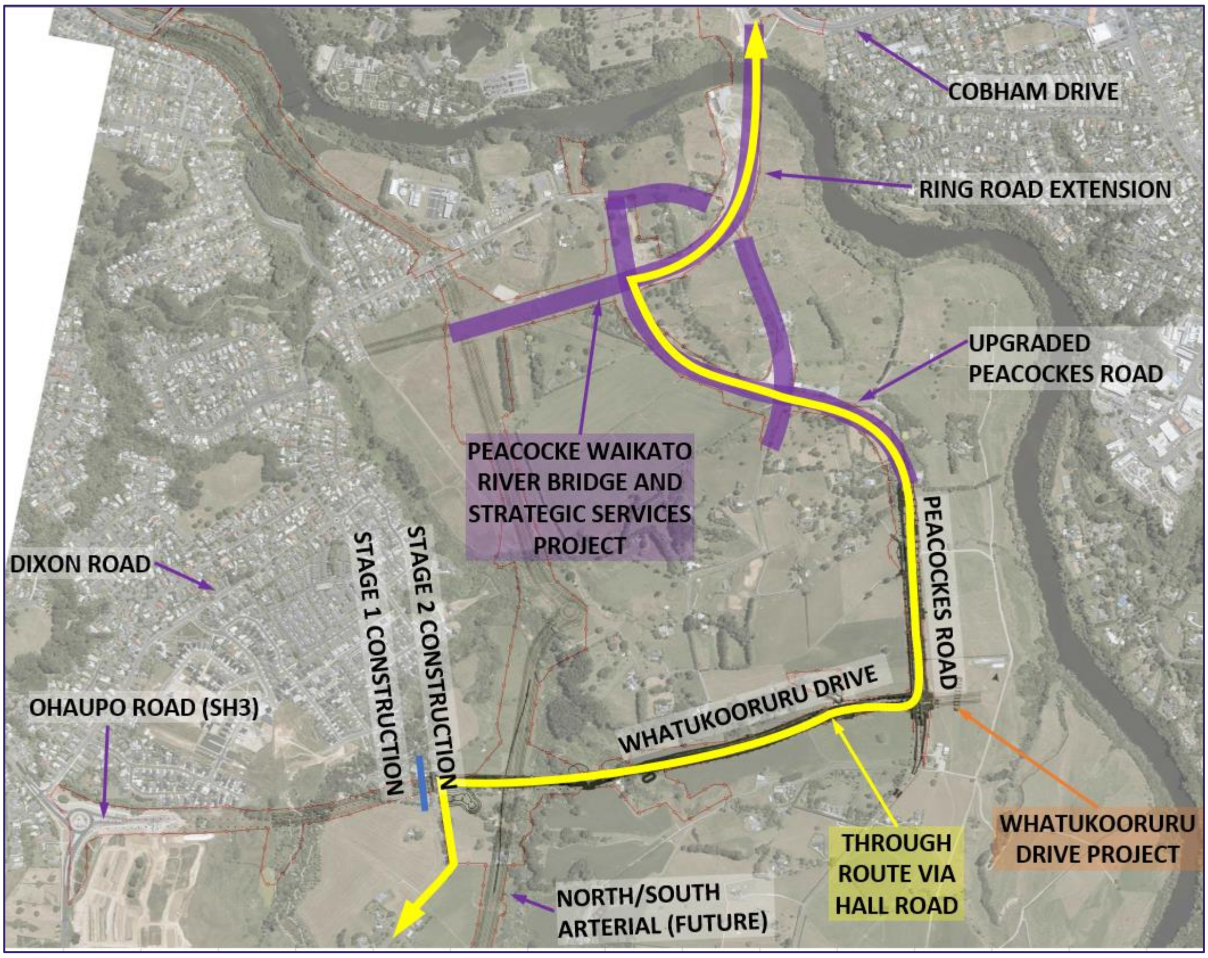


Figure No. 7: Additional potential through-route: Hamilton East to SH3 (and vice versa), via Hall Road (with the completion of Stage 1 of this Project)

Table 2: Alternative Route Assessment Summary (Project Stage 1)

	SH3/ Hall Road to Hamilton East via Normandy Avenue	SH3/ Hall Road to Hamilton East via Hall Road/ Whatukooruru Drive/ Peacocke Road	SH21/ Raynes Road to Hamilton East via Peacockes Road	Difference Between	
Option	Existing Route (6.8 km)	Potential Route (created by Stage 1) (5.5 km)	Alternative Route (created by PWRB) (10.3 km)	Existing Route and Potential Route	Existing Route and Alternative Route
AM peak travel time	00:14:00	00:09:25	00:11:11	+4:35	+3:00
PM peak travel time	00:14:00	00:09:25	00:11:11	+4:35	+3:00
Off-peak travel time	00:8:00	00:07:20	00:10:15	+0:40	+2:15

Conclusion:

- The potential through- route created by Stage 1 of the Project has a shorter travel time through the Project network than its corresponding existing route.
- While an alternative rat-run route is available (via Raynes Road and Peacockes Road), the new route created by Stage 1 of this project (via Hall Road) is likely to be more favourable than this route given the shorter length and travel time. Accordingly, the new rote may attract traffic that was anticipated to be attracted by the PWRB alternative route.
- The increased volume of vehicle turning at the SH3/Hall Road intersection as a result of the additional through-route traffic will create a safety issue at the intersection, due to the increased risk of side impact collisions at SH3/Hall Road Intersection.

Recommendation:

- It is recommended to monitor the SH3/ Hall Road intersection. Appropriate safety improvements should be considered if needed for the SH3/ Hall Road intersection due to safety risk associated with traffic deviating into the temporarily created potential through route.

3.3.2 Potential through-routes: Completed Project (Stages 1 & 2)

Potential Through-Route

Once “Stage 2” is completed, Whatukooruru Drive will open a new connection between SH3 and Peacockes Road and provide an alternative route for traffic travelling between Hamilton East (SH1/SH26) and Ohaupo Road/ SH3 (refer to Figure No. 8 for an illustration of the route). The intersection of Whatukooruru Drive and Hall Road will be terminated, and a cul de sac will be formed at Hall Road. The length of the new route is approximately 6 km from Cobham Drive / Wairere Drive Interchange via Peacocks Road to the SH3 roundabout.

The proposed speed limit for the new minor arterial within the Project is 40 km/h. Therefore, travel times on this new route have been estimated based on an average speed of 30kh/h during peak periods and 40 km/h during the off-peak period. The expected travel times for this route is shown in Table No. 3.

Existing route

The existing route via Cobham Drive, Normandy Avenue and Ohaupo Road has approximate length of 6.8km. Travel time on this existing route have based on an average speed of 29 km/h during all peak periods and 51 km/h off-peak periods. The expected travel times for this route is shown in Table No. 3.

Alternative Route via PWRB project

Alternative Route (illustrated as Route 1 in Figure No. 6) is approximately 4.5 km long from Cobham Drive to Ohaupo Road and passes through two roundabout intersections and 2.7 km of residential streets. Travel times on this new route have been estimated based on an average speed of 35kh/h during all peak periods on all roads and 45 km/h off-peak period, with the exception of the Ring Road extension (assumed 50 km/h during the AM and PM peak periods and 55km/h during the off-peak period). The expected travel times for this route is shown Table No. 3.

A summary comparison of the attractiveness of each route is shown in Table No. 3, followed by an explanation of each route.

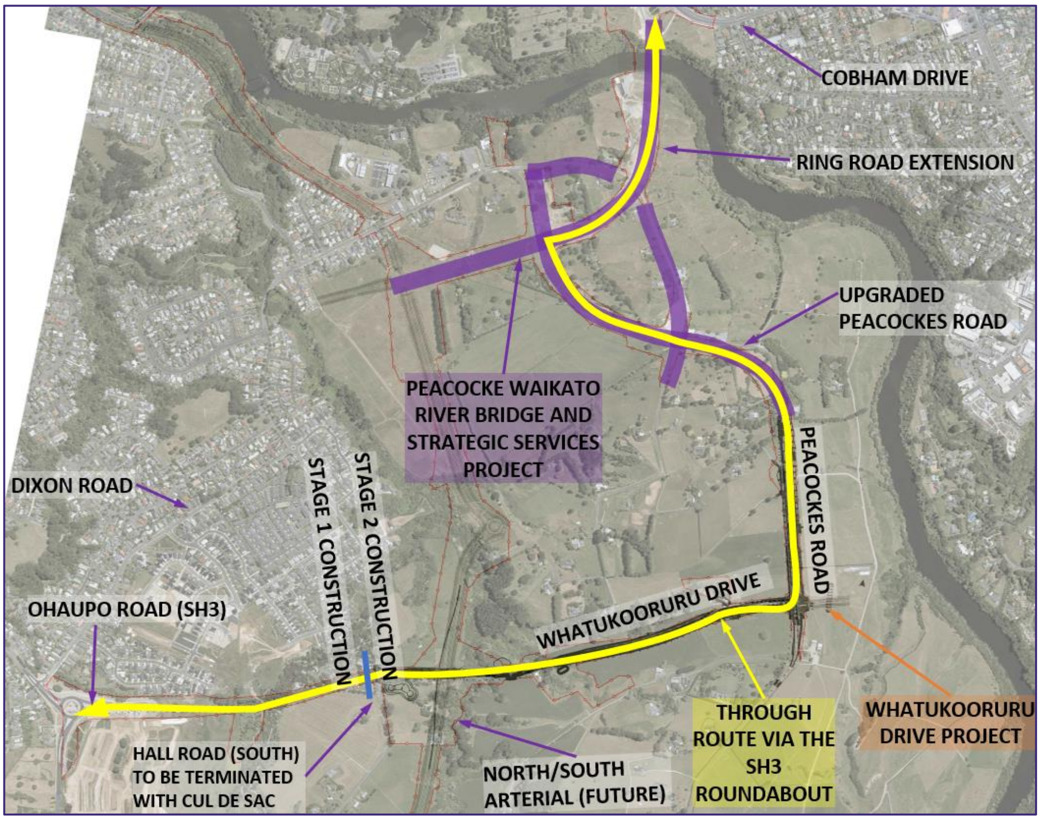


Figure No. 8: Additional potential through- route for traffic travelling North/South from Hamilton East (SH1/SH26) to Ohaupo Road (SH3) (with Stages 1 & 2 of this Project completed)

Table No. 3: Alternative Route Assessment Summary (Completed Project - Stages 1 & 2)

	Ohaupo Rd to Hamilton East via Normandy Avenue	Ohaupo Road to Hamilton East via the Ring Road extension	Ohaupo Road to Hamilton East via Whatukooruru Road	Difference Between	
Option	**Existing Route (6.8 km)**	**Alternative Route (PWRB project) (4.5km)**	**Potential Route (6 km)**	**Route 3 (alternative) and Route 1 (existing)**	**Route 3 (alternative) and Route 2 (existing)**
AM peak travel time	00:14:00	00:07:43	00:12:00	- 00:02:00	+ 00:04:17
PM peak travel time	00:14:00	00:07:43	00:12:00	- 00:02:00	+ 00:04:17
Off-peak travel time	00:08:00	00:06:00	00:09:00	+ 00:01:00	+ 00:03:00

Conclusion:

- The through-route created by the PWRB project route will remain a route with a much shorter travel time through the Project network than its corresponding existing route.
- Therefore, there is still a risk that as a worst case scenario, 100 % of the traffic on this route will divert to this new route (which is about 1-2% of existing traffic on Ohaupo Road at Dixon Road in the peak periods).
- However, the Waikato Expressway – Hamilton Section will also provide a viable alternative for motorists travelling from the south and into the city centre via the Ruakura Interchange and hence it

is assumed that traffic diverted through the Project Road network could conservatively be approximately 50% of existing vehicles between these zone pairs.

- Whatukooruru Drive will be urban road with a posted 40 km/h speed limit, direct property access will be restricted. While it will likely not be a faster alternative to the route created by the PWRB project. It will be a viable alternative through-route to the existing travel route. However, it may potentially become an alternative during the peak operating periods at the early stages of residential developments of Peacocke Area.

3.4 Likelihood and potential significance of traffic changes

The rat-running routes created by the PWRB project will likely be the most attractive route due to higher quality road and similar travel times through the Project network than the corresponding existing routes. The additional routes created by this Project may potentially become an alternative during the peak operating periodse at the early stages of residential developments of Peacocke Area.

3.5 Potential duration of the effects based on planned network changes

The Peacocke network will significantly change in mid-2023 when the new Waikato River bridge opens. Peacockes Road urban upgrade and the East – West arterial to Peacockes Road are currently expected to be completed by 2024/25.

Given the short period between future works coming on stream and the likely reduction in congestion on the existing key arterial roads, additional investment in interim safety improvement works is not expected to be justified given the expected diversion volumes on Peacockes Road.

3.6 Conclusion for Operational Effects of the Project

In conclusion, the volume of through traffic travelling through Whatukooruru Drive is unlikely to be significant in the interim period before the next stage of the Southern Links is completed. However, this is only a temporary effect until the North – South Arterial is built and is well within the capacity of a typical urban road.

The following is recommended to mitigate the operational effects of the Project:

- Monitoring of the SH3/ Hall Road intersection from the opening of the Project section.
- Application of the appropriate traffic calming measures to mitigate an effect of potential through traffic diverting from the existing route to the alternative routes that lies withing the residential area.
- Consideration of the appropriate safety improvements at the SH3/ Hall Road intersection due to safety risk associated with traffic deviating into the temporarily created potential through route.

4. Project Components

4.1 Peacockes Road Geometric Layout

Peacockes Road currently has an estimated AADT of 580 to 600 vpd. The upgraded section of Peacockes Road in this project will become a Minor Arterial Transport Corridor with a posted speed limit of 40km/h, which will increase to 60km/h at the southern tie-in (existing road). Traffic volumes on Peacockes Road are predicted to range from 13,000 vpd at the intersection with Whatukooruru Drive to 21,000 vpd at the Ring Road extension by 2041 (based on Traffic Modelling Report by Opus/AECOM), corresponding to an approximate peak flow rate of 700 to 1,100 vehicles per hour in each direction.

While a multi-lane carriageway would be necessary to maintain optimum levels of service for car-based operation, HCC has expressed a desire to reduce reliance on private vehicles and encourage the use of public transport and active modes. As such, the recommendation is to have a separated cycle lane and one traffic lane in each direction, with the traffic lane shared by cars and public transport vehicles, as shown in Figure No. 9. This philosophy is consistent with the project objectives and aligns with the PWRB project.

To improve safety and efficiency for public transport vehicles, bus stops will not be indented into the roadside. Instead, buses will stop within the lane while setting down and picking up passengers. Operational levels of service for cars on this carriageway will be reduced (to LOS E during peak periods) as a result. However, the advantage is that public transport vehicles can operate more efficiently and safely as they do not have to enter and leave the traffic stream at each stop and overall the safety and people moving capacity of the road corridor will be increased.

Active (and alternative) modes will be accommodated by a 2.0m wide off-road path on each side, and 2.3m wide on-road cycle lanes that are separated from the vehicle lane with raised "zebra/armadillo" separators.

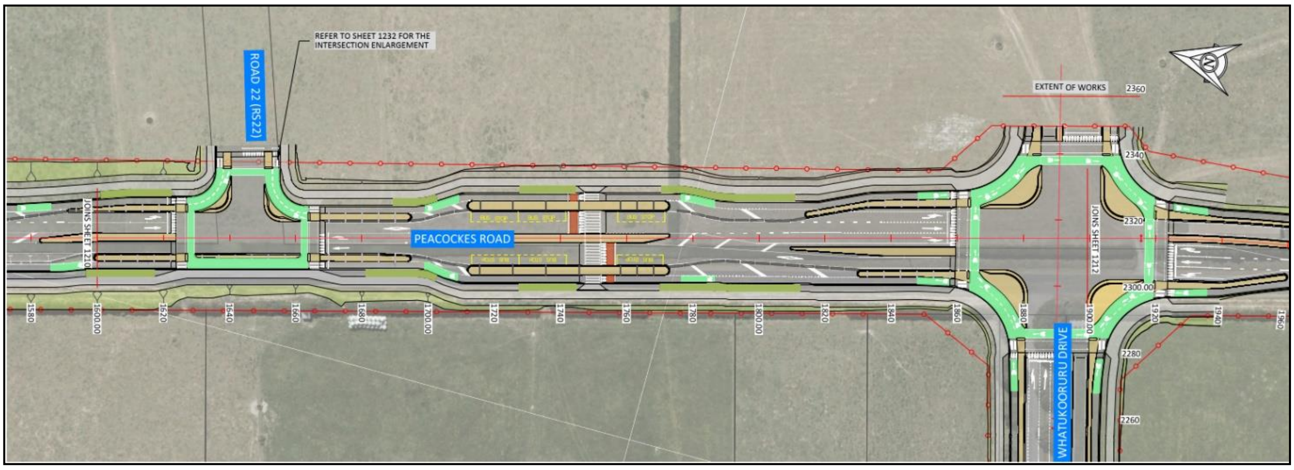


Figure No. 9: Peacockes Road Geometric Layout

4.2 Peacockes Road/ Whatukooruru Drive Intersection Geometric Layout

Based on the hierarchy philosophy described in Section 1.4, it is expected that the intersection between Whatukooruru drive and Peacockes Road will take the form of a signalised intersection with the use of raised safety platforms to manage vehicle speeds, as shown in Figure No. 10. As above, in the first instance, the intersection will aim to provide the greatest level of service for active modes and public transport. This includes providing separate paths and signalised crossing facilities for cyclists and pedestrians, limiting the width of the intersection (minimising traffic lanes) and providing single stage crossings across each of the four roads at the intersection.

This could potentially lead to a reduced LOS for vehicles; any decrease from the normal expected performance will be clearly documented and coordinated with HCC specialists.

Based on 2041 predicted flows (refer to Section 8.3), this intersection is predicted to operate at an acceptable level of service during the PM peak respectively.

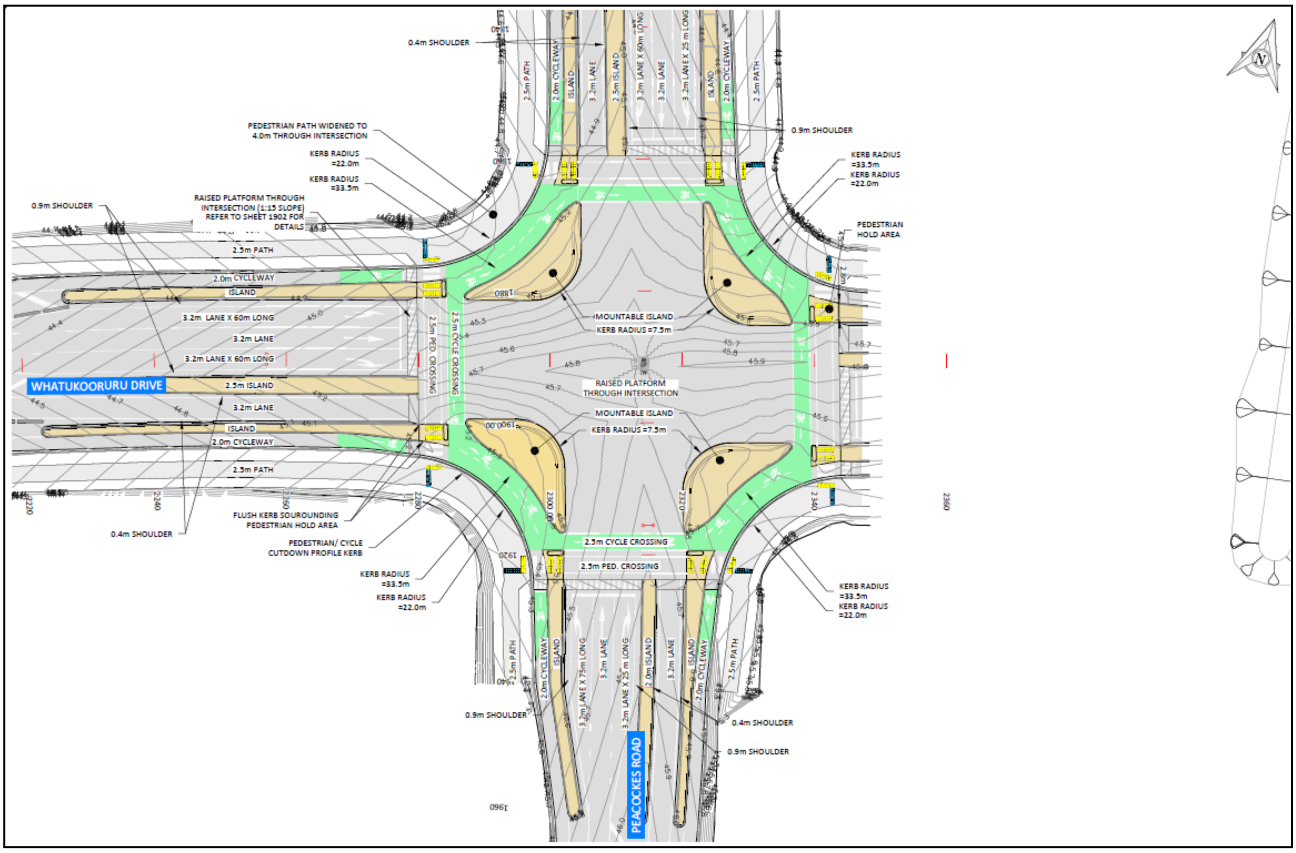


Figure No. 10: Peacockes Road/ Whatukooruru Drive Intersection Geometric Layout

4.3 Whatukooruru Drive Geometric Layout

Whatukooruru Drive is a two-lane, two-way flush median divided Minor Arterial Transport Corridor, as shown in Figure No. 11. The predicted 2041 traffic volumes on Whatukooruru Drive are approximately 9,600 vpd for the eastern section, 13,700 vpd for the central section and up to 19,900 vpd for the western section (based on traffic modelling estimates in the OPUS/AECOM Transport Modelling Report 2013).

The terrain is relatively flat so the eventual design will not result in vertical grades that affect truck speeds to the extent that an additional lane would be required.

Active (and alternative) modes will be accommodated by a 2.0m wide off-road path on each side, and 2.3m wide on-road cycle lanes that are separated from the vehicle lane with raised “zebra/armadillo” separators.

To improve safety and efficiency for public transport vehicles, bus stops will not be indented into the roadside. Instead, buses will stop within the lane while setting down and picking up passengers. Operational levels of service for cars on this carriageway will be reduced (from LOS A/B to LOS E during peak periods) as a result. However, the advantage is that public transport vehicles can operate more efficiently and safely as they do not have to enter and leave the traffic stream at each stop and, overall the safety and people moving capacity of the road corridor will be increased.

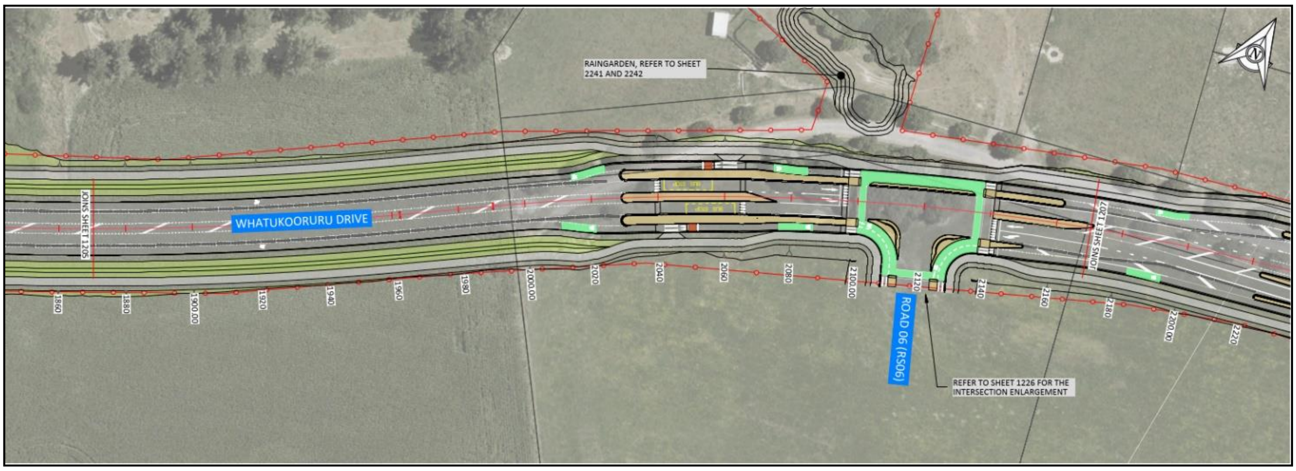


Figure No. 11: Whatukooruru Drive Geometric Layout

4.4 Mangakootukutuku Stream Bridge and Eastern Gully Bridge

Two new bridges as shown in Figure No. 12 will be constructer over the Mangakootukutuku Stream.

The bridge deck width is designed to accommodate two vehicle lanes, a flush central median, 2 m wide pedestrian footpath and a 2.3 m wide cycle path will be provided on both sides of the bridge.

Roadside barriers are proposed for each of the bridges and their associated approaches. This includes TL-5 concrete barriers with Texas HT (T80HT) rail system and semi-rigid to rigid transitions leading to end terminals. In addition, more traditional TL-3 (MASH) W-section barriers will be used at any other locations where the roadside hazard risk may be unacceptable, such as adjacent to roadside retaining walls and steep batters.

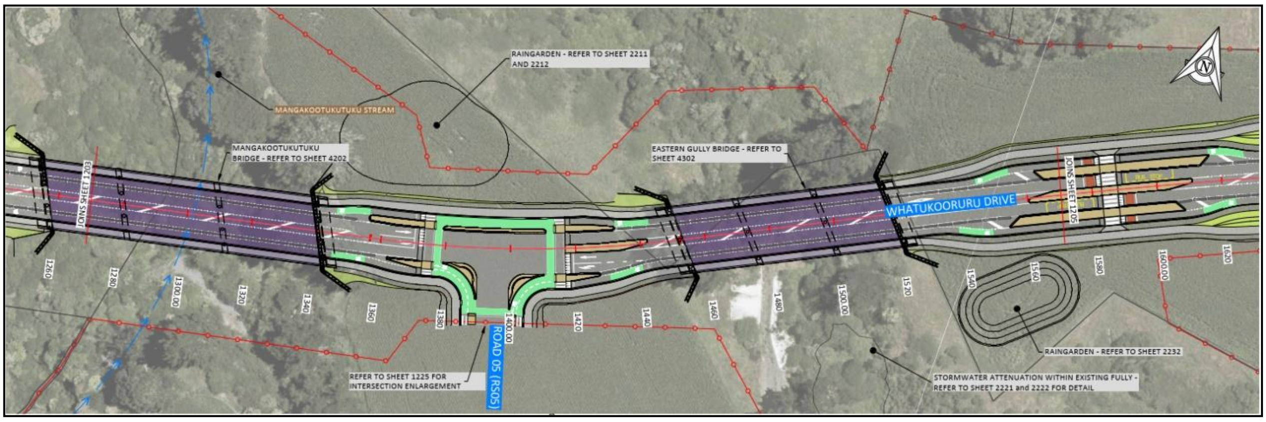


Figure No. 12: Mangakootukutuku Bridge and Eastern Gully Bridge Geometric Layout

4.5 Whatukooruru Drive Road/– Hall Road Intersection Geometric Layout

The temporary priority-controlled intersection includes three approaches positioned at right-anlges to one another, and the whole intersection is raised as a platform to provide speed management as shown in Figure No. 13. The Whatukooruru Drive approach will be Give-Way controlled (yielding to traffic on Hall Road), with free-flow on Hall Road.

The Hall Road connection to Whatukooruru Drive will be severed in future once the stage 2 works are completed, and a cul-de-sac formed on Hall Road as shown in Figure No. 14.

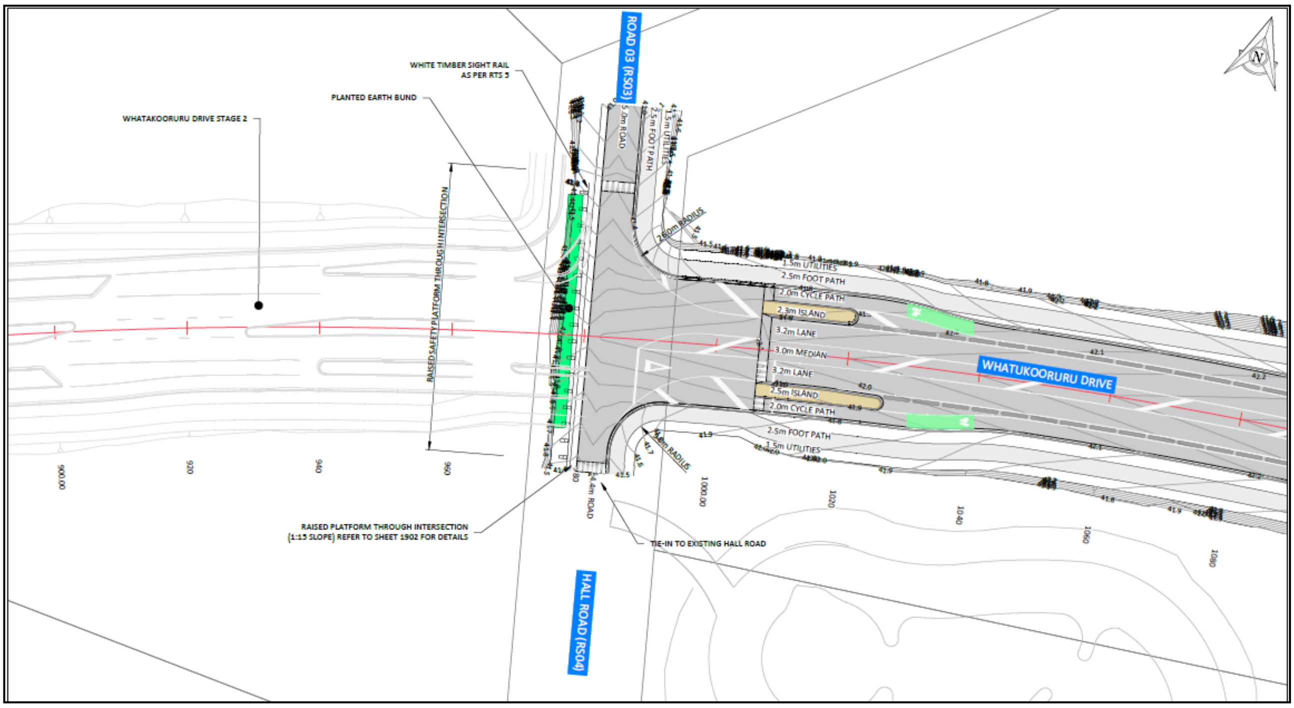


Figure No. 13: A temporary tie-in to existing Hall Road from Whatukooruru Drive

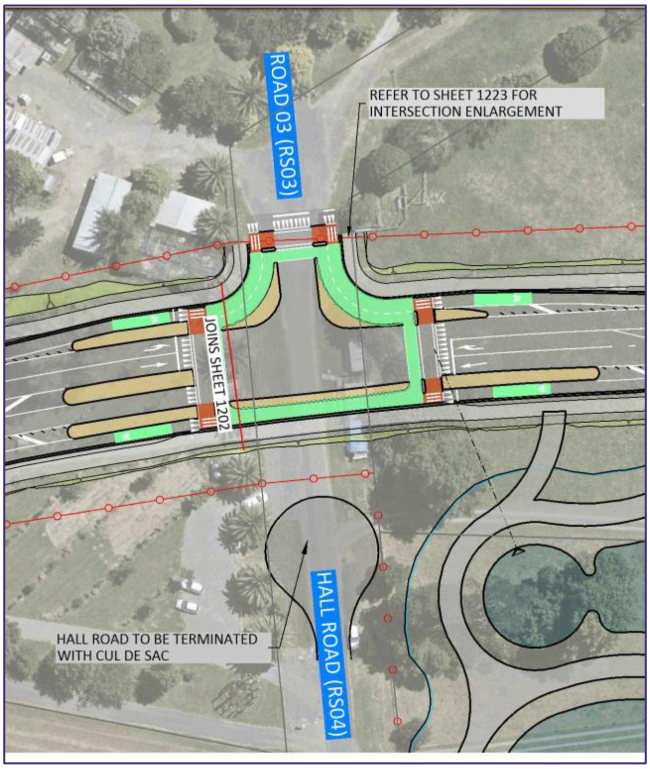


Figure No. 14: Future arrangement at Whatukooruru Drive/ Hall Road

4.6 North/ South Arterial Intersection

The intersection between Whatukooruru Drive and the North/South Arterial is not intended to be constructed as part of this project. The North/South Arterial is currently not within the HCC long term plan; and as such, there is uncertainty around the ultimate form of this road. This project aims to enable future construction of an intersection form with minimal disruption.

Based on the above hierarchy, it is expected that this intersection will take the form of a roundabout with grade separation for active modes as shown in Figure No. 15. The design of Whatukooruru drive will progress on this assumption and aim to develop a preliminary design of an intersection to a level to give HCC confidence that the final intersection, including grade, will be able to be constructed efficiently and with minimal disruption.

Figure No. 15: Future North-South Arterial/ Whatukooruru Drive intersection

4.7 Typical T-intersection Geometric Layout

Based on the hierarchy of intersection forms (as described in Section 1.5) it is expected that the future "Tee"-intersections along Whatukooruru Drive and the upgraded Peacockes Road will take the form of a signalised three-leg intersection with the use of raised safety platforms to manage vehicle speeds. In the first instance, the intersection will aim to provide the greatest level of service for active modes and public transport. This could potentially lead to a reduced LOS for vehicles; any decrease from the normal expected performance will be clearly documented and coordinated with HCC specialists.

4.8 Road Safety Audit

A Road Safety Audit for the 85% Detailed Design of Peacocke Whatukooruru Drive Project was undertaken in June 2022 by WSP Opus. The detailed design safety audit was based solely on examining the detailed design drawings and as agreed did not involve a site visit. The audit was carried out using the Stage 3 Detailed Design Stage Safety Audit checklists and was in accordance with requirements set out in the NZ Transport Agency's Safety Audit Procedures for Projects document (May 2013). The Safety Audit Team (SAT) met with the designers (BBO) and HCC on Microsoft Teams on Tuesday 2 November at 3:00pm for a pre-audit briefing.

No residual safety issues to be identified that needed to be addressed or considered.

4.9 Post implementation Review

A Post Implementation Review will be conducted by HCC in collaboration with Waka Kotahi, in accordance with condition 24.3 following the construction of the Peacocke development.

5. Pedestrian and Cycle Connectivity

Pedestrian and cycling facilities are integrated in the design in support of HCC's biking plan and the Peacocke Concept Landscape Management Plan (CLMP). The surrounding area will be complemented with a network of attractive high-quality pedestrian and cycling routes that will enhance a positive experience within the Peacocke area.

To align with the project objectives and encourage alternative transport methods, pedestrian and cycle facilities with physical separation from the road carriageway will be provided along the full length of both Whatukooruru Drive and Peacockes Road.

Facilities at intersections will be developed in accordance the design philosophy for intersections presented in Section 1.4. Where possible crossings will be grade separated, however, where not possible, vehicle speed will be managed through the use of raised safety platforms. Both current and future pedestrian desire routes will be identified in conjunction with the HCC Structure Plan to locate optimal crossing locations. Where raised zebra crossings are installed across Minor Arterial corridors, the design will include installation of ducting to enable future signalisation of the pedestrian crossing to a signal-controlled crossing (if future demand requires a greater level of crossing control).

Pedestrian/cycle kerb crossings will be developed with low (or no) lip profiles in order to avoid trip hazards and maximise accessibility to people of all mobility levels.

Paths shall generally be plain concrete, although other materials may be used for special purposes in feature areas such as bridges and intersections, to integrate with other landscape and urban design concepts and/or to embrace low-carbon alternative materials.

A comprehensive pedestrian and cycling network within the Peacocke development will improve accessibility to public transport, public facilities and places of employment. A general arrangement of the pedestrian and cycling connectivity is provided in Figure No 16 to Figure No 19 below. All pedestrian/cycle and shared paths are consistent with current best practice guidelines for moderate demand volumes.

5.1 Peacockes Road Cross Section

Pedestrian pathways and cycle lanes along Peacockes Road will continue to be physically separated from motorised traffic, as shown in Figure No 16. The configuration was designed in such a way that the bus platform and the utilisation of on-street parking provides a type of safety barrier between the cycle lanes and general traffic, as this section of Peacockes Road is likely to experience high cycling activity. The pedestrian and cycle paths will be 2.5m and 2.3m wide, respectively, which is consistent with current best practice guidelines.

For added safety, raised pedestrian crossings will be provided along Peacockes Road near the proposed PT facilities, reducing vehicle speeds which will allow pedestrians to cross the road in a safer manner. Raised pedestrian crossings are aligned with the Safe System approach that recognises that humans, as road users, make mistakes and are vulnerable to crashes. This traffic calming device lower the overall speed of vehicles to a Safe System collision speed.

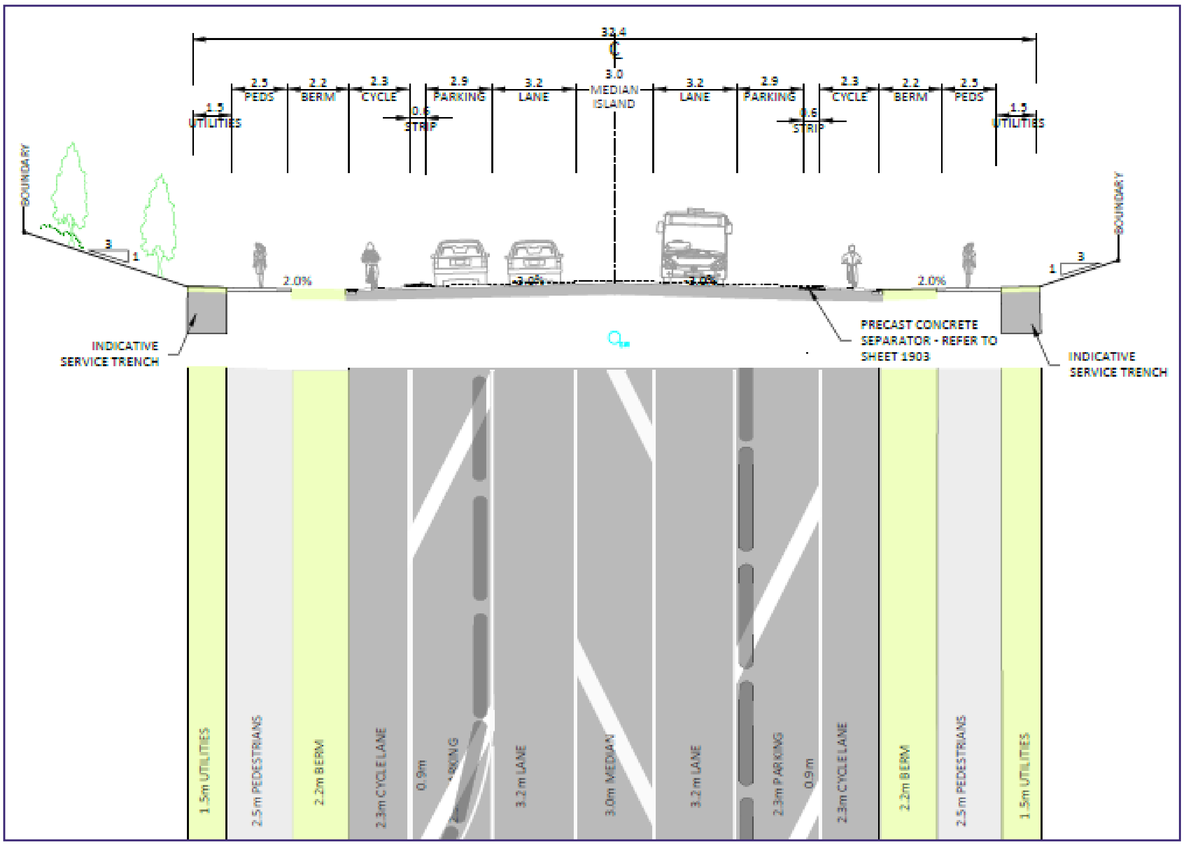


Figure No 16: Peacockes Road Typical Cross Section

5.2 Whatukooruru Drive Cross Section

Pedestrian and cycle paths will be provided on both sides of Whatukooruru Drive, as shown in Figure No 17The design shows that pedestrian pathways will be separated from cycle pathways by the 2.0 wide berm. Cycle pathways will be physically separated from motorised traffic by the precast concrete separator. Physical separation is a key component where vehicle flows are high to ensure the safety of pedestrians and cyclists. The pedestrian and cycle paths will be 2.5 m and 2.3m wide on both sides of Whatukooruru Drive, respectively, which is consistent with current best practice guidelines.

5.3 Mangakotukutuku & East Crossing Bridges Cross Section

A 2 m wide pedestrian footpath and 2.3 m wide cycle path will be provided on both sides of the two bridges as shown in Figure No.18. The design shows that pedestrian and cycle pathways will be physically separated from motorised traffic by 0.9m wide cycle lane dividers. Physical separation is a key component where vehicle flows are high to ensure the safety of pedestrians and cyclists. Barriers / fencing will also be used on the outside edges of the bridge for the prevention from falling.

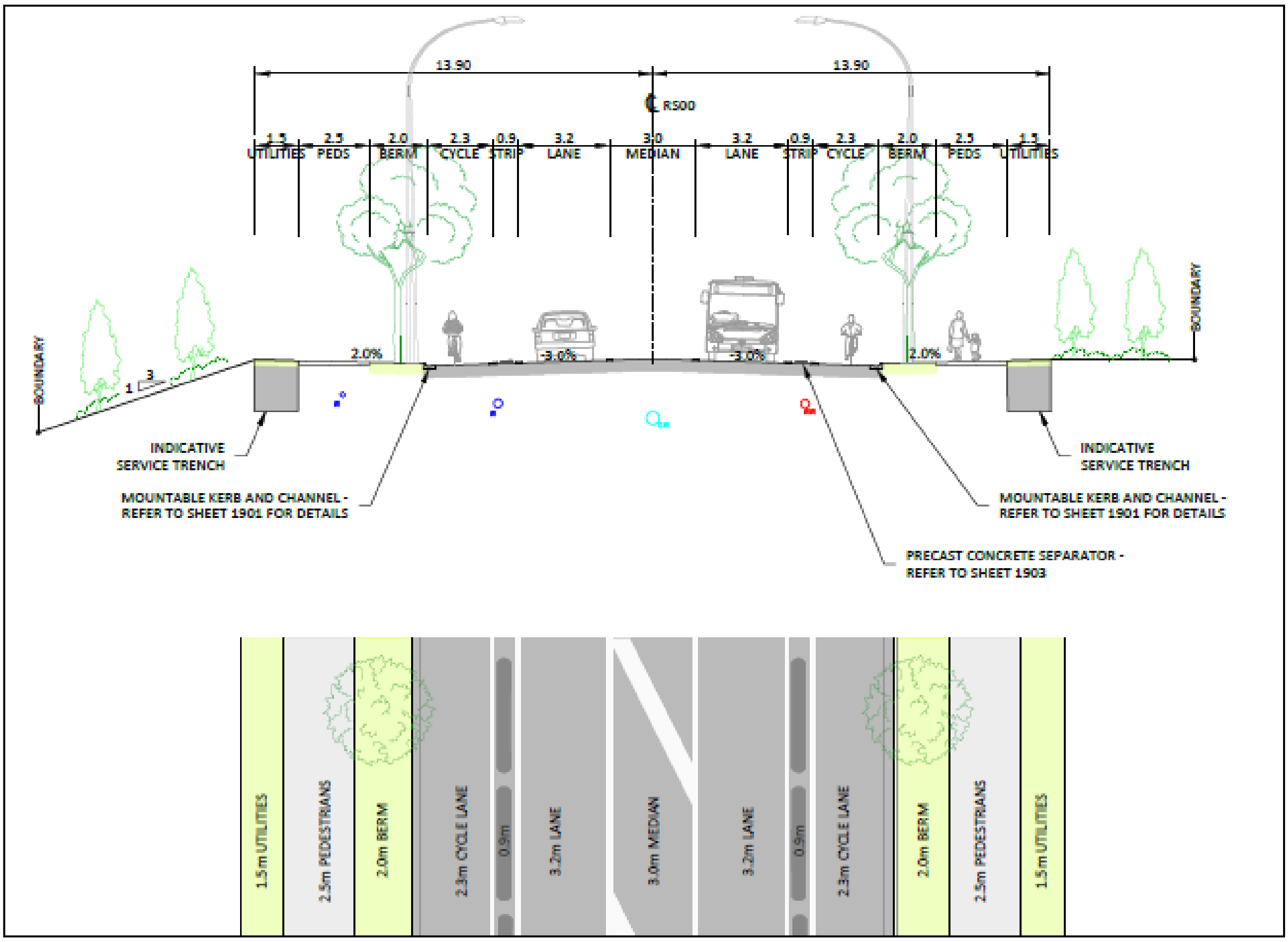


Figure No 17: Whatukooruru Drive Cross Section

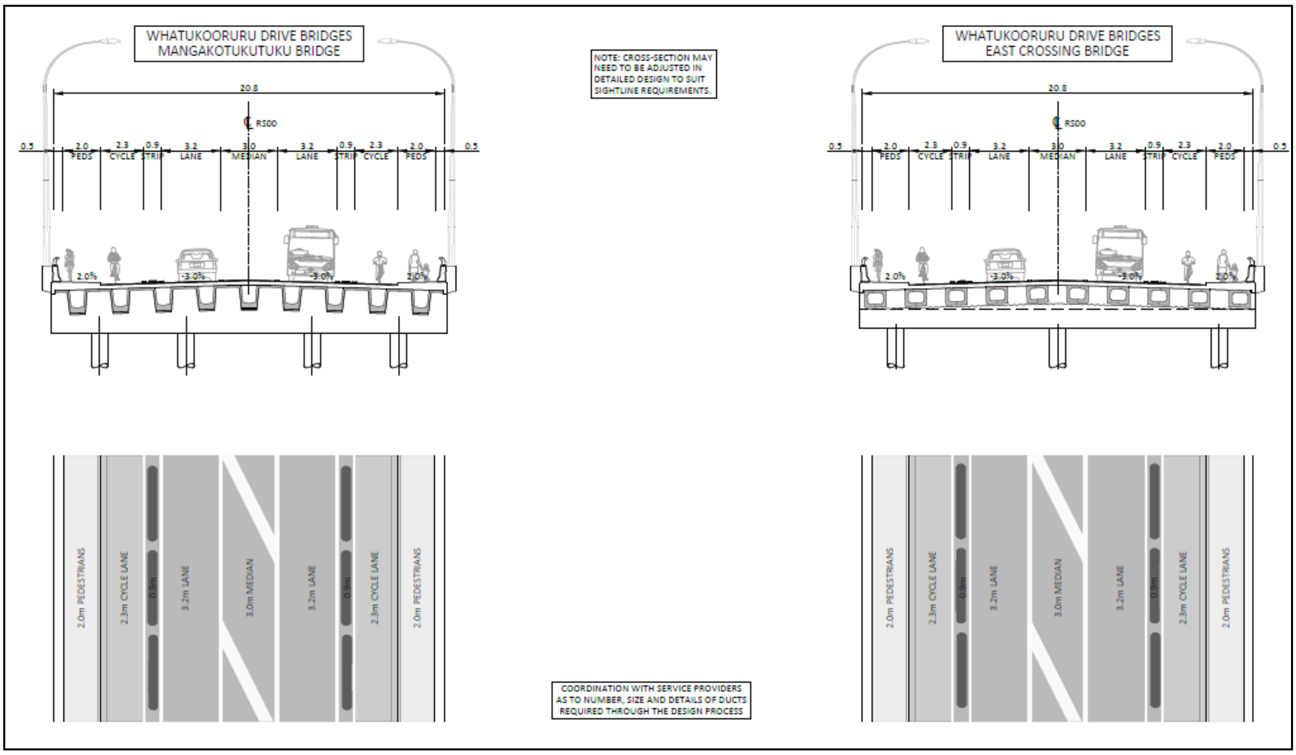


Figure No.18: Whatukooruru Drive Typical Bridge Cross Sections

5.4 Whatukooruru Drive/ Peacockes Road Signalised Intersection Crossing

The Whatukooruru Drive/ Peacockes Road signalised intersection is designed on the basis of the Copenhagen style layout with fully segregated signalised crossing facilities for pedestrians and cyclists. Cyclists that wish to avoid sharing the intersection with general traffic are provided with an exclusive clockwise travel lane around the intersection to enable safe and complete connectivity to all exits while minimising crossing conflicts with other cyclists and pedestrians. Signal phasing design is such that cycle and pedestrian signal crossings have an early-start on the left turn that runs in the same stage. Since cyclists are travelling in the clockwise direction on these crossings, it means the early start is essentially full protection from opposing vehicle movements. However, the signal phasing provides partial protection to pedestrians from left turn traffic since pedestrians can walk in in the anti-clockwise direction on the crossings.

Suitable ground markings, drop kerb facilities and signs will be provided for pedestrians and cyclists, including ingress and egress ramps for cyclists accessing the shared path facilities.

This is a raised platform intersection, as shown in Figure No 19, with ramp gradients designed to slow vehicles to no more than 30 km/h through the intersection. According to the Waka Kotahi's Standard Safety Intervention (SSI) Toolkit, raised intersections are used as vertical speed control elements that promote survivable impact speeds for pedestrians if hit by a vehicle travelling through the intersection.

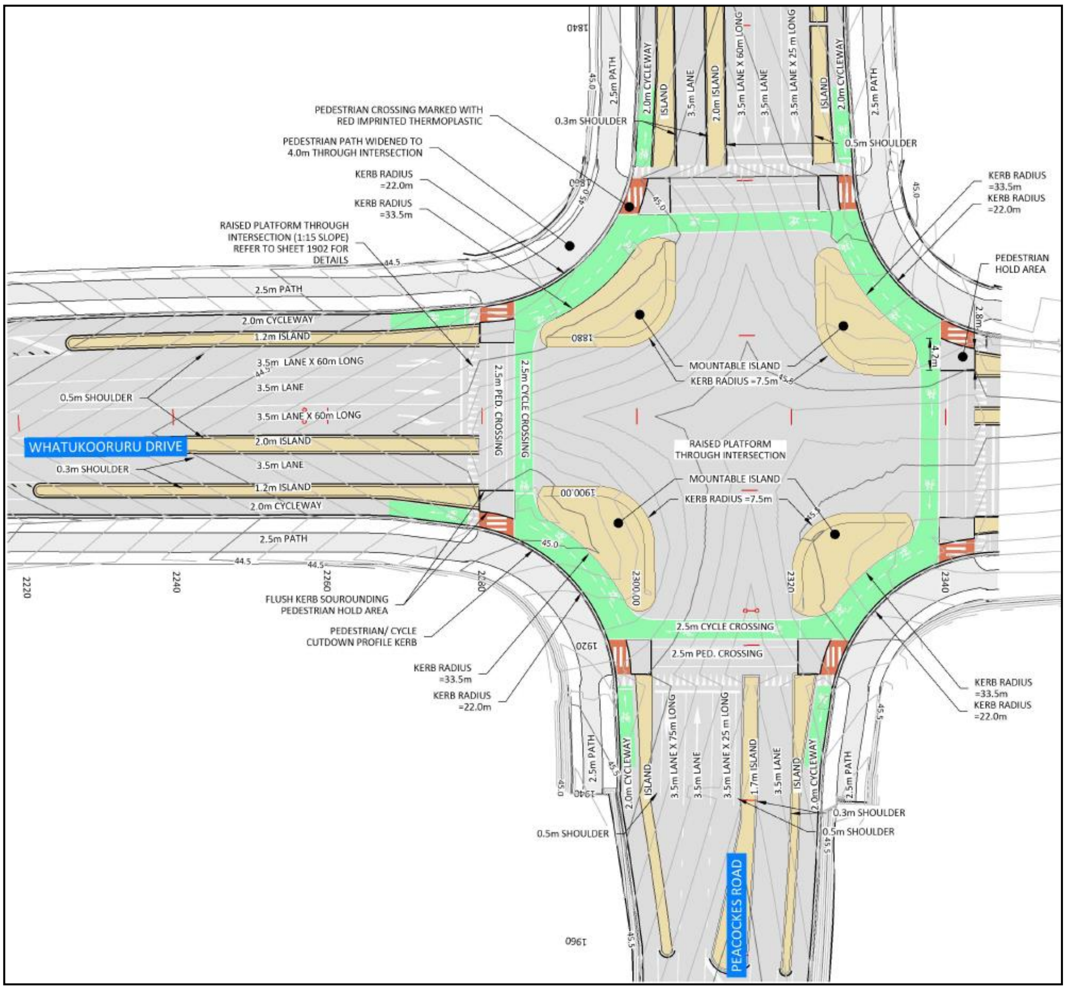


Figure No 19: Whatukooruru Drive/ Peacockes Road signalised intersection crossing

5.5 Road Marking & Signage

All street signage will be in accordance with the requirements of the Waka Kotahi's Manual of Traffic Control Devices (TDCD) and Manual of Traffic Signs and Markings (MOTSAM), and specific signage layouts will be provided for the extent of the Project. Pavement markings will initially be applied with Waka Kotahi's standard specification NZTA M/7 paint materials, which will include the Regional Infrastructure Technical Specifications (RITS) requirements.

Road marking and signage form an essential part of a successful transport strategy; therefore, special care was taken into consideration with the placement of road marking and signage. It is important that sufficient signs/road marking are displayed to allow drivers time to comprehend and safely react. Advance warning signs will be a contributing factor for the speed environment as well as clear and consistent signs which will help avoid driver confusion and sudden manoeuvres that could result in serious high-speed crashes.

5.6 Tactile Pavers

Tactile pavers for the blind and vision impaired pedestrians are provided at all intersections and crossing points where applicable. The tactile pavers were designed in accordance with Waka Kotahi's RTS 14 (Guidelines for facilities for blind and vision impaired pedestrians) and provide pedestrians with visual and sensory information.

Audible Tactile Traffic Signals (ATTS) are located at the Whatukooruru Drive/ Peacockes Road signalised intersection as well as the several signalised intersections located along Whatukooruru Drive and Peacocked Road. The ATTS is a push-button system at traffic signals that make a continuous beeping sound to indicate that it is safe to cross the road. Providing this type of facility will help the visually impaired with their orientation and making the intersection pedestrian friendly.

5.7 Summary of Pedestrian and Cycling Facilities

The future pedestrian and cycling design within the Project area aligns with the Peacocke Structure Plan. Universal access for people with special needs are addressed in the planning and designing stage. The Project also provides a network of walking and cycling pathways that will benefit active modes, reduce carbon emission, reduce congestion and improve the general public's wellbeing. Pedestrian and cycling facilities will be integrated into the design of intersections with pedestrian/cycle priority systems to be included within the traffic light systems at the Whatukooruru Drive/ Peacockes Road intersection and into traffic systems of other signalised T-intersections presented on Whatukooruru Drive and Peacockes Road. Suitable ground markings, drop kerb facilities and signage will be provided for pedestrians and cyclists and will include ingress and exit points for cyclist that access shared path facilities.

6. Public Transport Infrastructure

According to the Regional Infrastructure Technical Specifications 2018 (RITS), 400 m is an acceptable walking distance to public transport. However, a shorter distance shall be considered near centres and major public transport routes.

HCC has expressed a desire to set a very high level of service for public transport operations in the Peacocke area. As such, HCC has requested that a dedicated traffic lane and bus priority measures are provided to serve public transport in the future. WRC are currently looking at proposed bus routes within the Peacocke area and would ideally prefer that buses are the first form of transport to operate along the new corridor.

There are currently two bus services (Comet via Glenview and Fitzroy #12) that operates on the western extent of Peacocke, as shown in Figure No 20. Bus route 12 Fitzroy currently operates on a small section of Peacockes Road, between Norrie Street and Waterford Road. The service operates seven days a week including public holidays and travels between Hamilton Transport Centre and Dixon Road.

We are aware that Waikato Regional Council has presented a working paper to HCC on bus planning in the Peacocke area. The proposals in this paper are yet to be discussed with HCC staff and has no current status. Hence, any changes in public transport solutions that come from this working paper should be considered in subsequent reviews of this TNMP once it has been agreed with and approved by HCC.

Figure No 20: Existing public Transport Routes

The provision for future public transport along Peacockes Road and Whatukooruru Drive will be prioritised.

The HCC Transportation team have indicated that the shelters, where possible, should enable “Adshel” type features to be incorporated within the shelter, thereby requiring suitable underground electricity ducts to enable power supply to be provided to each shelter.

The use of traffic lanes for buses on Whatukooruru Drive and Peacockes Road are generally compatible with latest design standards, with some minor adjustment. These adjustments have been reflected and presented in section 6.3.4 of the Peacocke East West Arterial Background Report. The recommended arrangement that provides an outcome for both buses and safely accommodating on-road cyclists is shown in Figure No 21. Proposed bus stop provisions will be compatible with latest WRC planning and consistent with HCC network planning.

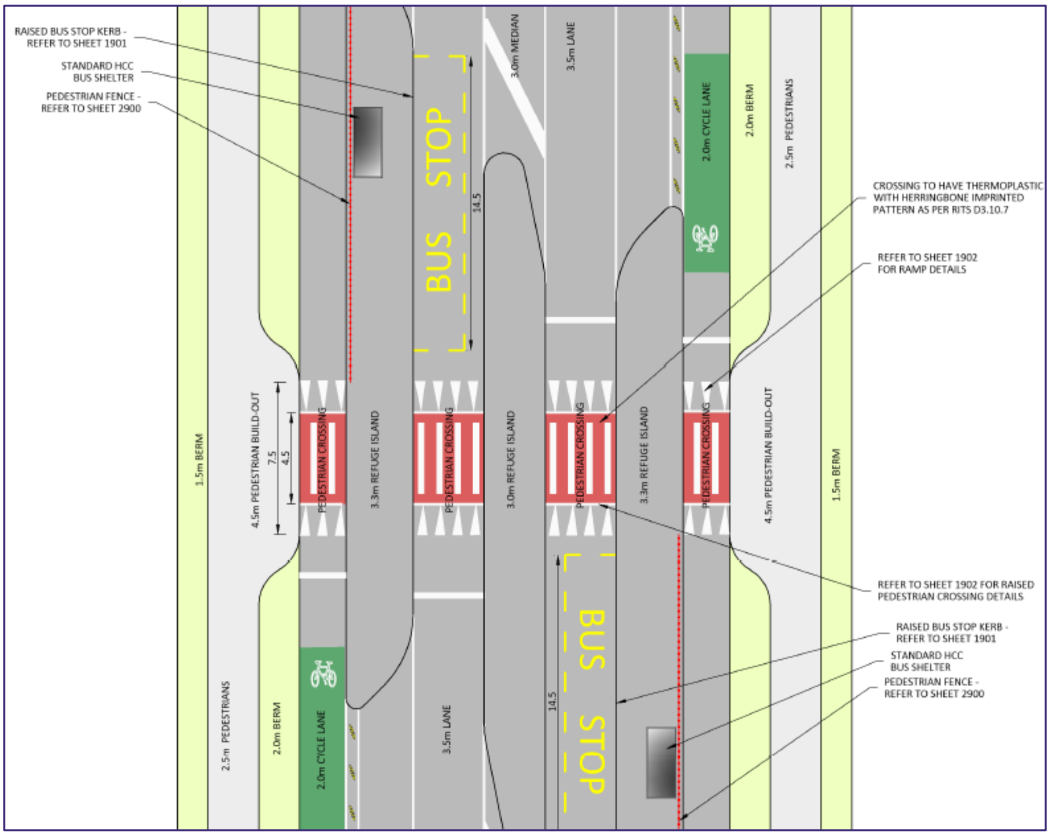


Figure No 21: General bus stop arrangement on Minor Arterial Roads

Kerbside boarding along Peacockes Road and Whatukooruru Drive were designed for universal accessibility (raised floor platform / level boarding) for wheelchair passengers. The platform will have sufficient space for a bus shelter and bus stop and will be constructed in accordance with the RITS standard (not including the "mini" shelter) and coordinated with positions of pedestrian crossing points. Final positions of bus stops will be agreed with HCC Transportation staff.

Bus stops will not be indented into the roadside, instead buses will stop within the lane while passengers are boarding and alighting as this will improve safety and efficiency for public transport. As a result, Peacockes Road and Whatukooruru Drive will experience prolonged delays during the AM and PM peak periods.

The advantage is that public transport vehicles can operate more efficiently and safely as they do not have to enter and leave the traffic stream at each stop. Overall, the safety and active mode capacity of the road corridor will be increased with this approach. Supporting an HCC desire to reduce reliance on private vehicles and encourage the use of public transport and active modes.

7. Future Demand Volumes

7.1 Waikato Regional Transportation Model (WRTM)

The WRTM is a multi-modal strategic planning tool that forecasts travel demand based on future land use and road network changes. The current WRTM has 2,500 zones and is calibrated to 2013 census data and traffic volumes on strategic network links. The model has forecast years 2021, 2031, 2041 and 2051 which is based on the National Institute of Demographic and Economic Analysis (NIDEA) “low” growth projections.

The 2041 WRTM version released in 2017 (file reference: WL41BBAALLB3 and WL41BBPALLB3) was reviewed by BBO, Waka Kotahi and HCC in collaboration with other recognised traffic modellers in Hamilton at the start of the Project. It was agreed by all in those meetings that there were seemingly significant inconsistencies between the original Southern Links designation models and the WRTM in terms of projected traffic volumes using the future strategic network. The group of engineers also agreed that the WRTM was the more up to date and appropriate tool to use, but that it predicted unrealistically low demand volumes for 2041. The group agreed that the reasons needed to be understood and so Waka Kotahi commissioned WRTM TRACKS developer, Stantec to compare the land use inputs to the designation models and the WRTM. Stantec identified a number of differences outside of Peacocke area, and approximately 1,000 more households in Peacocke in the designation models, but neither were the clear reason for the significantly lower volumes in the WRTM. Accordingly, BBO undertook additional work in the WRTM, with all the zones within the Peacocke Structure Plan area updated, including zone loading positions as this influence’s volumes at intersections nearby. The updates were done in collaboration with Tony Denton, the Infrastructure Planning Manager for HCC. Mr Denton had provided his prediction information on household numbers within 34 developable areas in Peacocke, with different densities and development timelines. The sketch provided by Mr Denton is attached in Appendix C.

With this information, BBO worked closely with Stantec in developing a Peacocke WRTM 2041 project model (file reference: WL41S1AALL5A and WL41S1PALL5A). This project model was used to forecast the Strategic network traffic volumes, to help guide the design on the basis of full build-out in 20 years (2041).

A Northern Precinct WRTM project model (file reference: WL31NDFALL5H.NL), which incorporated land use and road network information from the Peacocke WRTM project model, was subsequently developed for the Hamilton Airport area. By way of summary, the Northern Precinct WRTM project model included the following components:

- Only a 2031 assessment was undertaken for the project, which means that only the 2031 land use is included for the Peacocke area.
- The Airport Business Zone is fully developed which includes 104 ha of the Northern Precinct development.
- Southern Links is included.

Given that this latest model includes the latest land use and network changes for both the Peacocke and Northern Precinct areas, traffic volumes data from both the Peacocke and Northern Precinct WRTM project models were used; the additional 2041 land use in the Peacocke area is accounted for by adding the difference in traffic volumes between the 2041 Peacocke WRTM model (WL41S1FALL5A.NL) and the 2031 Northern Precinct WRTM model (WL31NDFALL5H.NL). The resulting peak hour volumes are presented in Figure No 22. As shown in the figure, only the 2041 PM peak hour turning volumes are provided as only this peak period was assessed given that it was the worst performing peak period.

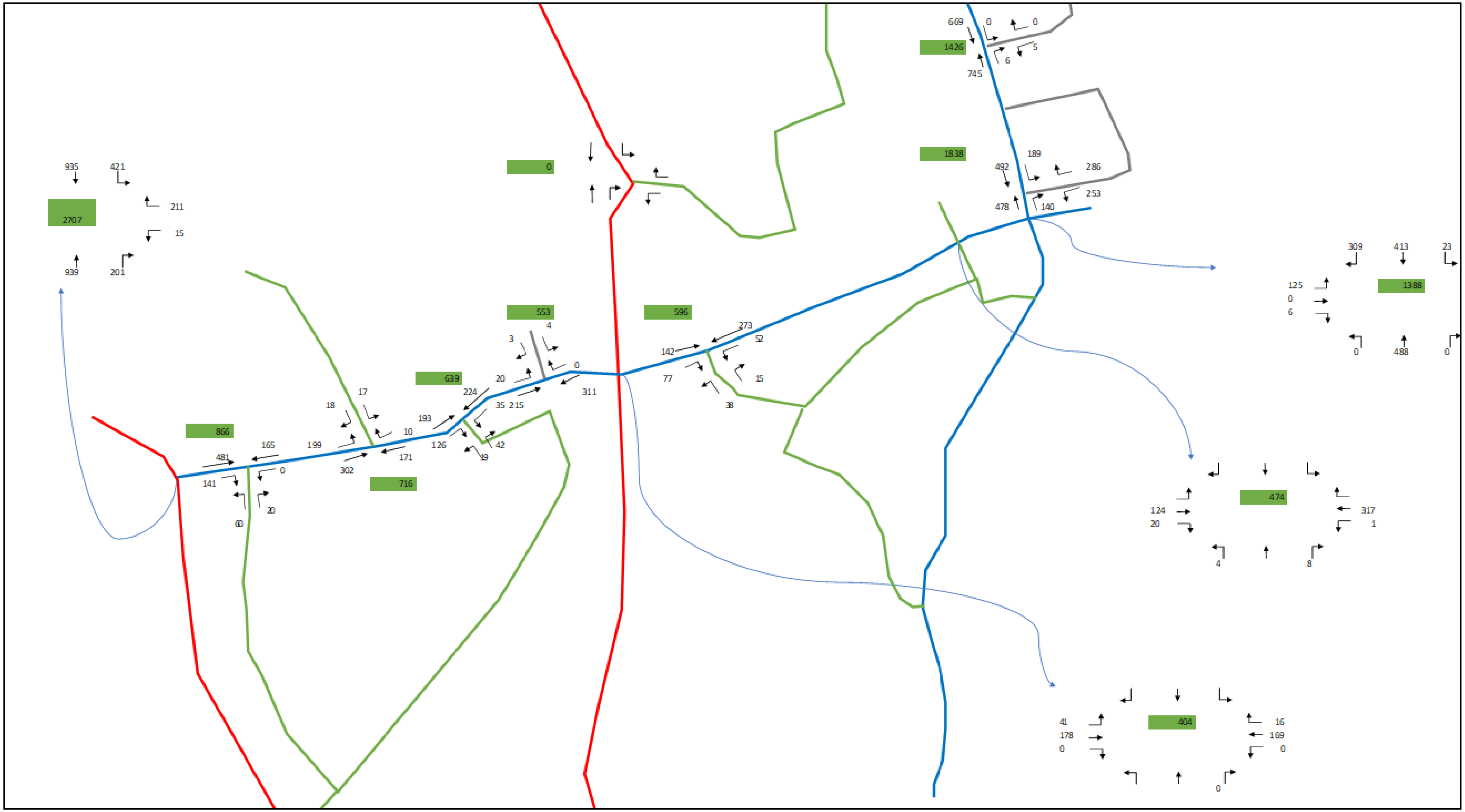


Figure No 22: Predicted 2041 PM Peak Hour Turning Volumes within the Project area

8. Future Intersection Performance

8.1 Intersection Layout

The key intersections within the Project network include:

- Peacockes Road / Whatukooruru Drive intersection
- Four "cyclist and pedestrian protected" signalised T-intersections along Whatukooruru Drive and the upgraded section of Peacockes Road.

These intersections have been designed on the basis of the foreseeable travel modes and demand volumes from the wider completed development, and in accordance with HCC's design philosophy objectives.

8.2 Capacity Analysis

The Level of Service (LOS) and 95th percentile vehicle queue length for the 2041 PM Peak hour scenario is summarised in Table No. 3.

LOS is a measure used to assess the operation of existing transportation infrastructure, as well as the effectiveness of infrastructure improvements. LOS is categorised in letters A to F, with A being the best and F being the worst, based on the average control delay experienced by vehicles at the intersection approaches. Broadly it can be defined as follows:

- A = Free flow
- B = Reasonably free flow
- C = Stable flow
- D = Approaching unstable flow
- E = Unstable flow
- F = Forced or breakdown flow

8.3 Peacockes Road / Whatukooruru Drive

The Peacockes Road / Whatukooruru Drive intersection configuration, shown below in Figure No 23, was derived from assessments in SIDRA Intersection v 9.0 software using the predicted 2041 PM peak hour demand flows described shown in Figure No 24.

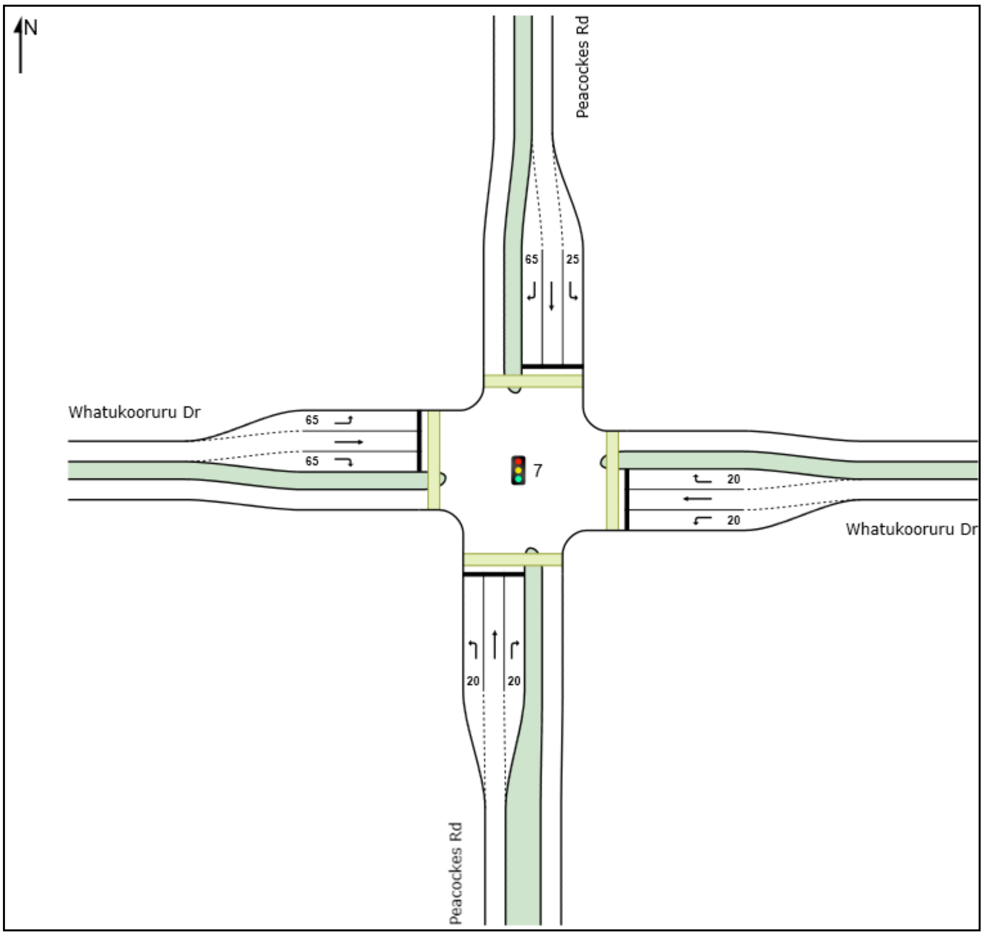


Figure No 23: Peacockes Road / Whatukooruru Drive signalised intersection

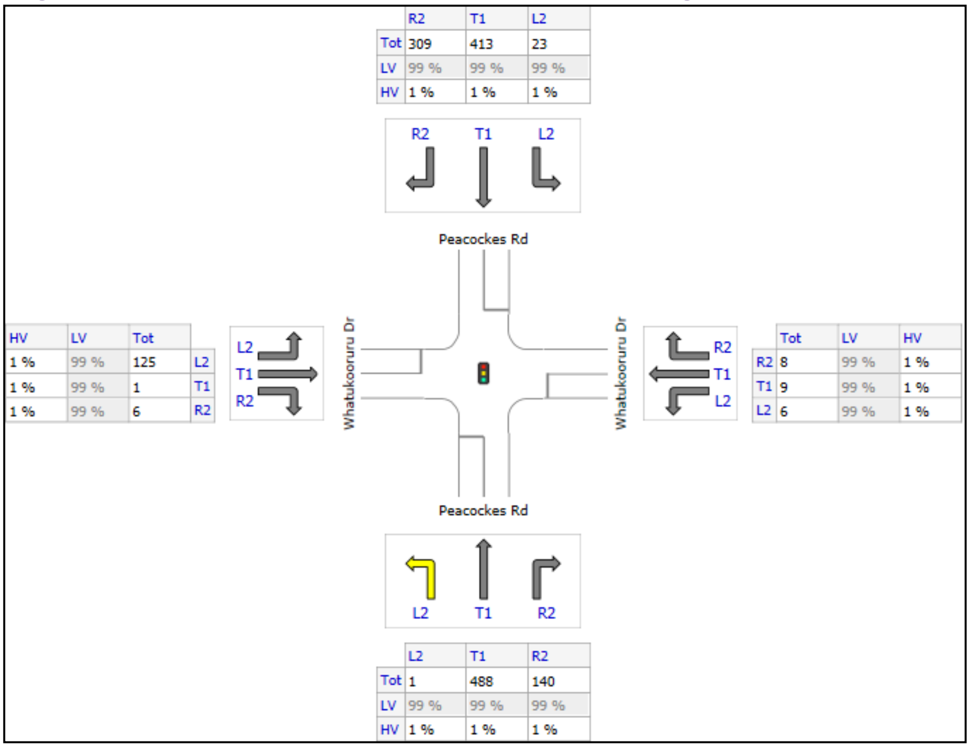


Figure No 24: 2041 PM Peak flows at the Whatukooruru Drive/ Peacockes Road intersection

Figure No 25 show that the intersection operates at an acceptable level of service with performance ranging between LOS C and D during the 2041 PM Peak period. As shown in the SIDRA Lane performance summary is provided in Table No. 4, the greatest congestion is on Peacockes Road during the PM Peak period operating at LOS D, with a 95th percentile queue of approximately 23 and 17 vehicles for the southern and northern approaches, respectively. The longest queues of vehicles for Whatukooruru Drive are mostly predicted for the eastbound approach (the left-turn lane) with a 95th percentile queue of five vehicles. This is a low/medium level of congestion that should cause no major issues for Public Transport travel time reliability.

This design meets HCC's objectives and priorities for the Project to provide efficiency for public transport and a high level of safety for all users, ensure safety, convenience and a high quality of amenity for non-motorised transport modes.

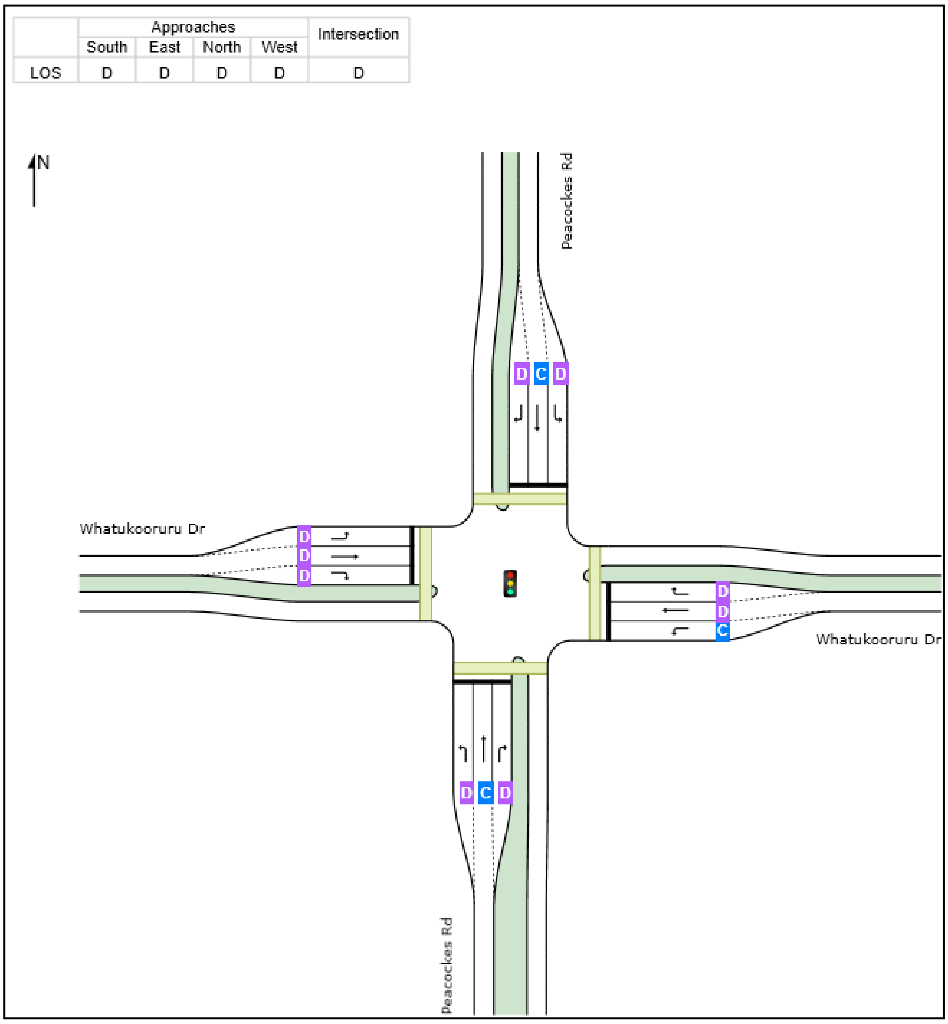


Figure No 25: 2041 PM Peak Level of Service by Lane

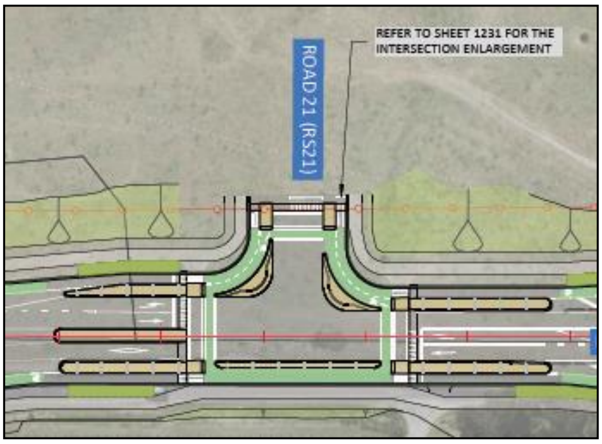
Table No. 4: Peacockes Road / Whatukooruru Drive – 2041 PM Peak Performance

Lane Use and Performance	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Peacockes Rd													
Lane 1	1	1.0	122	0.009	100	49.1	LOS D	0.0	0.3	Short	20	0.0	NA
Lane 2	514	1.0	637[1]	0.806	100	34.4	LOS C	22.8	161.2	Full	500	0.0	0.0
Lane 3	147	1.0	235[1]	0.626	100	38.7	LOS D	5.8	41.0	Short	20	0.0	NA
Approach	662	1.0		0.806		35.4	LOS D	22.8	161.2				
East: Whatukooruru Dr													
Lane 1	6	1.0	405	0.016	100	34.8	LOS C	0.2	1.6	Short	20	0.0	NA
Lane 2	9	1.0	255	0.037	100	38.2	LOS D	0.4	2.7	Full	200	0.0	0.0
Lane 3	8	1.0	122	0.069	100	50.3	LOS D	0.4	2.6	Short	20	0.0	NA
Approach	24	1.0		0.069		41.5	LOS D	0.4	2.7				
North: Peacockes Rd													
Lane 1	24	1.0	122	0.199	100	51.3	LOS D	1.1	7.7	Short	25	0.0	NA
Lane 2	435	1.0	611[1]	0.712	100	29.5	LOS C	17.2	121.5	Full	185	0.0	0.0
Lane 3	325	1.0	405	0.803	100	46.3	LOS D	15.2	107.6	Short	65	0.0	NA
Approach	784	1.0		0.803		37.2	LOS D	17.2	121.5				
West: Whatukooruru Dr													
Lane 1	132	1.0	405	0.325	100	37.8	LOS D	5.1	35.7	Short	65	0.0	NA
Lane 2	1	1.0	255	0.004	100	37.4	LOS D	0.0	0.3	Full	135	0.0	0.0
Lane 3	6	1.0	122	0.052	100	50.1	LOS D	0.3	2.0	Short	65	0.0	NA
Approach	139	1.0		0.325		38.3	LOS D	5.1	35.7				
Intersection	1609	1.0		0.806		36.6	LOS D	22.8	161.2				

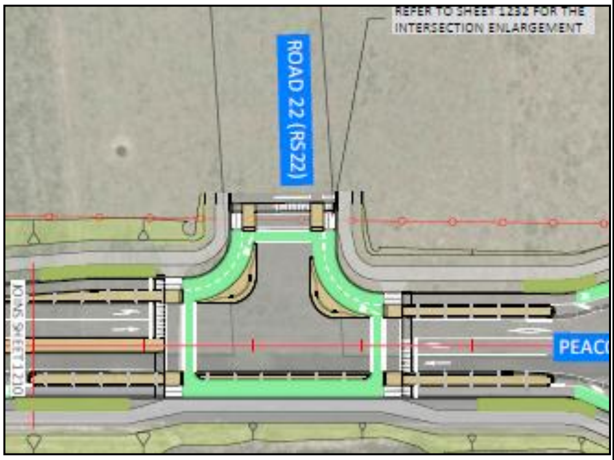
8.4 Signalised T-intersections on Peacockes Road and Whatukooruru Drive

The configurations of the four T-intersections are shown in Figure No 26 below.

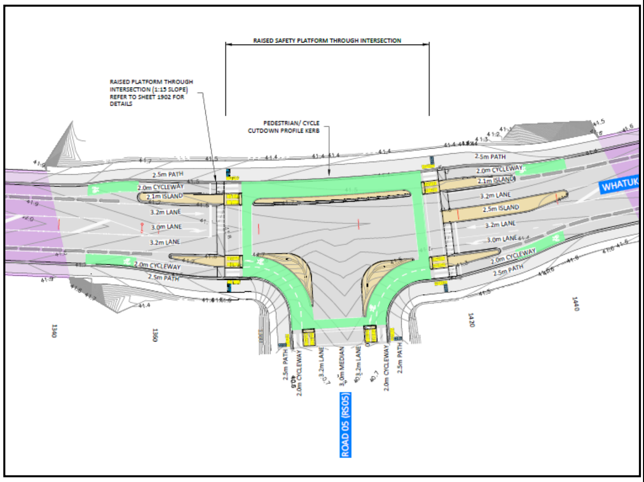
Peacockes Road/ Road 21



Peacockes Road/ Road 22



Whatukooruru Drive/ Road 05



Whatukooruru Drive/ Road 06

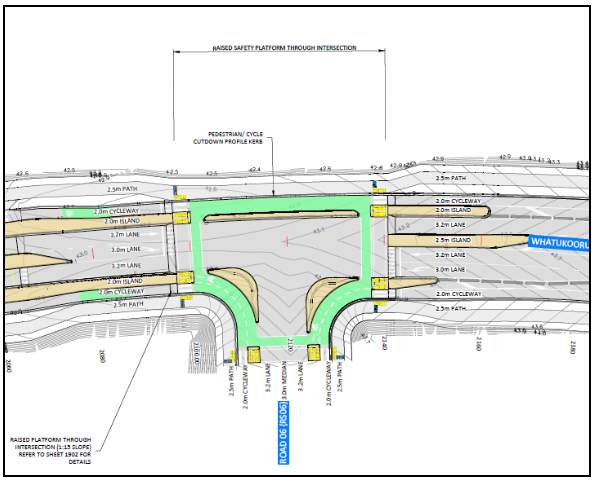


Figure No 26: Peacockes Road & Whatukooruru Drive signalised T-intersections

Table No. 5 provides the summary of intersections performance at PM Peak hours, while The SIDRA Lane performance summary are provided in Table No. 6 to Table No. 9.

As per the summary of Sidra's reports, all four intersections are expected to operate at acceptable levels of service with performances expected to range between LOS B and C during the 2041 PM Peak period. The greatest congestion is on the intersection of Whatukooruru Drive with Road 05, where Whatukooruru Drive during the PM Peak period operates at LOS C, with a 95th percentile queue length of approximately 50 vehicles. This is a low/medium level of congestion that should cause no major issues for Public Transport travel time reliability.

Table No. 5: Summary of T-intersections performance level at Whatukooruru Drive and Peacockes Road

T-Intersection	LOS of All vehicles	95-% back of queue, m	Average Delay, sec
Whatukooruru Drive/Road 5	C	49.9	7
Whatukooruru Drive/Road 6	B	59.8	9
Peacockes Road/ Road 21	B	26.7	15
Peacockes Road/ Road 22	B	27.5	16

Table No. 6: Whatukooruru Drive/Road 5 – 2041 PM Peak Performance

Site: 5 [Whatukooruru Drive / Road 5 - PM Peak (Site Folder: Year 2041 - No North/ South Arterial)]

Whatukooruru Drive / Road 5
Site Category: Future Conditions 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 55 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Road 5													
Lane 1	40	0.0	571	0.070	100	19.2	LOS B	0.8	5.4	Full	200	0.0	0.0
Lane 2	16	0.0	202	0.078	100	29.7	LOS C	0.4	2.8	Short	25	0.0	NA
Approach	56	0.0		0.078		22.2	LOS C	0.8	5.4				
East: Whatukooruru Drive													
Lane 1	55	0.0	199	0.274	100	30.7	LOS C	1.5	10.2	Short	25	0.0	NA
Lane 2	287	1.0	472[1]	0.609	100	20.2	LOS C	7.1	49.9	Full	500	0.0	0.0
Approach	342	0.8		0.609		21.9	LOS C	7.1	49.9				
West: Whatukooruru Drive													
Lane 1	149	1.0	911	0.164	100	9.0	LOS A	2.3	16.3	Full	360	0.0	0.0
Lane 2	81	0.0	199	0.406	100	31.2	LOS C	2.2	15.4	Short	25	0.0	NA
Approach	231	0.6		0.406		16.8	LOS B	2.3	16.3				
Intersection	628	0.7		0.609		20.1	LOS C	7.1	49.9				

Table No. 7: Whatukooruru Drive/Road 6 – 2041 PM Peak Performance

Site: 6 [Whatukooruru Drive / Road 6 - PM Peak (Site Folder: Year 2041 - No North/ South Arterial)]

Whatukooruru Drive / Road 6
Site Category: Future Conditions 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 62 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Road 6													
Lane 1	4	0.0	536	0.008	100	21.3	LOS C	0.1	0.6	Full	200	0.0	0.0
Lane 2	8	0.0	179	0.047	100	33.4	LOS C	0.2	1.7	Short	25	0.0	NA
Approach	13	0.0		0.047		29.3	LOS C	0.2	1.7				
East: Whatukooruru Drive													
Lane 1	1	0.0	177	0.006	100	32.6	LOS C	0.0	0.2	Short	25	0.0	NA
Lane 2	334	1.0	620[1]	0.538	100	19.0	LOS B	8.5	59.8	Full	135	0.0	0.0
Approach	335	1.0		0.538		19.0	LOS B	8.5	59.8				
West: Whatukooruru Drive													
Lane 1	131	1.0	995	0.131	100	8.4	LOS A	2.0	14.4	Full	500	0.0	0.0
Lane 2	21	0.0	177	0.119	100	33.9	LOS C	0.6	4.3	Short	25	0.0	NA
Approach	152	0.9		0.131		11.9	LOS B	2.0	14.4				
Intersection	499	0.9		0.538		17.1	LOS B	8.5	59.8				

Table No. 8: Peacockes Road / Road 21 – 2041 PM Peak Performance

Site: 21 [Peacockes Road / Road 21 - PM Peak (Site Folder: Year 2041 - No North/ South Arterial)]

Peacockes Rd / Road 21
Site Category: Future Conditions 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 111 seconds (Site Optimum Cycle Time - Minimum Delay)

Lane Use and Performance	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Peacockes Rd													
Lane 1	784	1.0	1258 [1]	0.623	100	11.6	LOS B	24.1	170.2	Full	195	0.0	0.0
Lane 2	6	0.0	99	0.064	100	60.9	LOS E	0.3	2.4	Short	25	0.0	NA
Approach	791	1.0		0.623		12.0	LOS B	24.1	170.2				
East: Road 21													
Lane 1	5	0.0	383	0.014	100	41.8	LOS D	0.2	1.6	Full	200	0.0	0.0
Lane 2	1	0.0	150	0.007	100	55.6	LOS E	0.1	0.4	Short	25	0.0	NA
Approach	6	0.0		0.014		44.1	LOS D	0.2	1.6				
North: Peacockes Rd													
Lane 1	1	0.0	148	0.007	100	55.6	LOS E	0.1	0.4	Short	25	0.0	NA
Lane 2	704	1.0	1058 [1]	0.666	100	18.9	LOS B	26.7	188.8	Full	195	0.0	2.1
Approach	705	1.0		0.666		18.9	LOS B	26.7	188.8				
Intersection	1502	1.0		0.666		15.4	LOS B	26.7	188.8				

Table No. 9: Peacockes Road / Road 22 – 2041 PM Peak Performance

Site: 22 [Peacockes Road / Road 22 - PM Peak - No suburban centre access (Site Folder: Year 2041 - No North/South Arterial)]

Peacockes Rd / Road 22
Site Category: Future Conditions 1
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 111 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance: Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Peacockes Rd														
11	T1	764	1.0	804	1.0	0.635	11.8	LOS B	25.2	177.7	0.64	0.59	0.64	35.3
12	R2	1	0.0	1	0.0	* 0.011	59.7	LOS E	0.1	0.4	0.96	0.59	0.96	16.1
Approach		765	1.0	805	1.0	0.635	11.9	LOS B	25.2	177.7	0.64	0.59	0.64	35.2
East: Road 22														
1	L2	15	0.0	16	0.0	0.041	42.3	LOS D	0.7	4.8	0.83	0.68	0.83	20.1
3	R2	8	0.0	8	0.0	0.056	56.8	LOS E	0.4	3.0	0.95	0.66	0.95	16.9
Approach		23	0.0	24	0.0	0.056	47.3	LOS D	0.7	4.8	0.87	0.67	0.87	18.8
North: Peacockes Rd														
4	L2	23	0.0	24	0.0	* 0.163	57.8	LOS E	1.3	8.9	0.96	0.71	0.96	16.8
5	T1	681	1.0	717	1.0	* 0.698	19.1	LOS B	27.5	194.2	0.78	0.70	0.78	29.9
Approach		704	1.0	741	1.0	0.698	20.3	LOS C	27.5	194.2	0.78	0.70	0.78	29.1
All Vehicles		1492	1.0	1571	1.0	0.698	16.4	LOS B	27.5	194.2	0.71	0.64	0.71	31.6

This design meets HCC's objectives and priorities for the Project to provide efficiency for public transport and a high level of safety for all users, ensure safety, convenience and a high quality of amenity for non-motorised transport modes.

8.5 Summary

The analysis was calculated based on conservative flow prediction scenarios for the 2041 PM peak period. The models show an indication of the expected performance of the Peacockes Road / Whatukooruru Drive intersection and adjacent signalised T-intersections once the Peacocke growth cell is fully completed.

The predicted performance of Peacockes Road / Whatukooruru Drive intersection ranging between LOS C and D during the 2041 PM Peak period. LOS C and D in general is acceptable operating service for facility users at urban roads.

Th predicted performance of the four signalised T-intersections are expected to operate at LOS B to C for the 2041 PM peak periods.

To reduce the delay to pedestrians and cyclist alternative phasing or/and special timing options (e.g., reduced upper limit for cycle time) can be applied. However, this would increase the delay to motorised transport. So, the design represents the priority the HCC wishes to afford non-motorised and public transport. Therefore, the reduced LOS for traffic will be acceptable.

9. Conclusions - Project Summary

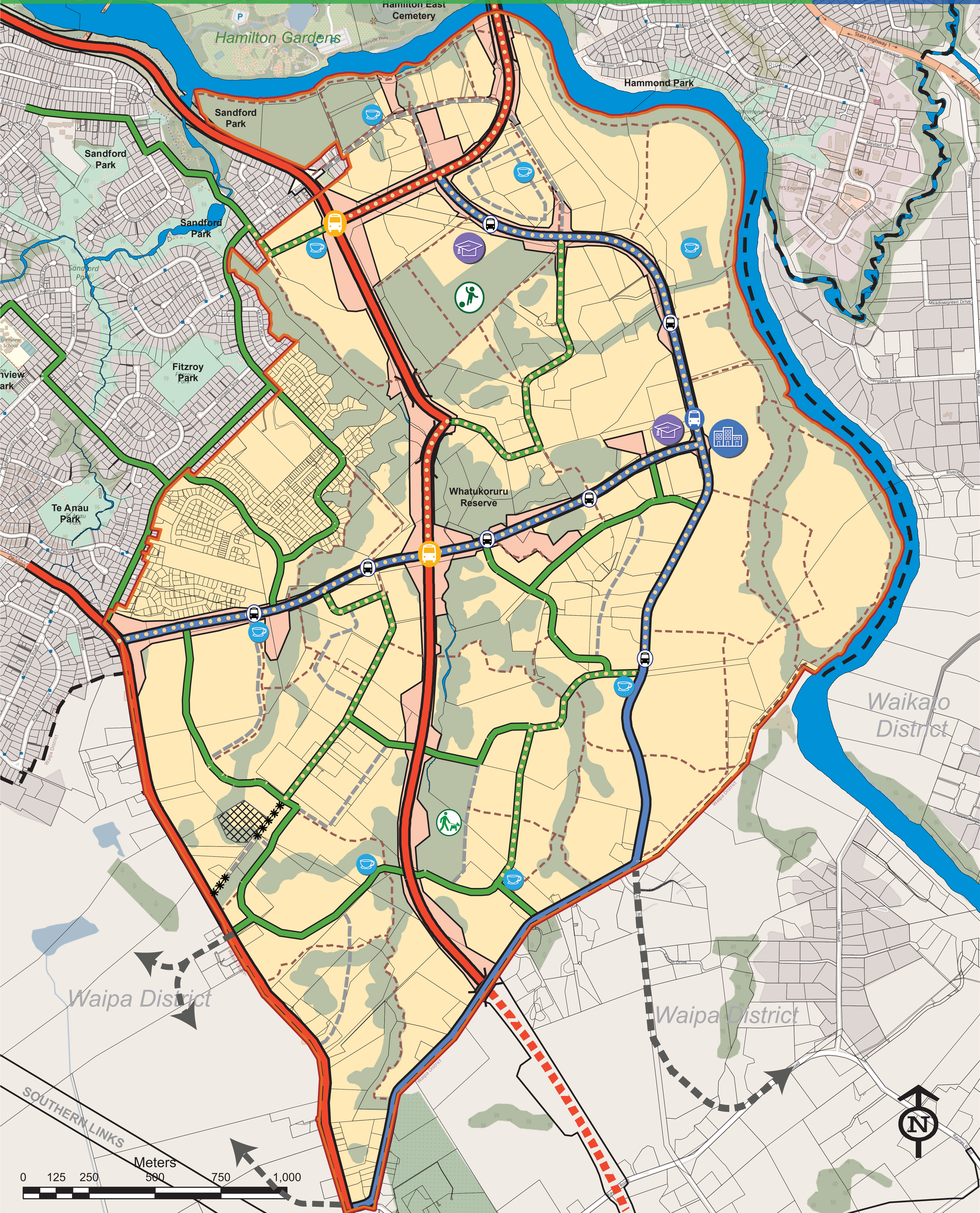
The following table provides an overview of where the relevant Designation Condition is addressed in this TNMP.

Designation Condition 24.1	Requirement	How addressed by project	Suggested Actions
d	An updated Design Philosophy Statement that establishes the standards, philosophies and references for construction final design outcomes required to achieve the objective of the TNMP. This shall include the intersection design philosophy as a part of a whole-route approach to road and intersection management and operation	Refer to Section 1.4	None required
e	The localised traffic impacts together with accompanying mitigation measures required as a direct or indirect result of road closures, diversions, new intersection arrangements and other measures needed to accommodate the Project;	Refer to Section 3 No adverse impacts are envisaged on the local transport network as a result of this project.	Consider interventions to deal with existing issues that may be exacerbated by additional traffic. All road sections: Monitor traffic volume and introduce speed management if needed.
f	The provision of cycle infrastructure and the design of cycle features and whether they are consistent with current best practice guidelines;	Section 5 addresses current best practice guidelines, while section 5.1 to 5.7 addresses cycle infrastructure along the internal roads	None required
g	The provision of pedestrian infrastructure and whether the design of pedestrian infrastructure is consistent with current best practice guidelines;	Section 5 addresses current best practice guidelines, while section 5.1 to 5.7 addresses cycle infrastructure along the internal roads	None required
h	Consideration of staged bus service infrastructure	Refer to Section 6	Respond to WRC and HCC service proposals when available.
1	Bus priority detection equipment at all signalised intersections along the route;	Refer to Section 6	None required
2	Bus stopping lay-bys at appropriate locations along the route;	Refer to Section Figure No 21 - Figure No 21 Buses will stop within the lane while passengers are boarding and alighting as this will improve safety and efficiency for public transport	Review requirements after outcomes from WRC PT working paper are finalised and agreed upon.

Designation Condition 24.1	Requirement	How addressed by project	Suggested Actions
3	Passenger waiting facilities and shelters with bus information as part of the final road design; and	Refer to section 6. - Figure No 21 Kerbside boarding along Whatukooruru Drive were designed for universal accessibility	None required
4	Bus priority measures at all non-signalised, controlled intersections;	Bus stops are within the traffic lane on Whatukooruru Drive rather than laybys, enabling buses to stay ahead of traffic and have a clear lane ahead after each stop. Refer to Section 6.	None required
i	The provision of pedestrian and cyclist connectivity to and from Hamilton Gardens and along the Waikato River and Peacocke gully system;	This condition was addressed in TNMP of Peacocke – Waikato River Bridge Project and not applicable for Whatukooruru project	HCC to champion future opportunities to build upon connections provided in this project.
j	The provision of pedestrian and cyclist connectivity from areas west of the Peacocke North-South Major Arterial to areas east of the arterial in the vicinity of the Glenview Club.	This is outside the scope of work and will be addressed at later stage of the project	None required
24.2	Road Safety Audit for the relevant stage of the Project in accordance with NZ Transport Agency's Road Safety Audit (RSA) for Projects	Refer to section 4.8 A Detailed Design RSA has been completed, and there are no residual concerns to be addressed.	None required
24.3	Post Implementation Review (PIR) in accordance with NZ Transport Agency's PIR policy, having regard to the Project objectives and the objectives of the TNMP	Refer to section 4.9	Undertake RSA post-construction in 2023.

Appendix A – Peacocke Structure Plan Transport Network

PEACOCKE STRUCTURE PLAN



Transport Network

- Major Arterial - Southern Links
- Major Arterial Transport Network
- Minor Arterial Transport Network
- Proposed Road Closure
- Indicative Collector Transport Network
- Indicative Key Local Transport Network
- Indicative Cycleway/Walkway Network
- Proposed Public Transport Route
- Proposed Future Transport Connections
- Proposed Public Transport Hub
- Key Public Transport Stops Locations
- Future Mass Transit Stop
- Transpower - Hamilton Communication Centre
- Local Centre
- Neighbourhood Centre
- Community Facilities
- Sports Park
- Community Park

Appendix B – Design Philosophy Report

Hamilton City Council

Peacocke - Whatukooruru Drive

Contract number: PSP 18251

Design Philosophy Statement

BLOXAM BURNETT & OLLIVER

Document control

Project identification		
Client	Hamilton City Council	
Client representative	Tahl Lawrence	
BBO details	Bloxam Burnett & Olliver (BBO) Level 4, 18 London Street, Hamilton 3240	
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Job number/s	146000	
Job name	Peacocke - Whatukooruru Drive	
Contract numbers	PSP 18251	
Report name and number	Design Philosophy Statement	
Date / period ending	7 May 2021	
File path	Peacocke Whatukooruru Drive - Design Philosophy Statement.docx	

Report status			
Status	Name	Signature	Date
Report prepared by	Stephen Sutton		7/5/2021
Checked by	Caleb McCarthy		7/5/2021
Approved for issue (v1)	Jeremy Gibbons	[signature]	7/5/2021

Document history			
Version	Changes	Signature	Issue date
V2	Updates based on feedback from HCC	[signature]	27/08/2021
V3			
V4			

Hamilton City Council
Te kaunihera o Kirikiriroa

Table of contents

1. Introduction

1.1 Purpose of Design Philosophy Statement

This Design Philosophy Statement (DPS) documents the scope, standards and assumptions that will apply to the development of the Detailed Design for Peacocke - Whatukooruru Drive.

The Peacocke Strategic Transport - East West Arterial Background Report covers many of the considerations that have influence on the design development. That report will be referenced throughout this document and will hereby be referred to as the "Background Report".

1.2 Report structure

Section 1 of this report introduces the design philosophy at a high level, including a description of the general project scope.

The design will be in accordance with the design references (standards and guidelines, approved departures, and outcomes of previous safety audits) listed in Section 2.

Specific design criteria and assumptions for each element of the design are described in Sections 3 to 17.

Appendix A of this report includes a set of drawings that present an update to the latest project scope and help describe the design philosophy and scope described within the content of this report.

Appendix B includes a copy of the Environmental Mitigation Statement, which summarises the specific environmental measures/aspects that need to be taken in to account when developing the detailed design. Where necessary, the relevant standards and design requirement have been reflected within the content of this Design Philosophy Report.

Appendix C includes a copy of the Environmental and Social Responsibility (ESR) screen, prepared in accordance with Waka Kotahi Z/19.

1.3 Abbreviations

The abbreviations used throughout this Detailed Design Philosophy Statement are presented in Table No. 1.3.

Table No. 1.3

Abbreviations	
Abbreviation	**Description**
AEE	Assessment of Environmental Effects
AEP	Annual Exceedance Probability
AGRD	Austroads Guide to Road Design
BBO	Bloxam Burnett & Olliver (consultant company leading the project team)
CLMP	Concept Landscape Management Plan
CPTED	Crime Prevention Through Environmental Design
D&C	Design and Construct
DBC	Detailed Business Case
DoC	Department of Conservation
EMMP	Environmental Management and Monitoring Plan

Abbreviations	
Abbreviation	**Description**
Ha	hectare
HCC	Hamilton City Council
HCV	Heavy Commercial Vehicle
HGL	Hydraulic Grade Line
HIF	Housing Infrastructure Fund
HOV	High Occupancy Vehicle
HPMV	High Productivity Motor Vehicle
ITS	Intelligent Transport System
ICMP	Integrated Catchment Management Plan
LOS	Level of Service
LTNZ	Land Transport New Zealand (now amalgamated within function of Waka Kotahi)
NDD	Normal Design Domain
m	Metre
NIWA	National Institute of Water and Atmospheric Research
NES	National Environmental Standards
NPS	National Policy Statement
OGPA	Open graded porous asphalt
ONRC	One Network Road Classification
PGAR	Preliminary Geotechnical Appraisal Report
PHGA	Peak Horizontal Ground Acceleration
PST	Peacocke Strategic Transport (relates to work undertaken as part of PSP 17482)
PVGA	Peak Vertical Ground Acceleration
PWRB	Peacocke Waikato River Bridge
RITS	Regional Infrastructure Technical Specifications
RMA	Resource Management Act 1991
RRPM	Reflective Raised Pavement Marker
RTS	Road Traffic Standards
SAC	Structural Asphaltic Concrete
SAR	Scheme Assessment Report
SID	Safety In Design
SSSHA	Site Specific Seismic Hazard Assessment
NZTA	Waka Kotahi NZ Transport Agency
TLA	Territorial Local Authority
TWWG	Tangata Whenua Working Group
vpd	Vehicles per day
vph	Vehicles per hour
WRC	Waikato Regional Council
WRTM	Waikato Regional Transportation Model

1.4 Design development

This Preliminary Design Philosophy Statement will form the basis for development of the Detailed Design and Project Specification/Principal's Requirements (as necessary).

Further to the Instruction for Service (IFS) Contract Scope, the design will:

- Develop the Preliminary Design to achieve compliance with the conditions of statutory approvals.
- Illustrate the required scope, character, and form of the project.
- Prove the constructability and viability of the project.
- Ensure that consent requirements have been identified so that all necessary consents can be obtained by Hamilton City Council (HCC) prior to construction.
- Appropriately respond to and/or address issues identified in any road safety audit.
- Address Safety in Design, CPTED and Vision Zero road safety principles.
- Consider issues related to procurement, staging, constructability, and access for construction (i.e. address how the project will be implemented, not just what will be constructed).
- Identify design standards that attract significant cost for little benefit and recommend outcomes that offer best value for money.
- Identify and rigorously challenge 'no-go' design elements and undocumented minimum requirements in consultation with HCC.
- Be developed to a stage sufficient to enable a reliable Cost Estimate to be produced.
- Be developed to a stage where significant risks to the successful delivery of the project have been identified and treated and included in the cost estimate.
- Collaborate early with the Tangata Whenua Working Group to identify and develop opportunities for cultural considerations and elements to be integrated into the design process.

1.5 Scope of works

This Design Philosophy Statement is based on the following project scope:

- Approximately 1.6km extension of Whatukooruru Drive from the completed end of Stage 1 (western end of Whatukooruru Drive developed as part of the SH3/East-West roundabout project) through to Peacockes Road.
- A 600m upgrade of the existing Peacockes Road from rural to urban, complete with all utility services.
- 4-leg signalised intersection between Whatukooruru Drive and Peacockes Road.
- An intersection at Hall Road North.
- Three major bridge structures.
- Stormwater treatment devices.
- Approximately 1.6km of strategic water main (from Stage 1 Whatukooruru Drive works to Peacockes Road).
- Incorporation of the strategic wastewater design (by WSP-Opus/Beca).
- Utilities in the road corridor required to service adjacent land.
- Footpaths and cycleways (as necessary).
- Landscaping / ecological mitigation planting.
- A future intersection at the North-South Arterial.

Figure No. 1.5: Extent and overview of project

2. Design references

2.1 Reference documents

The Detailed Design will be developed on the basis of the standards and guidelines listed in Table No. 2.1. Specific documents identified reference acceptable means of compliance, and specific standards detailed in the following sections of this Design Philosophy Statement.

Whilst not explicitly design standards or guidelines, the following documents have some specific design considerations that need to be considered in full during the design process, including (but not limited to):

- **Southern Links Environmental Management and Monitoring Plan (EMMP)** – sets out requirement for vegetation offsetting, together with identification (and management) of habitat restoration and protection.

- **Southern Links Designation Conditions** – refer to Section 2.5.

- **Mangakootukutuku Integrated Catchment Management Plan (ICMP) (Final Draft Dec 2020)** – outline for how HCC proposes to manage water supplies, wastewater, and stormwater within a defined set of catchment boundaries. It makes recommendations for improvements in areas that have already been built, and plans infrastructure for areas where future developments will be built. Stormwater is the main focus of this ICMP. Refer to Section 5.2

Table No. 2.1

Reference Documents		
Document	**Source**	**Version**
Geometric Design		
Guide to Road Design (all parts) using NDD values unless otherwise stated in this Design Philosophy Statement.	Austroads	current versions*
Manual of Traffic Signs and Markings: Parts II & III	NZTA	
New Zealand On Road Tracking Curves for Heavy Motor Vehicles (RTS 18)	NZTA	2007
Regional Infrastructure Technical Specifications (RITS)	Waikato LASS	2018
Cycling Network Guidance: • Planning a cycling network • Designing a cycling facility	NZTA	Web version*
Traffic Control		
Regional Infrastructure Technical Specifications (RITS) – Section 3.7 relating to Traffic Signals	Waikato LASS	2018
Land Transport Rule: Setting of Speed Limits 2017	MOT	2017
Speed management guide	NZTA	2016
Land Transport Rule: Traffic Control Devices	NZTA	2004
Traffic Control Devices Manual	NZTA	2011
Manual of Traffic Signs and Markings: Parts I, II & III	NZTA	
Guide to Traffic Management Series (all parts)	Austroads	current versions*
Road Safety Barriers		
AS/NZS 3845.1 Road Safety Barrier Systems and Devices: Part 1	Standards NZ	2015
Standard Specification M/23, M/23 Notes and M/23 Appendices A and B	NZTA	current versions*

Reference Documents		
Document	**Source**	**Version**
Various Technical Memoranda relating to road safety barriers	NZTA	current versions*
Various Technical Advice Notes relating to road safety barriers	NZTA	current versions*
Various RSB Standard Drawings relating to road safety barriers	NZTA	current versions*
Bridge Manual	NZTA	Third Edition Amendment 3
Guide to Road Design (Part 6)	Austroads	current versions*
Drainage		
Stormwater Treatment Standard for State Highway Infrastructure	NZTA	2010
Highway Surface Drainage A Design Guide for Highways with a Positive Collection System	NZTA	1977
Technical Memorandum TM-2502: Preferred method for calculating road surface water run-off in New Zealand	NZTA	2014
Guide to Road Design (Part 5)	Austroads	current versions*
Regional Infrastructure Technical Specifications (RITS)	Waikato LASS	2018
Waikato Stormwater Runoff Modelling Guideline	WRC	2020
Waikato Stormwater Management Guideline	WRC	2020
New Zealand Fish Passage Guidelines	NIWA	2018
Climate Change Effects and Impacts Assessment A Guidance Manual for Local Government in New Zealand	MfE	2008
Stream Crossings (LM05)	TM	
Hydrological and Hydraulic Guidelines	TM	2012
Hydraulic Design of Energy Dissipaters for Culverts and Channels (FHWA HEC14)	USDOT	2006
Design of Roadside Channels with Flexible Linings (FHWA HEC15)	USDOT	2005
Evaluating Scour at Bridges (FHWA HEC-18)	USDOT	2012
Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance-Third Edition, Volumes 1 and 2 (FHWA HEC-23)	USDOT	2009
Debris Control Structures, Evaluation and Countermeasures (FHWA HEC-9)	USDOT	2005
Bridge Scour (Melville and Coleman), except where superseded by HEC-18, HEC-23, and HEC-9	WRP	2000
Roughness Characteristics of New Zealand Rivers	NIWA/WRP	1998
Standard Specifications F Series (for drainage materials and construction)	NZTA	current versions*
Fish passage guidance for state highways	NZTA	2013
NZTA P46 Stormwater Specification	NZTA	2016
Earthworks		
Bridge Manual (for stability of cut and fill batter slopes)	NZTA	Third Edition Amendment 2
Structures		

Reference Documents		
Document	**Source**	**Version**
New Zealand Building Code	MBIE	current versions*
Bridge Manual	NZTA	Third Edition Amendment 2
Road Research Bulletin 84, Volume 2 Seismic Design of Bridge Abutments and Retaining Walls	NZTA	1990
Technical Report 97-022 Method and Recent Developments in Research using both SPT and CPT Data	NCEER	1997
CPT and SPT Based Liquefaction Triggering Procedures	Boulanger and Idriss	2014
Research Report 553 The Development of Design Guidance for Bridges in New Zealand for Liquefaction and Lateral Spreading Effects	NZTA	2014
AS 4678 Earth Retaining Structures	Standards Australia	2002 with amendments to 2008
NZS 3101 Concrete Structures Standard	Standards NZ	2006 with amendments to 2008
AS/NZS 1170.2 Structural Design Actions – Wind Actions	Standards NZ	2011 with amendments to 2013
NZS 1170.5 Structural Design Actions – Earthquake Actions	Standards NZ	2004
AS 2159 Piling Design and Installation	Standards Australia	2009 with amendments to 2010
Road Research Unit Bulletin No. 70: Creep and Shrinkage in concrete bridges	NZTA	1984
Bridging the Gap: Urban Design Guidelines	NZTA	2013
Protective coatings for steel bridges: a guide for bridge and maintenance Engineers	NZTA	2014
TAN #17-09 Verification testing of steel materials	NZTA	2017
Pavements		
Guide to Pavement Technology (all parts)	Austroads	current versions*
New Zealand Guide to Pavement Structural Design	NZTA	June 2017
Regional Infrastructure Technical Specifications (RITS)	Waikato LASS	2018
Chip Sealing in New Zealand	NZTA	2005
Standard Specifications B, M, P and T Series (for pavement and surfacing materials and construction)	NZTA	current versions*
TAN #17-01 (for roundabout asphalt depth)	NZTA	current version*
Landscaping and Urban Design		
NZTA Landscape Guidelines (Final Draft) September 2014	NZTA	2014
New Zealand Urban Design Protocol	MfE	2005
Bridging the Gap: NZTA urban design guidelines	NZTA	2013
Guide to Road Design (Part 6)	Austroads	current version*
Regional Infrastructure Technical Specifications (RITS)	Waikato LASS	2018
NZTA P39 Standard Specification for Highway Landscape Treatments	NZTA	2013
National Guidelines for Crime Prevention through Environmental Design (CPTED) in New Zealand	Ministry of Justice	2005
Acoustics		

Reference Documents		
Document	**Source**	**Version**
Guide to assessing road-traffic noise using NZS 6806 for state highway asset improvement projects	NZTA	2011
Guide to state highway road surface noise	NZTA	2014
State highway noise barrier design guide	NZTA	2014
State highway construction and maintenance noise and vibration guide	NZTA	2013
State Highway Guide to Acoustics Treatment of Buildings (Draft)	NZTA	2015
Environmental Plan (Section 2.1 Noise)	NZTA	2008
Street Lighting		
AS/NZS 1158 Lighting of Roads and Public Spaces	Standards NZ	2005 with amendments to 2015
Standard Specification M/26	NZTA	2012
Standard Specification M30	NZTA	2014
Regional Infrastructure Technical Specifications (RITS)	Waikato LASS	2018

** The design will aim to maintain the most up to date design standards. At a minimum, the standards will reflect the date this report is composed.*

2.2 Approved departures

No departures from HCC's mandatory and advisory standards are currently held for Peacocke - Whatukooruru Drive. However, departures may be submitted for the approval of HCC as development of the Detailed Design proceeds.

2.3 Safety audits, SiD, CPTED

A Road Safety Audit for the Preliminary Design of the entire Southern Links Project was undertaken in 2012 by AECOM/Opus. This audit identified a number of safety issues/concerns that needed to be addressed or considered in subsequent design phases. Given the scale of the Southern Links project many of the issues raised were at a relatively high level and covered philosophical issues that would normally be addressed through standard design refinement. As such, those issues are not repeated here. However, in respect to specific issues relating directly to this project, the following matter was identified, which will be addressed as part of the Detailed Design for this project: **Unsheltered right-turn bays at intersections along Peacockes Road**.

For clarity, as a minimum a Road Safety Audit will be sought at completion of the Detailed Design (i.e. prior to construction), and immediately following completion of construction (post-construction audit). These reports, including designer responses to audit comments, will be submitted to HCC Transportation team for decision-making.

Safety in Design reviews (and universal access reviews – refer Section 2.5) will also be completed and incorporated during the development of the design and resolved in conjunction with the safety audit findings.

CPTED is a crime prevention philosophy based on proper design and effective use of the built environment leading to a reduction in the incidence and fear of crime, as well as an improvement in quality of life. The emphasis is on prevention rather than apprehension and punishment.

In undertaking design with regard to CPTED principles it is important to understand any local (applicable) baseline trends in criminal activity. Existing crime patterns in rural Peacocke are less applicable to the future context for Whatukooruru Drive. Existing urban statistics are more likely to be relevant to inform CPTED assessments. In this regard, Waikato crime statistics show an improving trend with fewer victimisations. In Hamilton, assault (11%), burglary (22%) and theft (65%) are the dominant crime types.

The proposed Peacocke Plan Change will result in a change mainly to residential activities with a focus on increasing density and mode shift, which will lead to increased pedestrian, cycle and micro-mobility use with higher levels in the areas of higher density such as the local centre at the Whatukooruru Drive/Peacocke Road intersection, and transport nodes such as bus stops. Crime in higher density areas is more likely to be similar to higher density areas in Hamilton such as the university and central city, where the crime rates are higher than typical residential areas. The increased activity presents some threats with more people exposed, and opportunities in the form of increased activity and passive surveillance. As a minor arterial, Whatukooruru Drive and Peacockes Road provide for frontage development and access, increasing surveillance and a sense of ownership and supporting safer behaviour and speeds.

Detailed design will consider CPTED and opportunities for safety enhancements, with an expectation that there will be requirements for installation of CCTV cameras and ongoing liaison with NZ Police (and Hamilton's CitySafe patrols). Special consideration will be given to potential risk areas including the local centre interfaces, bridges at gully crossings, walkway connections and transport nodes, lighting, and open spaces such as wetlands. Accessibility and mobility will also be tested to ensure inclusive access.

Overall, the detailed design will seek to respond to each of the seven quality principles of CPTED (as defined within the National Guidelines for CPTED in New Zealand), and will be expressly recorded/assessed within eventual design reporting to demonstrate how the project is well aligned with these desirable CPTED outcomes.

2.4 Building consents

No building consents have yet been sought from Hamilton City Council. A dispensation for the building consent relating to the water crossing structures will be sought in accordance with Building Act 2004, Schedule 1, part 1, section 2(a). If the dispensation is declined by Hamilton City Council Building Department, then Building Consents will be prepared and lodged, with an expectation that consent review will only focus on F4 Safety from Falling requirements (on basis that structural peer review and evidence of Producer Statements will address structural compliance matters).

2.5 Environmental and social design statement

The Peacocke - Whatukooruru Drive corridor is a designated route that is covered by one set of overarching designation conditions. The specific conditions of the designation and/or resource consent have not been repeated in this document but can be referred to in detail within Sections 8 and 9 (and Appendix E) of the Background Report.

In short, the construction of this project is expected to be constructed and operated in a way that is at least environmentally neutral. That is, the vegetation to be removed is of minimal environmental significance and there will be no net long term effects on the corridor or any waterway. As a result, the project requires a number of environmental mitigation measures for vegetation, fauna, and habitats disturbed by the completion of the works.

HCC has expressed a desire for the Peacocke Whatukooruru Drive to be accessible (inclusive access) for all, with particular focus on accommodating those with disabilities and/or those being less able bodied. There is currently very little good practice design guidance to ensure good outcomes in this regard. As such, this project will embrace many of the positive outcomes achieved through the adjoining Peacocke Waikato River Bridge project (provision of safe, obvious, and step-free choices), and invite best practice advice to be sought through an independent accessibility review undertaken by a specialised practitioner.

The NZ Government has committed to net zero carbon emissions by 2050. In response, the Ministry of Building Innovation and Employment (MBIE) has prepared guidance on how proposed construction projects may better align with these expectations. As such, as the design is developed, the Project team may offer up low-carbon design options/opportunities that HCC may wish to pursue. These options will primarily be aligned (to varying effect) to respond to each of the three key objectives of the referred guidance, including:

- **Maximise the build efficiency**: ensuring the size and scale of the works are proportional to the need. Requires a balance of building once/building right, without necessarily building works that will not be required for a long-time.

- **Increase building Material Efficiency**: optimising the design to enable less material to be used in the end product (avoid over-conservatism), reducing areas of waste (e.g. cut/fill balance), and minimising need for replacement over project lifecycle (appropriate design life).

- **Reduce the Carbon Intensity of materials**. Challenge the use of status quo for material types and chase opportunities to reduce embodied carbon in materials – greatest opportunity in materials used for structures (concrete versus steel and/or cement content), path materials (alternatives to concrete or low cement alternatives), and pavement types (e.g. asphaltic concrete versus cement bound).

Appendix B of this report includes an Environmental Mitigation Statement (EMS). This is a document that identifies the actual and potential environmental effects associated with this project, and then describes the means by which those effects will be mitigated through detailed design. The EMS takes into account the design, designation and consent objectives as well as a preliminary Environmental and Social Responsibility Screen (Appendix C) used to identify high level themes and issues. Where relevant, the specific scope and standards that relate to the mitigation have then been incorporated within this design philosophy document. These include consideration of climate change, waste minimisation, and sustainable construction.

3. Design criteria and assumptions - Geometric design

3.1 Over-arching design approach

The approach to design for this project aims to follow and build upon the design philosophies developed within the Peacocke Waikato River Bridge (PWRB) project. It adopts a number of relatively new concepts which seek to change the focus from designing for cars towards designing for an improved human-centric outcome. These concepts could prioritise active modes and passenger transport over more traditional car-centric outcomes. They have previously been presented to and supported by Hamilton City Council and associated key stakeholders as part of PWRB.

In summary, the design philosophy governing the geometric design for mid-block sections (i.e. between intersections) includes:

- Adopting Vision Zero: A transportation system with features to minimise the risk of deaths and serious injuries.
- Promotion of public transport and encouraging active (and alternative) modes, if necessary, at the expense of reduced performance of the network from the point of view of (low occupancy) private car users.
- Optimising the people moving capacity of the road, by enabling efficient use of the network by buses and high occupancy vehicles.
- Providing flexibility in the design to cater for evolutionary and step changes in the transportation system.
- Working within the designation boundaries secured as part of Southern Links project, without alterations (unless pursued under non-notified processes).

3.2 Geometric design parameters

3.2.1 Speed parameters

Proposed speed limits and design speeds are presented in Table 3.3.

Table No. 3.1

Speed Parameters and Locations			
Section	Location	Design Speed	Posted Speed Limit
Whatukooruru Drive	SH3 to Peacockes Road	50 km/h	40 km/h[1]
Peacockes Road	Peacockes Lane to southern tie-in	50 km/h	40 km/h

In line with the project objectives, lower design and posted speeds are proposed than a typical car-centric design approach. This is also consistent with the PWRB project. To manage speeds along the route, it is proposed that traffic calming devices will be intermittently installed along both Whatukooruru Drive and Peacockes Road. These measures will align with the Waka Kotahi Strategic Options Toolkit – Traffic Calming.

Such measures will include raised safety platforms for pedestrian/cycle crossings, positive pavement markings and landscaping and urban design elements.

[1] Note that setting of posted speed limit is still subject to further discussion with HCC. Adoption of a higher speed limit on this corridor (50km/h) could be accommodated without adjustment needed to the geometric design standard.

3.2.2 Sight distance

Sight distances will be based on the AGRD desirable minimum normal design domain values for all parameters, including a reaction time of 2.0 seconds and coefficient of longitudinal deceleration of 0.36g.

For cycle facility design, sight distances will be based on recommendations from Section 5.7 of AGRD Part 6A, with reaction time of 2.5 seconds, eye height of 1.4m, and coefficient of longitudinal deceleration of 0.16g (assuming wet conditions).

3.2.3 Design vehicles

All road alignments and intersections will be checked for the turning movements of an HPMV (modelled using an 18m semi-trailer per LTNZ RTS 18, with a dimension of 9.4m from king pin to rear axis of trailer). Bridge design will cater for the standard 'Highway Normal' HN and 'Highway Overload' HO components of the loading regime as defined in the Bridge Manual published by the Transport Agency.

For clarity, and in accordance with RTS 18, the urban city bus has characteristics most similar to those of a "large rigid truck" design vehicle, so this design vehicle has been used to represent the "design bus" for this project.

3.2.4 Design vehicle clearances

The preferred minimum clearance (wheel-track to kerb and body to furniture) will be 1.0m, with the geometric design of the carriageway providing an absolute minimum clearance of 0.6m. Transverse location of design vehicles used for bridge design will satisfy the requirements of the Bridge Manual published by the Transport Agency.

3.2.5 Over-dimensioned vehicles

Although desirable given the increasing use of pre-fabrication in residential building construction, HCC has confirmed that these transport corridors do not need to make specific provision for over-dimensioned vehicles.

3.2.6 Horizontal alignment

Design of the horizontal alignment will be in accordance with AGRD, Part 3, Section 7. Super-elevation is not being provided for the local roads within this project scope. The exclusion of superelevation has been a conscious decision (and endorsed by Hamilton City Council on the adjoining Peacocke Waikato River Bridge project), in an effort to:

- Discourage high speeds on the corridor – that is by appearance and comfort that encourage lower speeds.
- Avoid the need for centrally located stormwater devices which introduces additional hazards and requires maintenance access during operations.

In general, minimum horizontal curve radii will likely be driven by limitations of effects from adverse crossfall. The starting position for minimum curve radii shall therefore be:

- 120 m for Whatukooruru Drive (50km/h design speed).
- 120 m for Peacockes Road south of Peacockes Lane (50km/h design speed).

Broken back horizontal curves may be applied on low-speed alignments (less than 50km/h posted speed) in order to realise value for money solutions. However, the use of broken back curves shall not be a starting point for the design.

The horizontal alignment will be similar to the Scheme Design but with some refinement to the horizontal curves to accommodate the constraints of the property footprint, help resolve geotechnical constraints, provide value for money solutions, and to ensure compliance with designation and consent conditions.

3.2.7 Vertical alignment

Design of the vertical alignment will be in accordance with AGRD, Part 3, Section 8.

Required vertical clearances to structures and utilities are given in Sections 8 and 15.

The vertical design will ensure that the carriageway is passable for emergency vehicles in a 1% AEP design flood event. This is detailed further in Table 4 in Section 5.4.

All road corridors will include street lighting, so comfort criteria will govern the design of sag curves.

The Whatukooruru Drive alignment is relatively flat (maximum of 2.5% grade over 80m length in Preliminary Design) but incised by localised and relatively deep gullies. This means that there is little scope to drastically change vertical alignment along the project length, except in respect to positioning the sag and crest points of comparatively flat vertical curves. Repositioning of crests/sags is only likely to be adjusted to avoid major structures (constructability reasons), accommodate the constraints of the property footprint, help resolve geotechnical constraints, provide value for money solutions, to optimise eventual stormwater management needs and to ensure compliance with designation and consent conditions.

3.3 Cross sections

3.3.1 Cross section dimensions and details

Cross-section dimensions and details are presented in Table 3-4. Refer also to the Design Drawings in **Appendix A**.

Table No. 3-4

Cross section dimensions and details		
Element	**Proposed standard**	**Comments**
Shoulder widths		
Whatukooruru Drive	0.0m	
Peacockes Road	0.0m	
Median widths		
Whatukooruru Drive	3.0m	The width is measured between centres of the edge line markings.
Peacockes Road	3.0m	
Traffic lane widths		
All roads	3.5m	Refer to Note 1. The width is measured from the centreline of the markings and to the face of kerbing.
Footpath		

Table No. 3-4

Cross section dimensions and details		
Element	**Proposed standard**	**Comments**
Whatukooruru Drive	2.0m	Both sides
Peacockes Road	2.0m	Both sides
Low Volume local roads	1.5m	Both sides (unless only required on one side)
Off road cycling facilities		
Whatukooruru Drive	None	On road with separators provided
Peacockes Road	None	On road with separators provided
Low Volume local roads	2.5m	Shared path on one side
On road cycling facilities		
Whatukooruru Drive	2.3m	Refer note 2
Peacockes Road	2.3m	Refer note 2
Low Volume local roads	None	Cyclists use the vehicle carriageway
Crossfall/superelevation		
Normal crossfall	3.0%	
Superelevation	None	Superelevation is not used within this project
Berms and utility strips		
Berms	Varies	Refer to drawings (Appendix A)
Utility strips		
Notes		
1	The LH lane width is 4.5m on the Waikato River Bridge because of the proximity of the edge barrier	
2	A 0.6m separator strip is included in addition to the 2.3m cycle lane	

3.3.2 Whatukooruru Drive

The expected 2041 traffic volumes on Whatukooruru Drive are 9,600 vpd in the eastern section, 13,700 vpd in the central section and up to 19,900 vpd in the western section (based on AECOM Transport Modelling Report 2013). Traffic is proposed to be conveyed within a single lane in each direction with a LOS A to LOS B along the route. The cross section will also have a central median to facilitate turning movements.

To improve safety and efficiency for public transport vehicles, bus stops will not be indented into the roadside. Instead, buses will stop within the lane while setting down and picking up passengers. Operational levels of service for cars on this carriageway will be reduced (to LOS E during peak periods) as a result. However, the advantage is that public transport vehicles can operate more efficiently and safely as they do not have to enter and leave the traffic stream at each stop and overall the safety and people moving capacity of the road corridor will be increased.

The terrain is relatively flat so the eventual design will not result in vertical grades that affect truck speeds to the extent that an additional lane would be required.

Active (and alternative) modes will be accommodated by a 2.0m wide off-road path on each side, and 2.3m wide on-road cycle lanes that are separated from the vehicle lane with raised “zebra/armadillo” separators.

A detailed typical cross section is provided in Appendix A.

3.3.3 Peacockes Road

Traffic volumes on Peacockes Road are predicted to range from 13,000 vpd at the intersection with Whatukooruru Drive to 21,000 vpd at the Ring Road extension by 2041 (based on Traffic Modelling Report by Opus/AECOM), corresponding to an approximate peak flow rate of 700 to 1,100 vehicles per hour in each direction.

While a multi-lane carriageway would be necessary to maintain optimum levels of service for car-based operation, HCC has expressed a desire to reduce reliance on private vehicles and encourage the use of public transport and active modes. As such, the recommendation is to have a separated cycle lane and one traffic lane in each direction, with the traffic lane shared by cars and public transport vehicles. This philosophy is consistent with the project objectives and aligns with PWRB project.

To improve safety and efficiency for public transport vehicles, bus stops will not be indented into the roadside. Instead, buses will stop within the lane while setting down and picking up passengers. Operational levels of service for cars on this carriageway will be reduced (to LOS E during peak periods) as a result. However, the advantage is that public transport vehicles can operate more efficiently and safely as they do not have to enter and leave the traffic stream at each stop and overall the safety and people moving capacity of the road corridor will be increased.

Active (and alternative) modes will be accommodated by a 2.0m wide off-road path on each side, and 2.3m wide on-road cycle lanes that are separated from the vehicle lane with raised “zebra/armadillo” separators.

3.3.4 Road safety barriers

The design philosophy will be to minimise the need for barriers by managing vehicle speeds and providing sufficient offset to potential roadside hazards. With a proposed speed limit of 40 to 50km/h on the Whatukooruru Drive and Peacockes Road, median barriers are reasoned to not be required to meet Vision Zero objectives. However, the proposed flush medians on both these roads do not prevent median barriers from being installed in the future (if desired).

The typical cross section and vehicle speeds allow for roadside features such as trees, streetscape, or utility infrastructure to be installed outside of the theoretical ‘clear-zone’ in order to avoid the need for roadside barriers. Roadside barriers are proposed for each of the watercourse crossing bridges (Western, Mangakootukutuku Gully, and Eastern Gully) and their associated approaches. This includes TL-5 concrete barriers with Texas HT (T80HT) rail system and semi-rigid to rigid transitions leading to end terminals (refer to Section 8.7 for more detail). In addition, more traditional TL-3 (MASH) W-section barriers will be used at any other locations where the roadside hazard risk may be unacceptable, such as adjacent to roadside retaining walls and steep batters (refer to Section 13.6).

3.3.5 Kerbing

Any kerbing positioned immediately adjacent to where cyclists normally ride will have a mountable profile (based on the RITS mountable kerb), which will reduce the risk of pedal strike. In addition, catch-pits adjoining carriageway that may contain cyclists shall (wherever practicable) be recessed behind the kerb and not positioned out in the cycle lane.

The minimum grade for kerb and channel will be 1:300. On vertical curves where the tangent grade is less than 1:300, kerb and channel will either be eliminated by the design (less preferred) or additional catch pits will be provided to prevent ponding of water against the kerb (preferred outcome).

3.3.6 Utility corridors and berms

The location of utility corridors and berms (landscape strips) is shown on the Concept Drawings in Appendix A. The location of utility strips and berms have been chosen to provide:

- Separation of the footpath from the boundary at vehicle entranceways (to improve inter-visibility).
- Separation between footpaths and cycle paths.
- Separation between paths and the vehicle carriageway, so that path crossfalls and grades are not affected by vehicle crossings.

3.3.7 Stormwater drainage assets

Road drainage for the western end of Whatukooruru Drive and the Peacockes Road upgrade will generally utilise kerb and channel with pit and pipe systems. This will convey road runoff to stormwater treatment and/or detention systems located outside the linear transport corridors. Catchpits will be recessed into the berms (where possible) to increase capture potential, provide easier access for maintenance and minimise hazards for cyclists using the road shoulders.

The eastern end of Whatukooruru Drive will utilise drainage swales to convey road runoff to stormwater treatment and/or detention systems located outside the transport corridors.

Stormwater manholes will typically be located within the median. The location of stormwater manholes has been considered through initial SiD process. Typically, the RITS recommends for manholes to be located 2.0m offset from the face of kerb within the carriageway. In this location, the manhole lids are likely to be within the wheel paths of vehicles and provide an unsatisfactory ride. By locating them in the median, there is sufficient working space for temporary traffic management to reduce lane widths and work within the median without closing lanes. Furthermore, by locating the stormwater mains in the centre of the road, it allows for other strategic services to be located within the carriageway with adequate separation.

3.3.8 Batter slopes, fences, and boundaries

Cut and fill batter slopes will initially be designed to be optimised to the road transport corridor and remain within the designation.

There is an expectation that the adjoining land will be progressively developed (for residential and light commercial purposes) and potentially result in substantial reshaping of the contours immediately adjoining the road transport corridors to maximise development potential. As such, cut and fill slopes are likely to be refined as knowledge of adjoining development profiles are known and/or retrofitted in due course if/when development occurs. Exceptions to this will be on a case-by-case basis where there is a significant and obvious benefit for both HCC and the adjoining landowner.

Therefore, fill batter slopes will typically be 2:1 or flatter (to enable interim grazing), with stockproof fences located a minimum of 1.0m behind the formed (usable) cross-section (i.e. outside the utility corridor and/or pathways as appropriate). The area between the formed cross-section and the stockproof fence will be designed for ease of maintenance.

It is possible that the legal boundaries will not initially follow the fence line position. As such, retrospective land disposal (and/or update to legalisation surveys) may be undertaken to optimise the position of the legal boundary outside of any stormwater drainage assets and cycle paths (so that these assets are within the road reserve), and ideally at the tops of fill slopes to minimise the residual road reserve footprint.

In cut situations the stock proof fence will generally be located at the top of the batter until future development contours are known. However, like above, there is an expectation that eventual legal boundaries will be optimised to retain HCC assets within the road reserve, but ultimately seeking to minimise the residual road reserve footprint. Cut slopes will typically be 2H:1V, subject to satisfying geotechnical demands.

3.4 Property access

New property accessway/entrances will be provided for existing individual lots that adjoin the new road construction, but only where alternative access is not currently available. Where possible, the newly formed entranceway will coincide with the current entrance position, However, diversion of some accessways may be necessary to integrate the entrance to new works whilst still achieving necessary design standards.

The design will seek to contain any realignment of accessways within the available designated footprint. Where this is not possible further discussion will be undertaken by the affected landowner to reach a suitable outcome, and where necessary seek the necessary license to occupy to complete those works.

The standard of any new/realigned accessway will match the form and condition of the existing access, whilst considering any requirements relating to new pavement materials/surfacing/grades/curvature/vehicle types/drainage etc, in accordance with the RITS. Expectations are for the access to comply with the RITS within the road boundary (including designation), whilst accepting there may be a need for temporary/staged development, and ultimately adopting the existing accessway condition as soon as practicable within the private property. The details of these outcomes will be discussed with the affected landowner.

3.5 Project tie-ins

At the northern end of Peacockes Road (upgrade) the design seeks to tie-in to the new works currently being constructed as part of the Peacocke Waikato River Bridge, at a position approximately 500m beyond the Peacockes Road/ Peacockes Lane intersection. The current works provides for all services (and full cross-section details) to a defined position, then a temporary merging cross-section has been applied to marry back into the current Peacocke Road cross-section. This temporary tie-in is likely to be removed as part of these project works.

At the southern end of the Peacocke Road upgrade, the cross-section from the upgraded Peacocke Road/Whatukooruru Drive intersection is proposed to be formed for a minimum of a 60m length, and then be tapered down to marry back into the existing Peacocke Road cross-section. This arrangement will mean this location will be a significant threshold between an urban and rural road. To emphasise the change in environment, traffic services such as markings and large threshold signs are proposed at this location.

At the western end of Whatukooruru Drive there is a current property constraint that may mean Whatukooruru Drive cannot be constructed through to the completed Stage 1 Whatukooruru Drive works (SH3 roundabout - construction completed early 2021). Whilst relief from this property constraint is being actively managed by Hamilton City Council, the current design philosophy expects for Whatukooruru Drive to require a temporary tie-in to existing Hall Road, through development of a temporary at-grade controlled intersection. The details for this arrangement, and extent of works, is likely to be resolved during the detailed design phase, including how the temporary arrangement will be safe for users.

4. Design criteria and assumptions – Intersections

4.1 Over-arching design approach

As with the geometric design for mid-block sections, HCC has provided clear direction on the philosophical approach to design for the PST intersections, which is now described and documented below:

Intersection forms shall respond to the following requirement (in decreasing levels of importance):

- Achieving Vision Zero safety objectives.
- Encouraging active modes.
- Public transport prioritization.
- Car efficiency.

This design approach leads to a logical hierarchy as a starting point for determining the intersection forms along the major and minor arterial roads, although there may be constraints that modify the preferred form at particular sites.

4.2 Hierarchy of intersection forms

Of utmost importance is consideration of personal harm. Therefore, grade separation of all vehicle conflicts and conflicts between modes is most desirable. Where full grade separation is not practicable then the most vulnerable users should be grade separated and the number of remaining conflict points should be minimised. Lastly, the risks from the remaining conflicts should be minimised.

This approach leads to the following intersection form hierarchy. The starting point for selecting the form of an intersection should be at the highest level, with decisions about practicability being made before moving to the next (lower) level in the hierarchy:

1. Grade separation of all movements.
2. Roundabouts with grade separation for active modes.
3. Signalised intersections with grade separation for active modes. Vehicle speeds to be managed through use of raised platforms on the approaches, or tables across the whole intersection.
4. Signalised intersections with signalised crossings for active modes. Vehicle speeds to be managed through use of raised platforms on the approaches, or tables across the whole intersection.
5. Roundabouts with "build-outs" (or similar) provided for active mode crossings being made at-grade.
6. Signalised intersections with signalised crossings for active modes. No physical control of vehicle speeds.
7. Priority controlled (Give Way) intersections.

In all cases above, public transport will be given priority at intersections, such as advanced start at signals, bus lane prioritisation at roundabout approaches, or via bus stop design/positioning at preceding stops as described in section 13.9 and as per details shown in Figure 13.9.

During the detailed design process, the consideration of this intersection form hierarchy will be tested for each relevant intersection. Outcomes from this assessment (and the relative benefits, dis-benefits, and risks) will be documented within design memorandums to enable informed decision-making. Where outcomes require a trade-off (such as significant impacts on operational performance, significant additional costs, or potential impacts on project programme) these decisions will be elevated to HCC Governance for endorsement and ultimate decision-making.

4.3 Intersection operational performance

Each intersection will be modelled using appropriate traffic modelling software to help optimise lane arrangements and for reporting of operational performance. Models of other intersection forms may be built to test practicality and to help inform the decision-making required in Section 4.2 above.

While traffic efficiency may not be the deciding factor in selecting intersection forms, the operational performance may be an important aspect to communicate with various stakeholders so there are no surprises once the infrastructure is built and operational. Performance criteria will be documented, including average delays, queue lengths, volume/capacity ratios and levels of service.

4.4 North/South Arterial intersection

The intersection between Whatukooruru Drive and the North/South Arterial is not intended to be constructed as part of this project. The North/South Arterial is currently not within the HCC long term plan; and as such, there is uncertainty around the ultimate form of this road. This project aims to enable future construction of an intersection form with minimal disruption.

Based on the above hierarchy, it is expected that this intersection will take the form of a roundabout with grade separation for active modes. The design of Whatukooruru drive will progress on this assumption and aim to develop a preliminary design of an intersection to a level to give HCC confidence that the final intersection, including grade, will be able to be constructed efficiently and with minimal disruption.

4.5 Whatukooruru Drive/ Peacockes Road

Based on the above hierarchy, it is expected that the intersection between Whatukooruru drive and Peacockes Road will take the form of a signalised intersection with the use of raised safety platforms to manage vehicle speeds. As above, in the first instance, the intersection will aim to provide the greatest level of service for active modes and public transport. This could potentially lead to a reduced LOS for vehicles; any decrease from the normal expected performance will be clearly documented and coordinated with HCC specialists.

5. Design criteria and assumptions - Drainage

5.1 General design philosophy

The stormwater management for this project will generally follow that set out in the draft Mangakootukutuku ICMP (December 2020). Water quality and quantity will be managed in accordance with the RITS and WRC – Waikato stormwater management guideline (May 2020). Drawing 146000-002A-0202 of Appendix A illustrates the general intent of managing stormwater for this project. In summary, all stormwater runoff from the carriageway will be collected and conveyed via swale and/or kerb & channel and reticulated to a stormwater treatment and/or attenuation device prior to discharging to natural watercourses.

5.2 Draft Mangakootukutuku Integrated Catchment Management Plan (ICMP)

The Peacocke area ICMP is mainly considered in the Mangakootukutuku catchment. This document is still going through formalities relating to having it finalised and approved; however, this project will align with the philosophies and intent developed to date within this document.

In accordance with the wider project philosophies to enable and support growth and development in the area, the detailed design will align with the ICMP in the following ways:

- Adopt the sub-catchment boundaries defined within the ICMP
- Where the adjacent developments are proposed to be managed within the same sub-catchment, the design will accommodate the post-development flows within the road infrastructure constructed.
- Adopt the preferred form of stormwater treatment and attenuation device.
- Adopt the preferred outfall arrangements and locations.
- Provide connections and crossings required by the ICMP between sub-catchments.

5.3 Design life

The design life of all stormwater infrastructure will be 100-years.

5.4 Design events

The various elements of the drainage system will be designed for the design events presented in Table No. 4.

Table No. 4

Drainage Design Events		
Element	**Design Event**	**Criteria**
Surface drainage for Arterial Roads	10% AEP 1% AEP	Stormwater flow not to encroach into traffic lanes and/or at least 1.2 m of cycle lanes to have no encroachment. At least one lane to remain passable and flow depth <150mm deep and velocity <1.0m/s.
Surface drainage for Local roads	To meet RITS System Design requirements	
Piped drainage infrastructure	10% AEP	HGL must not be higher than 1.0m below the finished carriageway level or, where pipe cover is 1.0m or less, ½ the distance between top of pipe and finished carriageway level.

Drainage Design Events		
Element	**Design Event**	**Criteria**
Cross culverts	5% AEP	Culvert must convey the design event without the flow reaching the soffit or obvert.
	1% AEP	Must convey flow in a manner that does not result in increased flooding outside of the designation. Ponding behind the culvert embankment to be <1.0m above the soffit, or less if necessary, to prevent scour due to high water velocities around the culvert entrance and exit.

The detailed design will be developed using the modelling requirements of the Waikato stormwater runoff modelling guideline (2020).

The design event flows will consider the effects of climate change, as required by the RITS and WRC.

5.5 Cross culverts

Culvert crossings will be installed to generally maintain the existing drainage patterns. This approach avoids risks arising from modification of existing drainage routes

Culverts will be sized based on catchment areas, assessed runoff, existing drain capacity and RITS requirements.

Where settlement of fill embankments will be significant, temporary culverts may be installed during construction, with the permanent culverts being installed after 90% of consolidation settlement has occurred.

Where culverts need to provide for fish passage, culverts will be designed to accommodate fish passage while conveying half of the peak 50% AEP flow, for the appropriate species of fish. There will be coordination with WRC to ensure general conformance with:

- NZ NES and NPS
- New Zealand Fish Passage Guidelines (NIWA)
- Best Practice Guidelines for Waterway Crossings (WRC)

5.6 Carriageway surface drainage

The design will provide sufficient inlet capacity to meet the levels of service in Table No. 4.

The maximum surface water depth above the top of the surfacing texture at any point on any running lane for a 50% AEP design storm event of ten minutes duration will be 4.0mm.

Catch pits will be detailed to be safely traversable by cyclists and to carry HN-HO-72 vehicle wheel loading. Grated inlets to piped stormwater systems will have a bypass that enables the inlet to remain effective should the grate become clogged with debris.

Consideration will be given in the reticulation and treatment system design to omitting the need for sumps in catch pits, thereby avoiding the need for sump cleaning.

Manholes will be located in locations where they are safe to inspect and maintain without traffic control.

5.7 Stormwater run-off from bridges

A positive collection system will be provided on all bridges. The primary objective will be for stormwater runoff from the carriageway to be conveyed and collected clear of the structure. The bridges proposed for the project are expected to allow the runoff to be captured in kerb & channel or against edge barriers; collected in catchpits beyond bridge abutments and piped to swales for treatment.

During detailed design if the bridge length and/or vertical alignment would otherwise compromise drainage performance or traffic safety, runoff will be collected at intermediate points along the length of bridges. In such cases stormwater will be intercepted in catchpits, piped and collected beyond bridge abutments, and directed to swales or ponds for treatment. This is not expected to occur.

5.8 Stormwater treatment

All stormwater runoff from road carriageways and paths with be treated in accordance with the RITS and WRC Stormwater management guideline (2020). Stormwater treatment methods will likely align with the ICMP, with any exceptions being discussed in advance with HCC (discussed further below).

The primary method of treatment along Whatukooruru Drive will be treatment swales and wetlands. In areas where swales are not appropriate (such as between the Mangakootukutuku and eastern water crossing bridge) the design will utilise raingardens for the primary treatment method.

Stormwater on Peacockes Road is expected to be treated by a combination of treatment swales and raingardens.

5.9 Stormwater attenuation

Stormwater attenuation will align with the sub-catchments identified within the ICMP. Attenuation will be provided in accordance with the RITS and WRC Stormwater management guideline (2020) for the treatment devices that discharge into existing gullies and drains. Attenuation will not be needed for the devices that discharge directly into Waikato River; as such treated stormwater runoff from Peacockes road is proposed to be conveyed directly to the Waikato River (through adjacent development) without attenuation.

6. Design criteria and assumptions - Earthworks

6.1 Summary

Geotechnical investigation, interpretations and recommendations will be developed and issued separately through a Geotechnical Factual Report, Geotechnical Interpretive Report, and associated geotechnical design memos. The information within those reports (currently under production) have not been repeated here, but the following provides a generalised summary for the philosophical approach that is expected to be undertaken for the geotechnical aspects of this project.

6.2 Design loads

The Peak Horizontal Ground Accelerations (PHGA) and associated earthquake magnitudes used for seismic design at the Damage Control Limit State (DCLS) shall be taken from the magnitude-unweighted data included in the supplied Site-Specific Seismic Hazard Study, but seismic demands are not to be less than 70% of those derived from the Waka Kotahi Bridge Manual, Section 6 using key parameters presented in Table 6.1.

Table No. 6.1

NZS 1170.5 parameters for Peak Horizontal Ground Accelerations at DCLS	
Factor	**Factor Class D: Deep or soft soil**
$C_{0,1000}$	**0.28**
Slopes associated with bridges	
AEP	AEP 1:2500
R_u	1.8
Magnitude	5.9
Slopes not associated with bridges but supporting the PST carriageway	
AEP	1:1000
R_u	1.3
Magnitude	1.9

AEP identified in Table 6.1 shall also be used when selecting PHGA and Magnitude combinations for DCLS design from the Site-Specific Seismic Hazard Study. Seismic actions other than at DCLS shall be obtained by modifying Return Period Factor R from RU as tabulated above to suit different AEP requirements as defined in the Bridge Manual published by Waka Kotahi.

Designs shall be checked for potential liquefaction, including settlement, deformations, and lateral spread, where appropriate. Liquefaction analyses will be undertaken to a depth of 20m.

6.3 Factors of safety

Cut and fill slopes will generally adopt the following factors of safety:

- Long term embankments and cuts: F > 1.5
- End of construction embankments: F > 1.3
- Temporary conditions for cuts and fills: F > 1.2
- Seismic design case for cuts and fills: F > 1.1

Due to the rapidly reversing nature of earthquake loading, factors of safety less than unity will be accepted for the worst-case seismic design situation, provided the failure is not sudden or catastrophic and resulting displacements are assessed as being manageable.

Models will be developed for all critical fill embankments. The model will take account of both stability and settlement.

In situations where the conventionally adopted factors of safety prove uneconomic, specific factors of safety may be determined using a risk-based approach and proposed to HCC.

6.4 Seismic performance requirements for earthworks

Seismic performance requirements for earthworks associated with bridges or other structures will satisfy the performance requirements for those bridges or other structures.

Seismic performance requirements for earthworks not associated with bridges or other structures will (if practical) satisfy the requirements of Waka Kotahi Bridge Manual Table 6.1 and associated text. Such a solution represents the preferred standard.

Where the requirements of Table 6.1 (and associated text) are identified to require substantial cost, particularly for ground improvement, to achieve Table 6.1 criteria, then:

- Alternative solutions will be identified which offer enhanced cost-effectiveness in conjunction with less demanding performance requirements.
- Technically compliant and alternative proposals will both be developed and submitted to HCC for consideration and selection of an acceptable solution. The material submitted to HCC will include performance expectations for each potential solution, couched in terms of Bridge Manual Table 6.2 and associated text.
- The solution accepted by HCC will be presented as part of the Detailed Design.
- Any compromise of Table 6.1 requirements implicit in the selected solution will be carefully drafted to define the minimum acceptable standard.

This proposal reflects the HCC's expressed preference to adopt a risk-aware rather than risk-averse stance under such circumstances, in the interest of providing technically appropriate cost-effective engineering solutions to such projects. This proposal mirrors the approach previously taken on the adjoining PWRB project.

6.5 Batter slopes

Design of cut and fill batter slopes will consider factors including:

- Designation and property boundary constraints.
- Local and global slope stability.
- Constructability.
- Effects on cut and fill balance.
- Drainage design.
- Resistance to erosion.
- Proposed landscape treatments.
- Maintenance cost and safety.
- Size of the road footprint.
- Final location of stock fences and opportunities for grazing.

Batter slopes steeper than 2:1 will be avoided where possible. If they cannot be avoided, specific consideration will be given to landscape treatments to avoid failure due to slumping of topsoil and vegetation.

6.6 Fill sources and spoil disposal sites

In general, there is an expectation that there will be a shortage of fill material able to be won from the site for this project. The quality of any cut material that could be reused as structural fill also needs to be confirmed. As such, there is a high likelihood for needing to identify a suitable borrow site (or commercial source) for the structural fill needed on this project, and a need for a local disposal site if site-won material is deemed unsuitable for reuse. From work already undertaken to date, we expect the spoil disposal site will be less of an issue to resolve than the source of suitable structural fill.

Throughout the design process, potential options for both borrow and disposal will be investigated. Particularly, adjacent landowners and developers will be consulted regarding opportunities that could benefit both them and HCC regarding balancing earthworks within the wider Peacocke development area.

Due to the expected high moisture content and sensitivity of many of the soils to be won from excavation to design levels, the earthworks design will likely impose a relatively conservative approach regarding the assessment of quantities of materials suitable for use as structural fill. Assumptions regarding spoil disposal requirements will also be conservatively based. This provides Hamilton City Council with the best tool to help manage uncertainty around earthworks costs during construction.

Adjacent landowners will be consulted regarding the best way to rehabilitate areas disturbed by the works in order to maximize the productive capacity and future sale value of the land.

7. Design criteria and assumptions – Ground improvements

7.1 Ground improvements design

The design will provide for ground improvements at the abutments, and pier locations, of proposed bridges if necessary, to satisfy the requirements of Section 6.2 above.

The need for ground improvements beneath embankments will also be assessed during design development, considering:

- Achievement of overall serviceability requirements for the bridges and embankments post design event.
- Value for money.
- The availability of alternative routes and the rapidity with which repairs could be affected.

It is proposed that the Detailed Design will present an optimized set of ground improvement extent and type and standard beneath embankments and at other specific locations, and that this data is used as a standard against which any alternative tender ground improvement solution is compared and evaluated.

8. Design criteria and assumptions - Bridges

8.1 Design life

The design life for all bridges will be 100 years.

8.2 Design loads

Pertinent design loads include all individual load cases and load combinations prescribed by the Waka Kotahi Bridge Manual.

8.2.1 Live loads

Traffic loads will conform to the HN-HO-72 load regime, including the 1.35 load factor on HN loads at SLS as required by the current edition of the Waka Kotahi Bridge Manual.

Live loads for pedestrian bridges will be 5kPa.

Allowance will be made for loads expected to be imposed by utility services as identified in consultation with utility service operators and HCC as territorial local authority. These requirements will be documented and accommodated in the Detailed Design bridge proposals.

8.2.2 Flood loads

Ultimate Limit State flood conditions for bridges over waterways will include log collision loading, considered as a CO load in Waka Kotahi Bridge Manual, Table 3.2, Case 3C without concurrent traffic loading.

Ultimate Limit State flood conditions for bridges over waterways will also include debris loading, considered as an additional FW load applied subsequent to the log load specified above, as defined in Waka Kotahi Bridge Manual, Table 3.2, Case 2C (i.e. concurrent with floodwater pressure and buoyancy loads with scour, and concurrent with HN traffic loading).

8.2.3 Seismic loads

The design Damage Control Limit State (DCLS) horizontal ground accelerations shall be derived from recommendations of the Site-Specific Seismic Hazard Study supplied. Horizontal ground accelerations adopted for any limit state shall be no less than 70% of values for that limit state which have been determined from the Waka Kotahi Bridge Manual in conjunction with NZS 1170.5 for the specific site location and exposure, using key parameters as presented in Table 8.2.3A.

Table No. 8.2.3A

NZS 1170.5 parameters for "Design-level" Horizontal Ground Accelerations at DCLS	
Factor	**Class D: Deep or soft soil**
AEP (Mangakootukutuku Bridge)	1:1000
R_u	1.3
Z	0.16
N (T,D)	-
S_p	1.0

When developing seismic demands for structures using the weighted data provided by the Site-Specific Seismic Hazard Study (SSSHS):

- The AEP parameters tabulated above are to be used in conjunction with spectral shapes provided by the Study when developing “design-level” DCLS seismic demands.
- Collapse-avoidance limit state seismic demands (CALS) appropriate to major earthquakes are to be taken as 150% of “design-level” DCLS seismic demands unless otherwise recommended by the SSSHS.
- Serviceability limit state seismic demands (SLS) appropriate to minor earthquakes are to be taken as 25% of “design-level” DCLS seismic demands unless otherwise recommended by the SSSHS.

When developing seismic demands for structures using the weighted data provided by NZS 1170.5:

- All parameters tabulated above are to be used in conjunction with the spectral shapes in NZS 1170.5, Table 3.1 and Figure 3.2 when developing “design-level” seismic demands.
- CALS seismic demands are to be taken as 150% of “design-level” DCLS seismic demands.
- SLS seismic demands are to be taken as 25% of “design-level” DCLS seismic demands.

Bridge design will be developed on the basis that:

- Both liquefied and non-liquefied soil conditions will be considered in combination with inertial loading acting on the seismic weight of the bridge.
- The effect of lateral spread resulting from liquefied soil conditions will be considered as a stand-alone “post-earthquake” load case.
- Lateral spread will not be considered as concurrent with inertial loading as a composite “during-earthquake” load case unless the percentage of the DCLS or CALS hazard at the site due to magnitude 7.5 or larger earthquake is estimated by the SSSHS to exceed 20% (refer Bridge Manual Clause 6.3.5 iii).
- Consecutive “design-level” DCLS earthquake events will be considered.
- A single major CALS earthquake event will be considered.

The performance requirements for various seismic events are presented in Table 8.2.3B.

Table No. 8.2.3B

Seismic Performance Requirements	
Seismic Event(s)	**Performance Requirements**
Repeat minor SLS event	As specified in *Bridge Manual*, Table 5.1 for minor SLS earthquake ($R = 25\% R_u$) Nil ductility demand Nil permanent displacement
Single DCLS event	As specified in *Bridge Manual*, Table 5.1 for design level DCLS earthquake ($R = 100\% R_u$)
Repeat DCLS event	As specified in *Bridge Manual*, Table 5.1 for major CALS earthquake ($R = 100\% R_u$)
Single CALS event	As specified in *Bridge Manual*, Table 5.1 for major CALS earthquake ($R = 150\% R_u$)

8.3 Displacements

The design will be developed on the basis that:

a) Compliance with the displacement limits specified in Waka Kotahi Bridge Manual, Sections 6.1.2 and 6.6.9 and Table 6.1 is not required, other than satisfying the upper bound of specified permanent displacements. Where upper bound permanent displacements are presented for varying hazard factor Z then the limits nominated for hazard factor Z ≥ 0.4 will be satisfied. Upper bound displacement limits will be regarded as total displacement limits which are acceptable following earthquake, irrespective of whether they result from:

- Inertial effects and/or soil movement.
- Liquefied and/or non-liquefied soil conditions.
- Compounding effects of concurrent and/or consecutive seismic events.

This proposal is more conservative than some expressed design opinion that permanent displacement limits apply to each of these situations if considered separately. It is however less conservative than adopting the permanent displacement limits specific to hazard factor Z, reasoning that there appears to be little justification for tailoring quantitative permanent displacement performance requirements to seismic exposure providing that the qualitative performance requirements for the various nominated limit states as outlined in b) to d) below are satisfied. HCC acceptance of this approach is sought:

b) Nil-damage is the summary performance requirement under exposure of a structure to one or more Minor (SLS) earthquake events.

c) Survival is the summary performance requirement under exposure of a structure to either a single Major (CALS) earthquake event or duplicate Design-level (DCLS) earthquake events.

d) Performance requirements for the intermediate single "Design-level" (DCLS) earthquake event are to some extent negotiable: the preferred and target standard is satisfaction of Waka Kotahi Bridge Manual, Table 5.1 criteria, but the potential to optimise cost and programme with modest departures from these criteria is recognised. Formal HCC acceptance of any such departure will be sought.

Permanent displacements will be assessed using three methods under liquefied soil conditions and three methods under non-liquefied soil conditions. All conclusions will be reported together with comment on the applicability of each method, and this set of data will be used to formulate judgment-based design recommendations.

8.4 Vertical clearances

The basic minimum soffit level for any bridge over a waterway will be set at 1.20m above AEP 1:100 flood level in accordance with Bridge Manual clearance criteria where the flood level assessment shall include for the effects of climate change. Vertical clearance under exposure to flood is not expected to represent a significant challenge for this project, but the basic minimum soffit level will only be reduced if assessment of potential debris load in any catchment upstream of the bridge justifies a reduction in freeboard from 1.20m to 0.60m, subject to HCC acceptance.

Assessment of climate change effects will, if possible, be based on data and guidance sourced from the Waikato Regional Council and supplemented by information provided from Mercury Energy (operating the Waikato Dam system). If such data is insufficient to support a credible analysis, then flood levels will be assessed based on flood assessment without consideration of climate change effects, but with waterway discharges increased by 20%, or such greater allowance as may be required by the Waikato Regional Council.

8.5 Horizontal clearances

As directed by HCC, minimum horizontal clearances between barriers for each specific bridge will not cater for over-dimension vehicles passing over that bridge.

Pier and abutment positions for bridge crossings have been developed in consultation with stakeholders and will comply with resource consent conditions.

Positioning of piers in both the Mangakootukutuku and Eastern gullies is still to be confirmed with the TWWG via a site visit scheduled for 19th May 2021. Written confirmation of support from TWWG for the preferred bridge arrangement and pier positions within the gullies was received (via email) on 30 July 2021. Letters of support from TWWG will be sought (in due course) for consent applications, and will be based on the final detailing of the bridges and any associated mitigation.

8.6 Cross-section

8.6.1 Minimum dimensions

Cross-sections for carriageways carried by each proposed bridge will satisfy the minimum dimensions in Section 0.

8.7 Edge barriers

Edge barrier systems mounted on bridges will be tailored to the requirements of user groups.

BM3.3, Table B2 indicates that the T80HT barrier form is acceptable to Waka Kotahi as a combination barrier. Confirmation of acceptability of this barrier form will also be sought from HCC, as will the potential need for intermediate horizontal wires between the base of the elliptical steel top rail and the top of the concrete F-profile section of the barrier, to cater for the presence of children. The bridge is unlikely to be classified as 'frequented by children'. Hence this proposal is precautionary, but it recognises the role of HCC as administrator of the Building Regulations, including Section F4 Safety from Falling.

All barriers on bridges will be designed on the basis of conventional overstrength philosophy to protect the deck structure supporting the barrier in the event of the barrier being overcommitted under collision loading.

On-bridge barriers will transition to off-bridge barrier systems in accordance with standardised barrier transition systems. Steel rail continued beyond bridge abutment to the position where the barrier without rail satisfies Building Code safety from falling requirements; and adopting standardised rail terminations or other detail acceptable to the Waka Kotahi to avoid spearing hazards and other risks.

8.8 Aesthetics

Bridge aesthetics will satisfy the project-specific requirements of the Concept Landscape Management Plan (and ultimately the Landscape Management Plan, once prepared), but has been a significant element of consideration when developing the preferred structural form of the bridge. Aesthetic priorities will impact on design choices for all elements, including superstructure and substructure form, and the detail of those forms.

The Tangata Whenua Working Group (TWWG) has identified an interest for cultural inputs into the bridge design process (primarily expected to influence the bridge aesthetics). The scope of these inputs, and the eventual detailing associated with those outcomes, are yet to be established. However, we expect this will involve workshopping the design with TWWG reps and inclusion of their cultural artists to help influence shapes and detailing of the designed structure (opposed to changing the structural form itself).

8.9 Whole of life

The required 100-year design life for all concrete structural elements will be achieved utilising appropriate combinations of concrete quality and cover. The use of supplementary cementitious materials will also be considered to provide enhanced durability without impacting adversely on creep/shrinkage behaviour.

All structural concrete elements will be designed to exposure classification B1 in accordance with NZS3101:2006. This exposure classification is more demanding than the required A2 appropriate for inland environment. This choice is deliberate to achieve enhanced durability performance at negligible incremental cost. Durability issues have been addressed using a combination of appropriate attention to concrete grade and reinforcement cover, tailored to the specific environmental exposure of the structure. Minimum covers for below-ground piles etc… satisfy both B1 requirements and additional cover required for members in contact with soil.

8.10 Low damage seismic bridge systems

A conventional approach to seismic design is proposed for the purposes of Detailed Design, considering both traditional force-based methods and the displacement-based methods introduced in the 3rd amendment of the 3rd edition of the *Bridge Manual* published by the Waka Kotahi. This approach recognizes that familiarity with force-based methods offers some advantages, and that displacement-based methods have been identified by the Waka Kotahi as preferred. Where conclusions of the two methods differ then the bridge design will cater for the envelope of the two methods.

8.11 Western, Mangakootukutuku, and Eastern Watercourse Crossings.

8.11.1 Initial assessment

Based on our initial desk top evaluation and a brief site visit, the three waterways have the following geomorphic characteristics:

- Western waterway, a small tributary to Mangakootukutuku Stream, is flowing along a low-lying, highly modified gully. The stream has been modified by a number of small dams of uncertain design and consenting status that create a series of consecutive small ponds. The vegetation at the banks of the gully has been landscaped and consists of native and exotic species. The actual geometry of the stream's channel and floodplain could not be identified from on-site visits due to the inundation and needs to be surveyed.

- Whatukooruru Bridge crosses the waterway of Mangakootukutuku Stream. The stream is incised into a steep gully, that in the proposed crossing area has a depth of approximately 15m. The stream is sinuous, with densely vegetated banks. The floodplain is narrow due to the stream's incision.

- The western waterway is another small tributary to Mangakootukutuku Stream. The waterway consists of an incised gully, with the same characteristics of Mangakootukutuku Stream but with less dense vegetation on its banks. The section of the gully upstream of the future crossing has been modified and its bank's vegetation has been significantly reduced. A pond has been formed at the gully's head due to the construction of an informal dam. The gully's depth at the location of the future crossing is approximately 12.5m.

8.11.2 Design approach

Design development to date has sought to keep construction works beyond the waterways, recognizing that it is highly undesirable from a cultural perspective for construction to encroach on the waterway. For the purposes of design the waterways have been assumed to be defined by low winter flow levels.

The proposed Western Water Crossing bridge form comprises a single span bridge which mitigates the need for a pier. The Mangakootukutuku Crossing and the Eastern Water Crossing are proposed to have the piers situated outside of the waterways.

Design goals, with regard to the potential impacts on the waterways:

- In the existing condition, the waterway and floodplain are very stable. The bridge designs will be developed to maintain this geomorphic stability.

- The bridge designs will minimize or avoid increases in upstream flood levels. At a minimum, the proposed bridges will be designed to avoid creating new flood burdens on landowners within and adjacent to the affected waterway reach.

- The proposed bridges will be designed to minimize the need for scour countermeasures in the channel, as much as possible. By minimizing the need for scour countermeasures, environmental impact is also minimized.

8.11.3 Design methodology

The design methodology will begin with progressing the geomorphic, hydraulic, and hydrological assessment of the three water crossings to a detailed level. Part of the assessment process will be to coordinate with HCC to establish the required hydraulic performance that will be necessary to not negatively impact them or other stakeholders. This coordination will include acquiring hydraulic modelling and establishing design flows that are acceptable.

Based on our initial river assessment, we anticipate that the hydraulic modelling for the bridge designs will be a 1d model, as the waterways do not include wide floodplain areas outside of their effective flow zones. The modelling will be completed using HEC-RAS 6.0 or more recent update if required.

8.11.4 Bridge deck drainage

Sag curves in bridges will either be eliminated by the geometric design or appropriate low maintenance solutions to water collection and conveyance on the bridge will be developed.

8.11.5 Provision for inspection and maintenance

Abutments and piers will be readily accessible from ground level, although the height of the deck at the pier positions will warrant careful consideration of stability of access plant. Consideration will be given to the provision of a permanent firm and level area at the piers which is suitable for supporting a scissor lift.

Stainless steel sockets may be placed in the soffit of the reinforced concrete deck to facilitate access using roped access techniques or scaffolding over the full width of the bridge should such access be necessary.

8.11.6 Architecture

The architectural input for the three water crossings aims to generate a cohesive and integrated user experience which brings together the practical and economic requirements of a successful structure, with an aesthetic that is both sympathetic to the landscape and natural environment, as well as being sensitive and responsive to the diverse cultural context in which it serves.

9. Design criteria and assumptions – Retaining walls

9.1 Design life

The design life of retaining walls and retention elements will be 100 years.

Timber retaining walls are not currently anticipated to be adopted but may be considered as a last resort for minor retention works which can be replaced without adverse impact on the HCC roading network or other retained development. As an additional precaution, the minimum durability treatment nominated for the timber components of any such wall will be one stage more robust than stipulated for a 50-year design life in the anticipated exposure. This proposal recognises the lack of proven durability records for timber for 100-year design life, but also expert opinion that an approach of this type is expected to prove adequate. HCC direction is sought regarding the acceptability of this proposal.

9.2 Design loads

The design of retaining walls will take into account all foreseeable immediate and future excavations, using the Waka Kotahi Bridge Manual Section 6 as the base reference.

Design of cantilever retaining walls (if required) will take into account unplanned excavations by assuming excavation in front of the wall of 0.5m or 10% of the total retained height, whichever is the greater, under ULS conditions. Allowances for future excavation will be nominated on the drawings.

Groundwater conditions at each wall location will be assessed to determine the most unfavourable conditions that could occur in extreme circumstances. Groundwater conditions for the SLS check will assume the most unfavourable conditions that are likely to occur in normal circumstances.

Seismic design shall be based on a combination of the philosophy defined by the Waka Kotahi Bridge Manual and the specific proposals for other elements of the project as follows:

- *Bridge Manual* Section 6.2.2 for liquefaction/stability/displacement criteria for retaining walls shall be interpreted as ***Design Criteria and Assumptions: Earthworks*** Section 6.1 above.
- *Bridge Manual* Section 6.2.3 for structural design of retaining walls shall be interpreted as ***Design Criteria and Assumptions: Bridges*** Section 8.2.3 above.

9.3 Deflections

Predicted sliding displacements of retaining walls under design seismic loading will not exceed the maximum limits specified in the Waka Kotahi Bridge Manual, Sections 6.1.2 and 6.6.9 and Table 6.1, but the approach to permanent displacement limits described in Section 8.3 above is again proposed, provided that:

- These displacements do not adversely affect adjacent structures and services.
- It can be demonstrated that bridge piles and other structural elements reliant on the walls can accommodate these displacements without exceeding their elastic limits or capability to carry concurrent demands, as described in Section 8 above.

10. Design criteria and assumptions – Pavements and surfacing

10.1 Pavement system selection

The design approach for the pavement is to follow the approach undertaken in the PWRB project and build on lessons learned by Waka Kotahi and others from a number of significant infrastructure projects where pavement failures have occurred sooner than predicted by the designers. Some of the lessons include:

- A stiff foundation (subgrade layers and embankment formation) is essential to enable the upper pavement layers to be properly compacted.
- Cost savings or value engineering should focus on the upper layers rather than the lower layers because foundation issues are generally expensive and disruptive to remedy.
- Rutting will occur if the basecourse can be further densified by traffic.
- Cement modified basecourse, used in some state highway pavements to improve resistance to rutting, has not been successful.
- Material properties are important to the long-term performance of the pavement and require constant monitoring for compliance.
- Sources of moisture must be dealt with, including from below, from above (through the surfacing), from the sides, and trapped in the pavement layers during construction.

The above lessons will be considered when selecting the pavement layer and surfacing system for the pavements. Note that the calculation of layer thickness using layered elastic analysis (CIRCLY) will be one of the final steps in the detailed design process, rather than the starting point for design.

An additional consideration for road pavements is that, in comparison with a typical state highway project where the pavement is heavily loaded immediately when the road is opened, traffic loading on Whatukooruru Drive and Peacocke Road will build up relatively slowly, with only moderate demands on the basecourse and surfacing early in the life of the pavement.

The proposed pavement system will consist of:

- A well-drained in-situ subgrade in cuttings, or a structural fill subgrade over embankments.
- A subgrade improvement layer of imported pit sand, with tight controls on silt content.
- Sub-basecourse of premium aggregate.
- Cement stabilization of the sub-basecourse (if required) to limit deflections on the top of the sub-base layer.
- An unbound TNZ M4 AP40 basecourse layer.
- Chipseal surfacing with not less than 2.4l/m^2 residual bitumen prior to trafficking.
- Asphalt wearing course on arterial roads, permanent turning heads, and on approaches and through intersections.

The subgrade and SIL requirements together with premium sub-base aggregate should eliminate the risk of foundation and sub-base failure. The unbound basecourse carries some risk of rutting but the next step up in performance would require a leap in cost to structural asphalt. In this regard, design traffic above 10^7 ESA typically causes rutting problems for M4 basecourse. Heavy traffic volumes are expected to be well below this for the road corridors, therefore a well-constructed unbound M4 basecourse is expected to perform adequately and the more expensive options such as foam bitumen stabilization or wholesale deep lift asphalt over the main corridor length is unlikely to be deemed necessary. Reflective cracking risk with the stabilised sub-base is minimised by the low deflection limits on the subgrade and SIL, and by providing the recommended minimum depth of cover in Section 8.2.6 of the Austroads Guide to Pavement Technology.

Deep lift asphalt is expected to be used for the signalised intersections because of the additional loads on the surfacing and basecourse caused by acceleration and braking.

10.2 Structural design

The design traffic loading and structural design will be based on the methods referred to in the New Zealand guide to pavement evaluation and treatment design (NZTA 2018).

Structural design will check layer thicknesses to confirm that the damage factors calculated using CIRCLY are very low even when using pessimistic assumptions for the stiffness of all pavement layers. Layer thicknesses may be adjusted to values greater than theoretically required to reflect construction considerations.

It is important not to over-estimate subgrade CBR values. Subgrade CBR for design will be estimated from soaked CBR tests on undisturbed samples from cuttings, and from potential fill materials recompacted in the laboratory to densities expected to be achieved in the field. These tests will be repeated during construction to verify the soaked CBR values.

Benkelman Beam deflection targets will be calculated for the various stages of construction (top of SIL, top of sub-basecourse and top of basecourse) using the expected range of constructed pavement layer properties so that the performance of the pavement can be verified as each layer is constructed.

Design of cement stabilised sub-base layers will be based on the stabilized layer withstanding the full design traffic loading in the un-cracked state. Again, conservative values for the stiffness of the cement stabilized layer and the underlying layers will be used in the CIRCLY analysis, to avoid overly optimistic predictions of performance.

10.3 Pavement materials

Standard NZTA and RITS specifications will be utilised for pavement materials. In addition, RLT and ethylene glycol testing will be used to assess aggregates for susceptibility to weathering. Sources (quarries) with known durability issues will be avoided.

For stabilised sub-base, a coarser grading envelope will be specified through the middle sieve sizes to account for the approximately 5% increase in percent passing each sieve caused by the mixing process. This will limit the risk of cracking which can occur with stabilized mixes which are too fine.

10.4 Pavement construction

As per the PWBB project, the Project Specifications are intended to have a stringent testing regime to ensure the pavement construction aligns with design assumptions and requirements. Opportunity will be taken at each stage of construction to assess the as-constructed layers by Benkelman Beam testing to verify the design before proceeding with the next layer.

Density targets and rolling patterns will be established by the usual methods involving laboratory testing and plateau tests. However, density targets can be wrong for a number of reasons and, by themselves, are unlikely to replace the experience of construction crews when determining whether a layer is finished (e.g. achieving “tinging” under the roller). The aim will be to work the basecourse particles into a condition as dense as possible, short of causing particle break down. This will minimise post construction rutting.

Emerging intelligent compaction (IC) technology has the potential to improve compaction by adjusting vibration amplitude and frequency on the fly to optimize compaction, as well as identifying under-compacted areas and preventing over-coympaction. Contract documents will require all primary compaction plant to be IC equipped and operators appropriately trained in its use.

Cement stabilising (if adopted) is a complex operation involving large numbers of plant items and requires good planning and a detailed knowledge of a number of critical success factors. Prior to commencement, Contractors will be required to submit a Production Plan for approval which addresses all aspects of the stabilizing operation (if relevant). This will be tested on a trial section prior to full scale production.

Stabilised sub-base (if relevant) will not be "pre-cracked" and instead will be protected from trafficking until cured.

10.5 Surfacing

Surfacing needs to provide adequate waterproofing of the basecourse layer. Chip seals with not less than 3.0l/m^2 residual bitumen will be applied.

Asphalt surfacing will be applied as required for noise attenuation or ride quality. It may not be required initially, until traffic volumes build, and the number of noise sensitive receivers warrants low noise surfacing. Small chip sizes or asphalt surfacing will be used where cyclists must travel on the road.

10.6 Pavement drainage

An effective pavement drainage system is required to ensure water drains quickly from the pavement layers and is prevented from entering. Pavement drains will be included at the lower edges of the pavement layers for all pavements, including on embankments.

The pavement drainage system is not intended to drain groundwater in road cuttings. An effective system for capture, collection, and discharge of groundwater seeping from the sides and base of cuttings shall be installed in addition to and at a lower level than the pavement drainage system.

Pavement drains will generally begin and end at catch pits or manholes. Otherwise, a rodding/flushing point will be installed at the ends.

11. Design criteria and assumptions – Landscaping & urban design

11.1 Introduction

The urban and landscape design approach to Whatukooruru Drive will aim at creating an integrated design where engineering and environmental aspects meet the requirements of HCC. It will apply best practice landscape and urban design principles to provide a culturally sensitive design that minimises the landscape and visual effects of the project and responds to the requirements of the Ecological Management and Monitoring Plan (EMMP).

The vision for Whatukooruru Drive is to create a robust roading network that is multi modal and enhances the urban fabric of the area, while catering to future uses that are planned within the area. To this extent, it must provide good connectivity, be visually stimulating, attractive, and express a localised 'sense of place' that is unique to this area of Hamilton, without compromising safety and efficiency requirements.

To achieve HCC's urban design aspirations, the PST will focus on balancing the infrastructure requirements and the need to maintain and enhance the amenity and liveability of the local community. In addition, the Project will utilise guidance from the Southern Links Urban and Landscape Design Framework (ULDF) and the Peacocke Concept Landscape Management Plan (CLMP). These documents provide the general design requirements/desired outcomes for the design of the project. To achieve the requirements, the landscape and urban components of the project will focus on the following aspects:

- Ensure an integrated road network linking the broader Peacocke development area with Whatukooruru Drive to improve connectivity, access and safety for all road users.
- Ensure high design quality of the transport network in terms of amenity, aesthetics of the experience, accessibility, safety, and landscape context.
- Support a wider range of transport choices through the provision of safe and user-friendly cycle and pedestrian facilities that includes the application of crime prevention through environmental design (CPTED) principles. Design reporting will include specific description of how the design aligns with each of the seven CPTED principles.
- Provide all road network users with a coherent design based on an overarching theme that responds to the differing context across the network while meeting community aspiration.
- Incorporate design treatments that moderate the scale of the project while providing quality aesthetic design outcomes that contribute and reinforces the character of the area.
- Encourage environmentally responsive design to maintain and enhance the ecological value, improve water quality, and uphold the visual amenity of the area.
- Consider aspects 'beyond the pavement' to integrate neighbouring land uses with particular focus on the development and integration of surrounding open space(s). Examples of this concept are provided in Appendix D.

11.2 Landscape character

The Peacocke development area traverses a variety of landscape character areas with the PSP area located within the Waikato River terrace character area, which sits on the peri-urban edge of Hamilton and is characterised by lifestyle block properties, open pastoral land with landforms of river terraces, gullies, and escarpments. In addition, a number of historical and cultural sites occur in and around the PSP area including former Pa sites including Whatukooruru Pa, the Redoubt, and Hamilton Gardens.

Land use and vegetation types vary across the area and is currently pastoral with hedgerows and shelter belts with a variety of large exotic and native trees scattered across the landscape. This landscape is rapidly changing with large scale subdivision occurring within the immediate vicinity of the project. Native vegetation is typically associated with the gully system, although some remnants of kahikatea are scattered across the landscape. Views vary depending on topography and vegetation, but more expansive views can be obtained from the rolling hills to the south.

The challenge is to achieve a sense of place while considering the varied landscape character and future uses proposed for the area. In addition, the roading network is not just a utility - but it forms an important public space and multi-use environment in its own right. Therefore, the landscape and urban design aspects of the project will contribute to creating an environment that is designed responsively to the surroundings and the needs of users, while aiming to maintain and enhance the ecological value of the area.

11.3 Urban and landscape design opportunities

To help meet the urban design requirements of HCC, the project will aim at incorporating the following design opportunities/principles to achieve a road network that:

- Is context sensitive where it contributes to the character and community by responding and connecting to the surrounding landscape, cultural and environmental setting.
- Reflects an integrated design approach with cohesive and innovative solutions embracing all aspects of design including structures, highway furniture, landforms, storm water, cultural elements, and planting.
- Ensure an integrated road network, linking SH3/Ohaupo Road and Peacocke Road with Whatukooruru Drive to improve access and safety for all road users.
- Integrate adjacent land uses with particular focus on the development and integration of the surrounding open space.
- Support a wider range of transport choices through the provision of safe (including CPTED) and user-friendly cycle and pedestrian facilities and bus lanes.
- Improved access for public transport users.
- Ensure integration with future infrastructure projects.
- Contribute to the ecological enhancement to increase habitat and improved water quality.
- Has continuity in style and character that utilises a consistent palette of materials across the transport network.
- Recognises and incorporates opportunities for cultural/art interventions and achieves these within design/construction solutions.
- Provides best practice management and maintenance approaches to achieve outcomes as promoted and expected by HCC.
- Is cost-effective base on a whole-of-life cost assessment.

11.4 Key urban and landscape design components

The following components of the project will require particular focus from an urban, landscape and environmental design perspective due to their size, scale, function, and significance. The design and integration of these components will play an important role in terms of achieving positive urban design and landscape outcomes, which in turn will contribute to the overall character of the project and the local area. Key components include:

- Whatukooruru Drive 3 No. gully crossings.
- Road hierarchy - major and minor arterials.
- Integration and interface with (proposed) adjacent land uses.
- Intersections and roundabouts.
- Integration of earthworks.
- Integrated stormwater.
- Integrated cycle and pedestrian facilities.
- Street and open space furniture.

- Retaining walls, fencing and noise walls.
- Landscape and ecological planting.
- Cultural and heritage values.
- Whole-of-life.
- Maintenance and specification requirements.

11.5 Whole of life

All urban and landscape design proposals will be designed to have a design life of not less than 50 years and require minimal maintenance for the first 20 years of the project. Coatings will have a minimum design life of 10 years. The design will include provision of appropriate measures to:

- Avoid the risk of graffiti and vandalism.
- Protect the visual integrity of the Project.
- Ensure there is adequate safe access for maintenance.
- Establish and maintain self-sustaining landscape planting.
- Utilise durable materials that can be readily sourced.

HCC's Parks and Open Spaces team, alongside HCC's Asset Management team, will be consulted regarding plant species to ensure a robust long-term environment is achieved.

11.6 Maintenance and Specification Requirements

The RITS specification shall be utilized in the first instance for supply and construction techniques. However, in accordance with the Peacocke CLMP, the Transport Agency's *P39 Standard Specification for Highway Landscape Treatments (2013)* will also be referenced where necessary to strengthen the construction/implementation standards and requirements. The RITS and P39 Specification together with project specific requirements will set out the minimum standards for performance, quality, and workmanship. This will accompany the Detailed Design Landscape Plans and Plant Schedules.

Contract requirements for the construction and maintenance period will include:

- The development of a Landscape Maintenance and Management Plan for at least a 2-year period (ideally 5-year period subject to HCC approval) after hand over, as part of the Asset Owner's Manual.
- Maintenance proforma to record site maintenance activities.
- Risk management associated with landscape activities.
- Storm water and wetland management documentation.

12. Design criteria and assumptions – Acoustics

12.1 Design conditions

The designations contain conditions in respect of operational noise. The Detailed Design will provide mitigation for operational noise at any dwellings on land not owned by the Crown for the purposes of the project that were in existence at the time the notice of requirement was lodged, where the noise levels of the designation conditions cannot be complied with.

Mitigation may be in the form of (in order of preference of treatment) a quiet road surface, barriers (or noise fencing), specific noise insulation for the dwelling or a combination thereof.

12.2 Property Agreements

The design will comply with any conditions of property agreements that relate to noise.

13. Design criteria and assumptions – Traffic services

13.1 Street and pedestrian lighting infrastructure

Street lighting for each road type will incorporate standard equipment that can be readily sourced for maintenance and replacements. This shall include the use of standard "Oclyte" poles and LED lanterns that satisfy RITS requirements (Section 3.3.20) – specifically (as requested by HCC) the Philips "Roadcharm" or "Roadgrace" will be used in order to be consistent with a recent roll-out across the city. Design shall be undertaken in accordance with AS/NZ 1158 and reference is made to NZTA M26 and M30 in relation to maintenance/warranty expectations and approved materials.

Consideration will be given to the lighting requirements outlined within the EMMP in relation to light locations, lighting (LUX) levels and spill relating to bat flight paths and habitat areas. The EMMP has some specific requirements (or restrictions) to how lighting is provided on the Mangakootukutuku Gully Bridge to help mitigate potential adverse effects to bat habitat and local ecology. In this location, lighting standards for vehicle lanes will be incorporated to provide consistent light levels across the bridge. Lighting columns are likely to be lowered (6m height opposed to standard heights), with LED lanterns being coloured as warm white. Pedestrian lighting will be designed to minimise light spill beyond the bridge deck. The EMMP requirements make the use of feature lighting unlikely on this project.

Whatukooruru Drive and Peacocke Road will be lit to a V3 category. The V category lighting on the Whatukooruru Drive and Peacocke Road satisfy the pedestrian lighting requirements on the adjoining paths. Other local roads and primary shared pedestrian and cycle facilities will be lit to P3 standards, but will also be subject to EMMP considerations. Off road paths within the gullies are not expected to be lit.

13.2 Pavement markings

Pavement markings will initially be applied with Transport Agency standard specification NZTA M/7 paint materials (including RITS requirements for this type of paint marking) then, following second coat sealing and asphalt surfacing, re-applied with high performance road marking materials complying with NZTA M/20.

13.3 Signs

All signs will be in accordance with the requirements of the Transport Agency's *Manual of Traffic Control Devices* and *Manual of Traffic Signs and Markings*.

Roadside signs will be standard pole mounted signs if there is sufficient room in the berm. Otherwise, cantilever supports will be installed behind safety barriers. Overhead gantries are not expected to be required.

Legends, including destinations, will be agreed with Hamilton City Council.

Wayfinding and destination signage discussions will be required with Hamilton City Council. The design will allow for signs as placeholders, which will be set out in accordance with the guidance in *Hamilton City Cycle Wayfinding Design Guide (2018)*. It is understood that Hamilton City Council is undertaking a project regarding wayfinding and destination signage for the wider Peacocke development, which can then be applied to the placeholder signs allowed for within the design.

13.4 Traffic signals

Traffic signals, if used, will be designed in accordance with NZTA P43 and RITS requirements. All signal designs will be subject to review and approval by HCC.

As per previous, the design of intersections seeks to prioritise public transport and active modes. Bus priority is likely to be provided through the allowance of "jump starts" for buses in the signal phasing, with buses using the left turn lanes to jump queues that may exist through lanes.

An independent traffic signal audit is also recommended to review safety and operational issues. These audits shall be undertaken at completion of the detailed design and again as part of the commissioning phase.

To provide an element of future-proofing, those local road at-grade priority controlled intersections will include a number of nominal diameter carriageway ducts to enable potential for future upgrade to a signalised arrangement.

13.5 Delineation

Edge barriers will be fitted with yellow reflectors mounted on the top of the post.

Edge marker posts are not expected to be required as the roadway is completely lit.

13.6 Safety barriers

Barriers will comply with NZTA M23, the various NZTA Technical Memoranda, Technical Advice Notes and RSB standard drawings and the interim acceptance notices listed on the NZTA M23 web page.

Road safety barriers are to be installed where there is a need to protect a vehicle from a significant hazard. In saying this, barriers are not expected to be provided to protect point hazards such as frangible specimen trees, road signs or light columns as the likelihood of an errant vehicle striking the barrier is much greater than the point hazard itself.

13.7 Cycle separators

The proposed separation strip between the vehicle carriageway and on road cycle lanes consists of two parallel edge lines 0.60m apart with proprietary zebra/armadillo cycle dividers (refer to https://plasback.co.nz/zebra-cycle-dividers/) providing continuity with the PWRB project.

The arrangement of the dividers needs to allow for refuse collection trucks to pass over/between the dividers to reach bags and bins placed on the berm. Appropriate arrangement of the dividers will be devised considering the proposed design vehicle for refuse collection and any specific requirements determined from consultation with the HCC Infrastructure Alliance and refuse operators (as directed).

13.8 ITS and Smart Hamilton infrastructure

ITS and Smart Hamilton infrastructure such as fibre ducts, pull pits junction pits, CCTV cameras and the like will be included as directed by HCC. This can be incorporated relatively easily prior to construction of pavement layers but would ideally be decided prior to start of project tendering (to allow competitive pricing and incorporation within construction drawings).

As a minimum, there is an expectation that CCTV cameras will be located at each of the signalised junctions, at each "formal" bus stop, and at key junctions where pedestrians/cyclists may congregate and/or not be immediately viewable by the travelling public. These locations will be confirmed in consultation with the HCC City Safe Operations team, including confirmation of latest camera specifications.

13.9 Bus stops

Bus stops will be designed in accordance with the RITS standard (not including the "mini" shelter) and coordinated with positions of pedestrian crossing points. Final positions of bus stops will be agreed with HCC Transportation staff.

The HCC Transportation team have indicated that the shelters, where possible, should enable "Adshel" type features to be incorporated within the shelter, thereby requiring suitable underground electricity ducts to enable power supply to be provided to each shelter.

The use of traffic lanes for buses on Whatukooruru Drive and Peacockes Road are generally compatible with latest design standards, with some minor adjustment. These adjustments have been reflected and presented in section 6.3.4 of the Peacocke East West Arterial Background Report. The recommended arrangement that provides an outcome for both buses and safely accommodating on-road cyclists is shown in Figure 13.9 below:

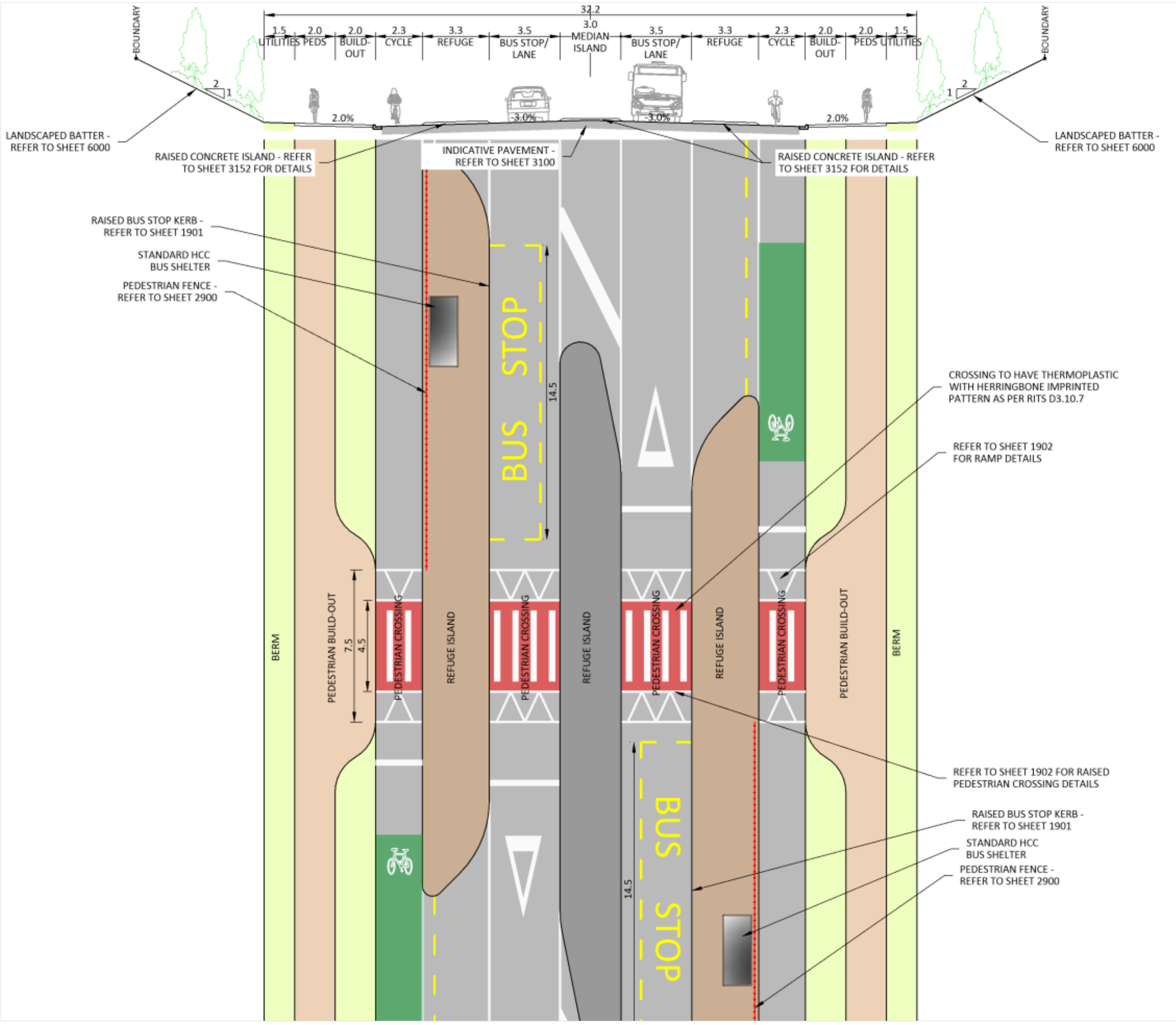


Figure 13.9: General bus stop arrangements on Minor Arterial Roads

Pedestrians are directed to cross behind the stopped buses when embarking or disembarking from the bus. This approach is aligned with relevant guidance that has shown this to be the safest arrangement. The pedestrian crossings are not proposed to be staggered. This is based on HCC guidance where there was concern that staggering the crossing would give the appearance that prioritisation is being focussed towards vehicles, as opposed to prioritisation to pedestrians. All pedestrian crossings are on raised platforms, including across the cycle lane, to encourage lower vehicles speeds. Platform height will match “accessible bus stop” height kerbing.

14. Design criteria and assumptions – Pedestrian and cycle facilities

14.1 Pedestrian and cycle facilities

To align with the project objectives and encourage alternative transport methods, pedestrian and cycle facilities with physical separation from the road carriageway will be provided along the full length of both Whatukooruru Drive and Peacockes Road.

Proposed locations and widths of footpaths, cycle paths and shared paths are shown on the drawings in Appendix A.

Facilities at intersections will be developed in accordance the design philosophy for intersections presented in Section 4. Where possible crossings will be grade separated, however, where not possible, vehicle speed will be managed through the use of raised safety platforms. Both current and future pedestrian desire routes will be identified in conjunction with the HCC Structure Plan to locate optimal crossing locations. Where raised zebra crossing are installed across Minor Arterial corridors, the design will include installation of ducting to enable future signalisation of the pedestrian crossing to a signal-controlled crossing (if future demand requires a greater level of crossing control).

Pedestrian/cycle kerb crossings will be developed with low (or no) lip profiles in order to avoid trip hazards and maximise accessibility to people of all mobility levels.

Paths shall generally be plain concrete, although other materials may be used for special purposes in feature areas such as bridges and intersections, to integrate with other landscape and urban design concepts and/or to embrace low-carbon alternative materials.

Opportunities for secondary (or informal) paths will be investigated through the design phase to align with the urban design and landscaping philosophies discussed in section 11.

15. Design criteria and assumptions – Utility services

15.1 Consultation

The following utility service authorities will be consulted regarding their current infrastructure, necessary infrastructure relocations, and any future plans for additional infrastructure:

- FirstGas
- WEL Networks
- Chorus
- Vodafone
- Vocus Group (formally FX Networks)
- Ultrafast Fibre
- Hamilton City Council
- Waikato Regional Council
- Land Information NZ

Vodafone and Vocus have previously advised (through Peacocke Waikato River Bridge project) that they do not need any services (or ducts) to be installed in the immediate future and do not expect to need any ducts in the future – we will confirm this in the context of this project.

Ultrafast Fibre have indicated a desire to install ducts for roadside fibre connection to be distributed throughout the Peacocke Development. As such, the design philosophy provides the opportunity for unlimited internet capacity (i.e. remove capacity constraint), subject to service provider installation. Expectation to date is that internet service will be provided to all development areas at least to a "Broadband" internet service speed.

Through previous rounds of consultation, service providers have been made aware of any known future plans for the Peacocke area in order for them to make medium to long term plans for their infrastructure. Each service provider will be able to advise of the expected number of ducts/ cables required on each corridor, the minimum separation requirements within trenches and any foreseeable futureproofing requirements.

The design will focus on providing necessary infrastructure to retain existing services and not preclude installation of future services/upgrades. This will primarily be achieved through the provision of adequate ducting within the corridors. Importantly, it does not mean that future-proofed services will be provided at the time of construction, and it will remain the service providers responsibility for installing any works deemed as betterment (i.e. enhancement over the existing services).

15.2 Service relocations

Relocation of services will be undertaken if they are directly affected by this project. In general, there is an expectation that existing above ground services (that are affected) will be relocated beneath ground. Ultimately, all existing above ground services within the Peacocke Development area are envisaged to be relocated beneath ground (as development occurs), however, this project is unable to make this an explicit requirement. Instead, the design for this project has allocated space within the cross-section for utility services to be directly buried during construction, and/or ducts installed to allow future installation (as development is undertaken or demand calls for services). Where the services provide betterment to the supplier, it will be up to the utility provider to install these services (or to relocate them beneath ground).

Consideration of construction sequencing for the Detailed Design will determine whether any relocation prior to contract award is warranted to reduce programme risk.

Quotations and draft methodologies will be obtained from utility owners for the purpose of preparing the estimate. However, actual relocation requirements will be determined and priced by tenderers, as the extent and scope of relocations is likely to be dependent on the tenderer's construction and staging methodologies.

15.3 Common services trenches

Common service trenches are proposed along both sides of each road within this project. The arrangement of the trench will ultimately be a responsibility of the Contractor; however, the design drawings will provide typical trench layouts based on the following information:

- Number of ducts (including futureproofing ducts) required by each of the service providers
- Minimum separation from other services required by utility owners – where conflicting separation distances were provided; the greater separation requirement was used.
- Minimum cover over ducts

Each service provider will be provided copies of the proposed layout throughout the design process and given chances to comment and request changes.

15.4 Bulk services

Bulk services to be included in the arterial roads to service the greater Peacocke development area include:

- Approximately 800m of new trunk wastewater rising main.
- Approximately 2,300m of new trunk water supply pipeline.

Refer to drawing 146000-002A-0201 in Appendix A for the Water and Wastewater Overview Plan.

The location and design of the water supply will be as directed by HCC, but initial indications are for a preference to install twin 250mm dia watermains (one each side of road), as this provides greatest level of flexibility to retain local connection and fire hydrant serviceability.

The location and sizing of any wastewater pipes will be as required to accommodate the wastewater design being undertaken by WSP.

15.5 Utilities to service adjoining land

Utility networks parallel to the transport corridor to allow connection into adjoining property without disruption to the transport corridor will be installed where such needs can be reliably established. These utilities will include the likes of:

- Water supply fire mains and rider mains.
- Stormwater pipelines (where this aligns with outcomes from the ICMP).
- Ducts for power and gas.
- Ducts for communications (fibre) infrastructure.

Laterals will also be provided to adjoining land to allow for future development where the location and size of such connections can be predicted, based on land use advice provided by HCC. These laterals will (where practicable and reasonable) coincide with the position of local roads identified in the Draft Peacocke Structure Plan and/or based on knowledge of key access points serving adjoining property (namely well-advanced land development proposals).

15.6 Provision for future services

Provision will be made to retrofit future services within structures and road corridors, as determined from discussions with utility owners.

Existing utility operators within the road corridor as well as potential new utility operators will be canvassed to determine their future needs. Recommendations will then be made to HCC regarding provision for future services within the road corridor and on structures parallel to and crossing the route.

15.7 Safe access

Provision for safe access to utility services will be discussed with utility owners. Equipment to enable remote metering will be installed for road lighting installations. It is expected that services will be ducted/sleeved across the structures to minimise the need for maintenance access.

16. Maintenance criteria

16.1 General

Input will be sought from the HCC Transportation Non-Civils Manager (at the Infrastructure Alliance) to understand the maintenance issues experienced, particularly in respect of graffiti. Lessons learnt from similar structures will be incorporated into the design to minimise risk of unnecessary maintenance.

As well as paying attention to the details of the physical works to reduce maintenance costs, the design of the road alignment, earthworks, batters, drainage, and landscaping will seek in an integrated way to reduce the footprint of the completed infrastructure, thereby minimizing the area of land that Hamilton City Council must maintain and maximizing the area of land available for disposal after construction.

Where land within the designation is modified by the works but will later be available for disposal, in conjunction with the Land Disposal Strategy, consideration will be given to the effects of construction on the future value of that land. In some instances, this may result in restrictions on use by the Contractor and/or investment in improved rehabilitation techniques.

The eventual Contract Documentation for construction of the works will also include provision for handover details (from the Contractor to the HCC Operational team (Infrastructure Alliance) on project completions, including:

- Risk Register (including status of project risks and residual risk elements)
- Safety in Design register (residual operational and demolition requirements)
- Asset Owners Manual (operational and maintenance requirements)
- Quality Assurance records (including (amongst others), inspection, testing, and as-built records)
- Completed RAMM records
- Completed Bridge Descriptive System (BDS) records

16.2 Maintenance access

The design will provide the safest practical access for periodic maintenance of:

- Grassed areas within the road reserve not fronting private property and requiring mowing by HCC.
- Planted areas and wetlands.
- Stormwater treatment/attenuation devices.
- Terminals, lamps, and other street lighting equipment.
- Traffic signal controllers.
- Open space furniture.

Consideration will also be given to safe parking for maintenance vehicles.

Steep batters will be hard landscaped to avoid the need for maintenance. Integral strong points for rope access to steep areas will be provided if inspection is likely to be required.

16.3 Corrosion protection

Components which are constructed in steel and which are modular and replaceable (such as light poles and guard rails) will be corrosion protected with a system capable of achieving a time to first maintenance of 10 to 25 years unless otherwise agreed with HCC.

Secondary structural members (such as barrier and handrails) which are constructed in steel and which are readily accessible for maintenance and replacement will be corrosion protected with a system capable of achieving a time to first maintenance of at least 25 years unless otherwise agreed with HCC as road controlling authority.

Structural steelwork placed below ground will include surplus steel thickness in accordance with the Heavy Engineering Research Association's published recommendations for the nominated 100-year design life. Combinations of sacrificial thickness and surface coating will also be considered, with reference to AS 2159 and the Heavy Engineering Research Association's published recommendations.

16.4 Bridge components

Elimination of expansion joints by using integral or semi-integral bridge abutments is increasingly favored, both in New Zealand and internationally, because of the reduced initial construction cost, reduced ongoing maintenance cost, reduced traffic disruption during joint replacement and improved ride quality for road users. Similarly, the reduction or elimination of bearings through monolithic connection between superstructure and substructure can yield significant advantage in initial cost and throughout the life of the structure.

Where bearings are required, elastomeric bearings will be preferred over pot bearings.

Jacking facilities will be provided for bearing replacement, wherever bearings are used.

Structures will provide for the passage of services and will be designed to accommodate in-service excavation to access services for maintenance, without need for specialist retention works.

Bridge and retaining wall components will be selected to discourage vandalism and/or minimise maintenance required as a result of vandalism. This will include consideration of:

- Positioning of components susceptible to vandalism.
- Mass of segmental wall units.
- Use of vandal-resistant materials and graffiti guard.
- Use of landscape planting in front of walls.

16.5 Ground retention systems

The design life of retaining walls and retention elements will be 100 years. Ground retention solutions (such as timber retaining walls) with a design life less than 100 years will only be used in locations where they can be replaced without disruption to live traffic operation. Refer to section 9.

16.6 Planting

Reference should also be made to Section 11.6 (above).

Planting will be designed with the objective of:

- Avoiding and mitigating maintenance requirements.
- Minimising maintenance requirements (e.g. weed control, grazing).
- Minimising the impact of landscape maintenance activities on traffic (e.g. provision of access for maintenance, safe parking for maintenance vehicles).

The HCC's Parks and Open Spaces team, along with HCC's Asset Management team, will be consulted regarding any preferences they have regarding planting and grassing, and types of hard surfaced areas. The cost of maintaining these surfaces will be considered in the selection of landscape treatment types and locations. Feedback to date has indicated that large areas of grass requiring mowing are both a significant cost and a safety issue, as can landscaping areas if positioned very close to traffic without providing reasonable separation distances or good access provisions. Ultimately, the design will seek to minimise the amount of mowing required and landscaped areas will have dedicated and planned access points to keep operations vehicles clear of live traffic.

17. Construction methodology and site access

17.1 General

The construction methodology and site access provisions will be developed as the Detailed Design is progressed, and modifications made to the Detailed Design if necessary, to ensure it can be constructed in a manner which is cost efficient and minimises disruption to road users and stakeholders.

17.2 Enabling Works

Opportunities for early works will be identified as the Detailed Design is developed. Where such early works will bring programme and/or cost advantages and/or reduces underlying project risk to the project without limiting opportunities for the physical works contractor, these will be discussed with the Project Manager and implemented as instructed. This could include:

- Selected service relocations.
- Selected accommodation works from property agreements.
- Vegetation clearance.
- Building removal.
- Access tracks to enable early site establishment.
- Advanced ecological mitigation planting.

17.3 Bridge structures

It is expected that the ground profile around Mangakootukutuku bridge crossing and the Eastern water crossing bridge abutments will be contoured to allow conventional construction.

The Western water crossing is expected to be of conventional bridge construction, with standard abutment construction methods.

Construction of the superstructure of the three bridges is proposed to be standard prestressed, precast concrete beams, Super-T and Single Hollow Core beams are proposed. This is a conventional system with standard construction methods.

Construction of the in-situ deck slab is orthodox and is not seen as unduly demanding and is a simple and robust superstructure.

The detailed design documentation will include a notional construction sequence and construction system which has been supported by analysis, but temporary works will remain the Contractor's responsibility, and it is probable that no tenderer will opt to follow the notional construction sequence in all respects. Contract documentation will ensure that the demarcation between responsibilities for temporary and permanent works is clear, including the Contractor's obligations for design and design review certification of temporary works.

17.4 Construction Traffic Management

Construction traffic management is a requirement that needs to be addressed as part of the project designation requirements. Given the effects are highly dependent on works undertaken on adjoining projects and planned urban developments, this is a matter that needs to be managed/controlled at a wider (Peacocke Development area) network basis opposed to a local project level. This is to ensure all outcomes are well-coordinated and planned by all parties. To assist in this Construction Traffic Network Management process, the following provides some of the key aspects/details that need to be considered in respect to this project:

- The contract period is expected to extend over a 1.5-year period, and construction activity will be seasonal.
- At its peak, there are expected to be approximately 80 HCV movements per day (in each direction) in addition to approximately 70 worker vehicles per day. This peak is expected be in the summer of 2023/2024.
- There are only three (general) road network access points to the Peacocke Whatukooruru Drive project area. These access corridors are not ideal and include:
  - Through the rural area of Peacockes Road
  - Through the rural area of Hall Road
  - Through the urban area of Ohaupo/Dixon Road

Key issues with each of these access corridors include:

- **Peacockes Road and Hall Road**
  - Low standard rural road with relatively narrow cross-section and areas where low sight distances are achieved.
  - For Peacockes Road, it is currently used by an increasing volume of rat-runners seeking to avoid existing roadwork activities on the State highway network.
  - Existing condition of pavement is very poor, with indication that pavement will not be able to withstand predicted HCV content.
  - Potential damage to new works on Peacockes Road completed during PWRB.
  - Potential safety issues associated with construction vehicles using existing intersection with SH3 (SH3/Hall Road and SH3/Raynes Road)

- **Ohaupo/Dixon Road area**
  - Residential area with associated safety issues mixing HCVs with residential activities (such as school kids, regular access points, cyclists etc).
  - Potential damage to new works at Ohaupo Road roundabout and/or the development works at the western end of Whatukooruru Drive.
  - Restriction to HCV tracking.
  - Noise/dust/nuisance complaints by nearby residential population.

There are several potential solutions that need to be considered, and we recommend the following is discussed with the wider HCC and Peacocke Development team to agree on how best to manage construction traffic effects:

- Public relations – information on effects being well publicised so no surprises.
- Tender documentation to ensure construction traffic effects are well considered in their submissions, with clear constraints and incentives being provided for construction methods that seek to minimise effects.
- Consider restriction of routes for construction related traffic – key questions about how to manage/police this, commercial limitations of outcomes (i.e. extra cost), how to isolate effects from other developments etc.
- Further staging of works to limit peak construction traffic (but probably extend duration of works). Consider what improvements are needed to each corridor to manage effects and get those works either constructed in advance, or as part of the scope of works. Options include:
  - Speed limit changes
  - Intersection improvements/restrictions/road closures
  - Network signage

- Pavement rehabilitations (primarily Peacockes Road)
- Additional safety improvements – particularly on residential roads
- Footpaths/cycleways built in advance.
- Do nothing (or do minimum) and just accept there will be noise/nuisance complaints and requirement to patch the roads (i.e. these are legal roads that anyone can use).

17.5 Temporary carriageways

17.5.1 Stubbs Road

During construction of the Peacockes Road upgrade, there is the potential to utilize Stubbs Road (at least to enable connectivity) early in the construction phase and diversion of Peacockes Road traffic. This would need to be developed with cooperation from adjacent landowners but could enable Peacockes Road to be upgraded without disruption from operational traffic (with the exception of maintaining access to adjoining properties).

17.6 Accessway (driveways) into work site

Construction access proposals will be developed in conjunction with the Detailed Design. There is limited access to much of the site as it is largely landlocked. It is expected that access will be is relatively straight forward from existing roads, although construction traffic will need to be managed as discussed in section 17.4. The Project Manager will be advised at the earliest opportunity if access over private land and/or outside of the designation is considered desirable. An example of this was identified within the Peacocke East-West Arterial Background Report, which sought temporary access across the Tsai property to provide early/easy access to the Mangakootukutuku Gully crossing.

17.7 Earthworks cut/fill balance

Currently a shortage of fill material is envisaged of approximately 60,000 to 80,000m^3. Fill options include:

- Imported material.
- Local borrow sites from within adjoining properties to help form ultimate property development levels, subject to landowner agreement.
- Minimise the fill requirements for the project. Given the limited scope to change the vertical alignment the best opportunity would be to lengthen bridge structures where possible to minimise approach embankment extents.

17.8 Erosion and sediment control

Construction and maintenance of erosion and sediment control measures will be considered in the Detailed Design and discussed directly with Waikato Regional Council. A draft Erosion and Sediment Control Plan will be produced to support the resource consent application, to confirm that controls are feasible within the designation and for cost estimation purposes.

18. Implications for procurement

A procurement strategy will be prepared during the detailed design phase to respond to latest project knowledge and feedback from industry. At this time, the following procurement details are envisaged:

- Procurement as one-single project package, but potentially including a number of Separable Portion, such as: (1) Peacockes Road Upgrade, (2) Peacocke Road to Hall Road, and (3) Hall Road to Stage 1 Whatukooruru Drive)
- Developed in a way to enable other adjoining Peacocke Development projects to be included in the contact scope (e.g. Strategic Wastewater “Bikes on Pipes”)
- Likely to be traditional – Measure and Value contract, with potential for “mini” Design & Construct elements for ancillary works and/or elements such as “Bike on Pipes (refer above).
- Call for registrations of interest – November 2021
- Shortlisting – January 2022 to February 2022
- Tender proper – April to July 2022
- Award – August 2022

The following matters are the key things that the project team will continue to think about that relate to the procurement process and may also have an influence on the design as it continues to be developed:

a) Incorporating lessons learnt from the PST and other similar recent projects into designs to achieve improved outcomes.

b) Identification of design elements that could be refined (designed) by the contractor – this could include elements that are low risk or have low consequence of the outcome or be elements that HCC requires less control over the eventual outcome. Contract could seek to incentivize opportunities for contractor to identify these opportunities and share in a portion of the net savings returned.

c) Enabling contracts could be let in advance of the main contract – such as demolition services, relocations, vegetation removal, fencing, ground improvements (including preload set up) etc.

d) Potential for HCC to pursue the direct appointment of (a) preferred supplier of some construction elements (such as supply and installation of bridge components). Interface issues will be critical.

e) There is currently a high risk that there is a delay in access to some key properties (or delay in consent issue) that may affect how project staging can be undertaken (aim to make work elements less reliant on completion of other features).

f) Community response to construction traffic matters could influence how access to the site is managed – restriction of routes, time of day etc.

g) Construction cost estimates could exceed budget some further refinement/optimization of the design may be necessary, and/or removal of some (less critical) design elements. Need to identify critical and complementary design elements.

h) Weather – different construction methodology and/or programme in response to inclement weather.

i) Different contractors may have preferred bridge launching methods and/or equipment that could change how the bridge structural elements are developed. Important to make sure that assumed construction methodology is tested with a range of contractors, and/or ensure design is developed in a way that is less reliant on one particular method.

j) Lead-times for specific supply elements (e.g. supply from service agents, weathering steel, Strategic Water/Wastewater pipes etc). Important to understand these in completing the design as some specified elements (particularly non-standard elements) may have more/less lead-in period and ensuring the procurement/construction programme makes allowance for these leads.

k) Interface with contractors on adjoining projects. Allowances may need to be made to any restriction imposed by adjoining works or how crossovers of project footprints (site possession) or construction traffic may be managed. Completely independent accesses/site offices etc may be needed, and likewise shared accesses/sites may need to be well defined.

Appendix A – Concept Drawings

PEACOCKE
WHATUKOORURU DRIVE
PSP 18251

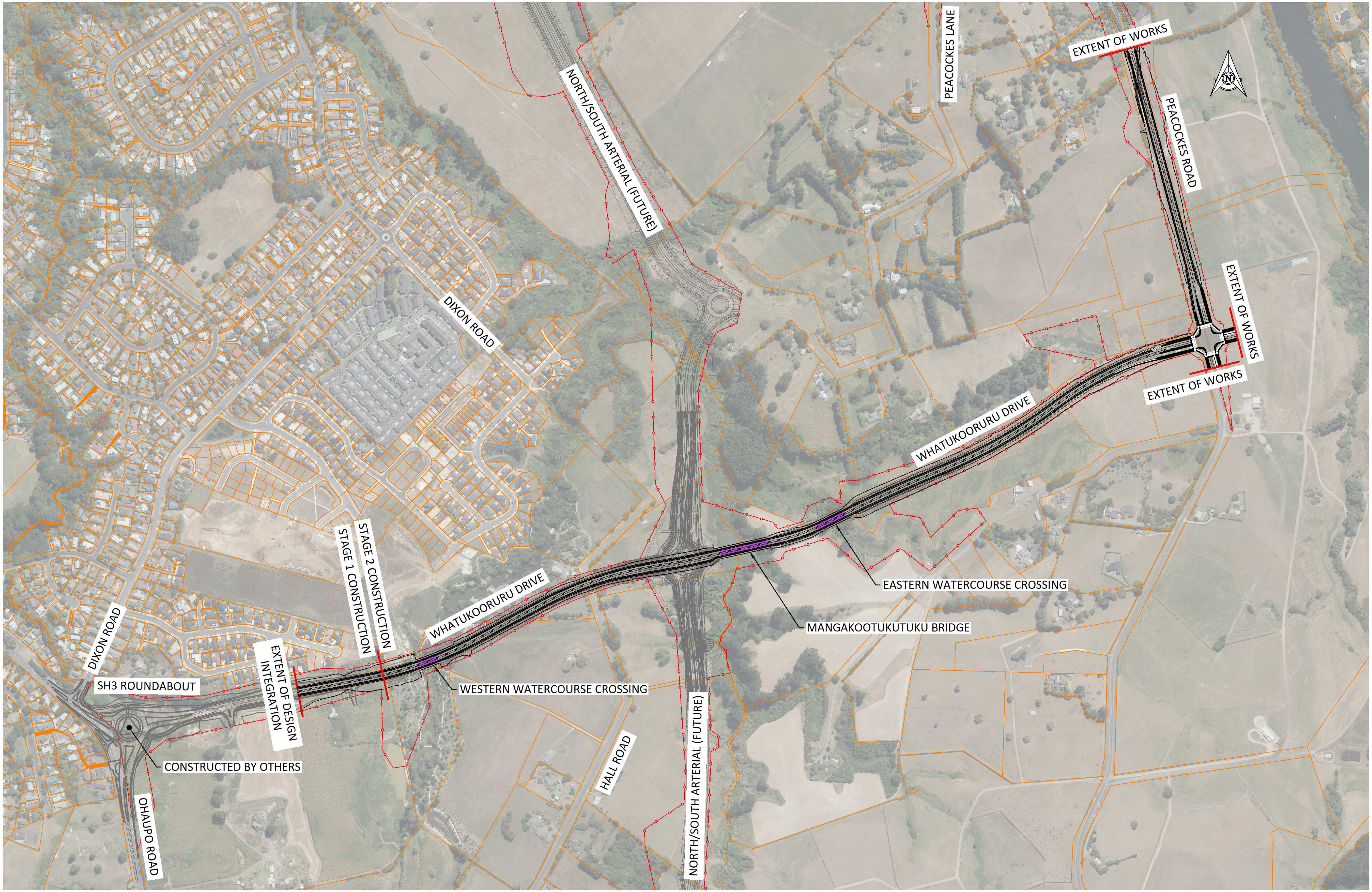
PRELIMINARY

146000-002A

MAY 2021

BLOXAM BURNETT & OLLIVER

Version 2.0 - March 2020



REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS
CHECKED: CM
DRAWN: SS
APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: GENERAL OVERVIEW PLAN

STATUS: PRELIMINARY

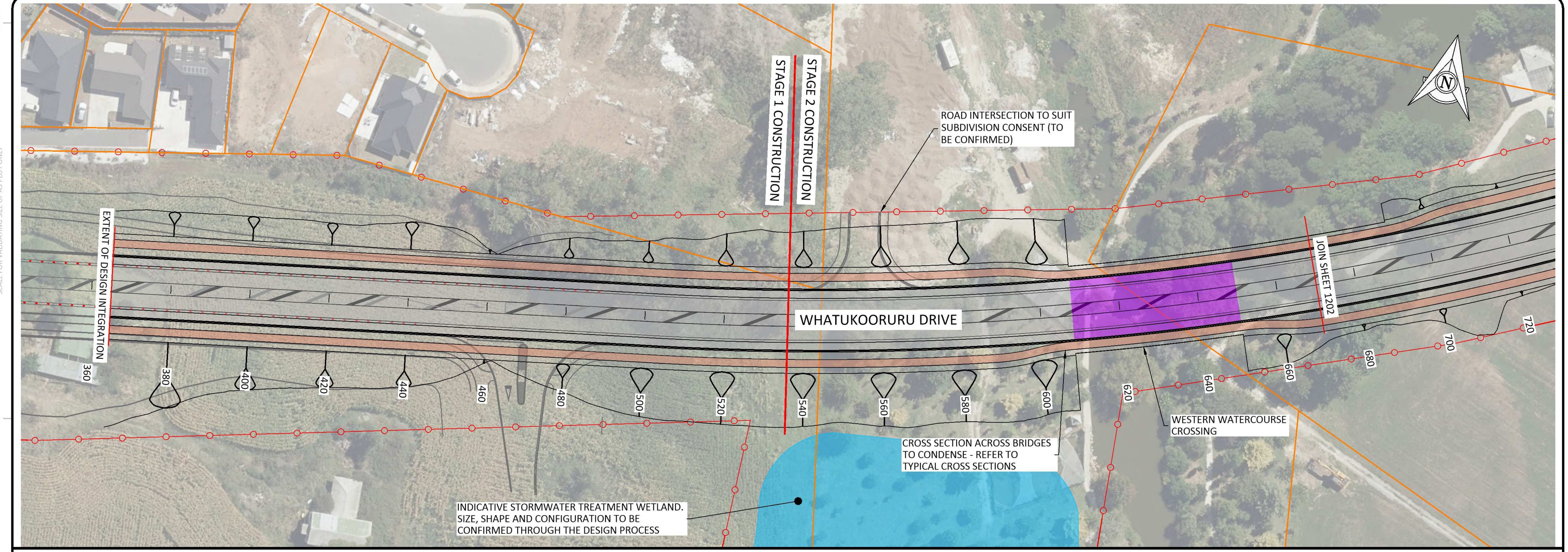
DATE: 07.05.2021

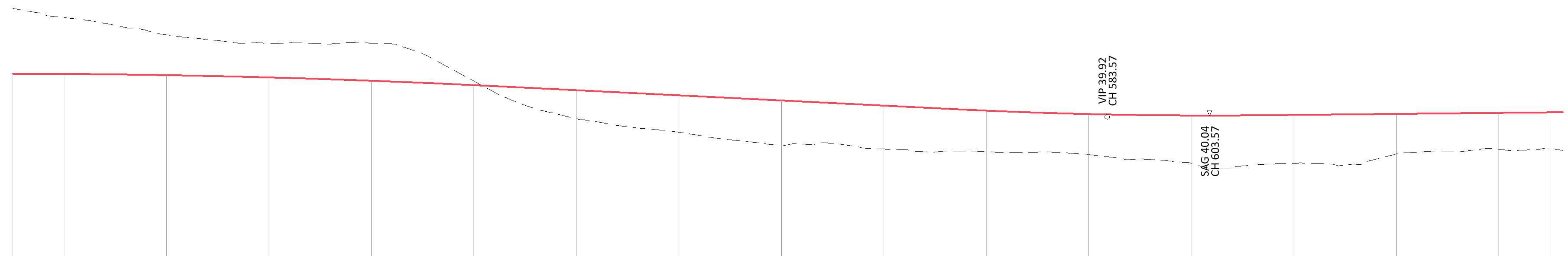
SCALE (ORIGINAL SIZE A3): -

DRAWING NUMBER: 146000-002A-1200

REVISION: A

Version 4.0 - March 2020





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440.00	43.43	47.09	3.66
460.00	43.00	43.39	0.39
480.00	42.51	39.73	-2.78
500.00	42.01	38.41	-3.60
520.00	41.51	37.15	-4.36
540.00	41.01	36.77	-4.23
560.00	40.52	36.51	-4.00
580.00	40.18	36.23	-3.95
600.00	40.05	35.38	-4.67
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LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

PLAN
- LEGAL BOUNDARY
- DESIGN BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

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REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council, Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

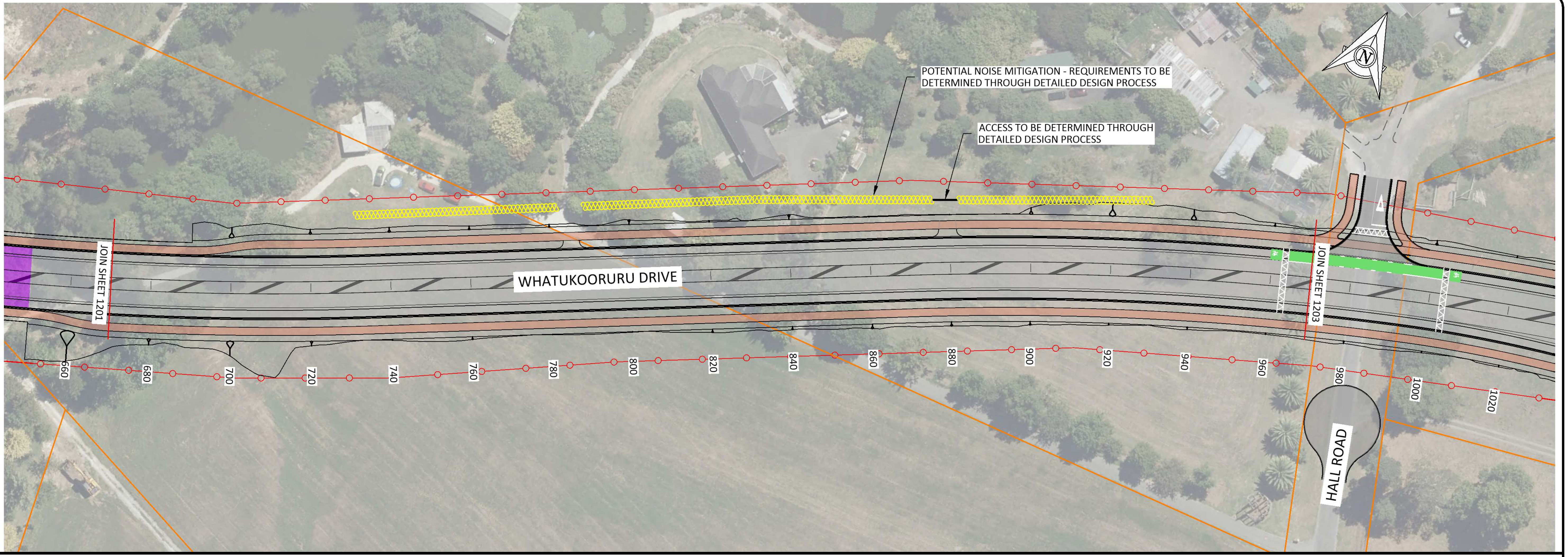
DRAWING: WHATUKOORURU DRIVE GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 1

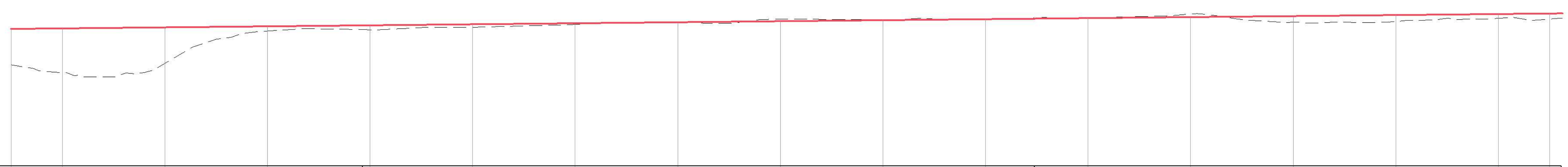
STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-1201 | REVISION: A

Version 4.0 - March 2020





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LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

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- DESIGNATION BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

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A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED SS | CHECKED CM
DRAWN SS | APPROVED JG

BLOXAM BURNETT & OLLIVER

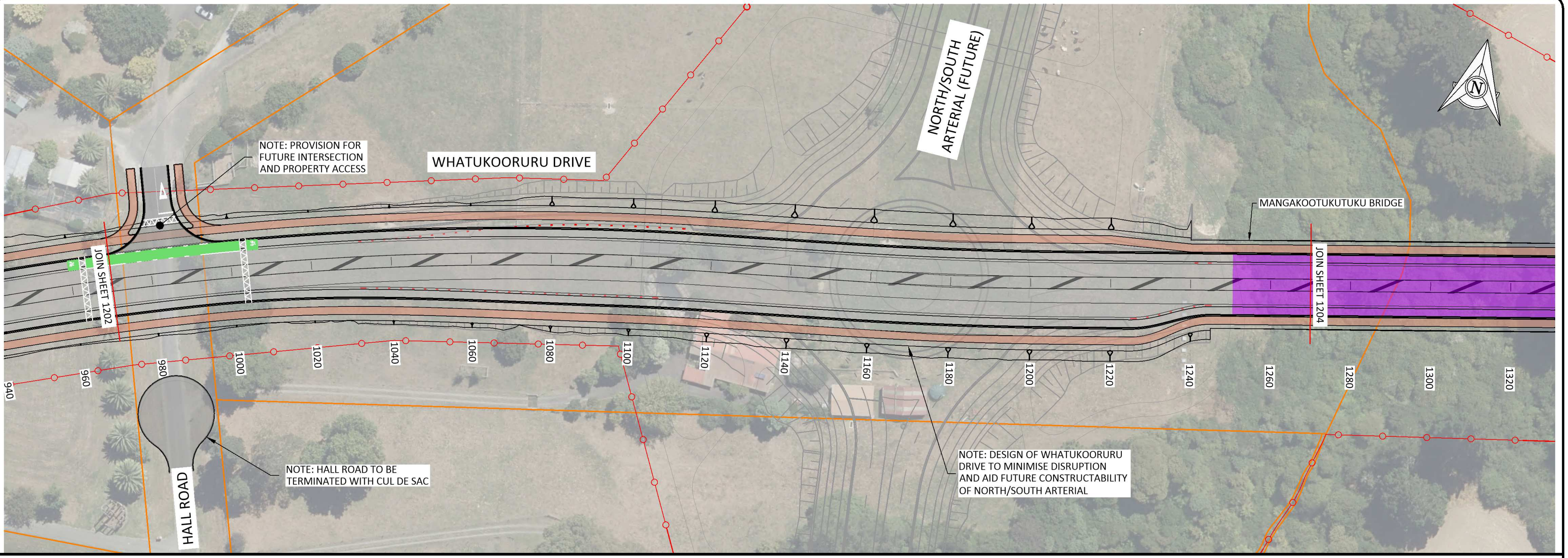
CLIENT: Hamilton City Council
Te kaunihera o Kirikiriroa

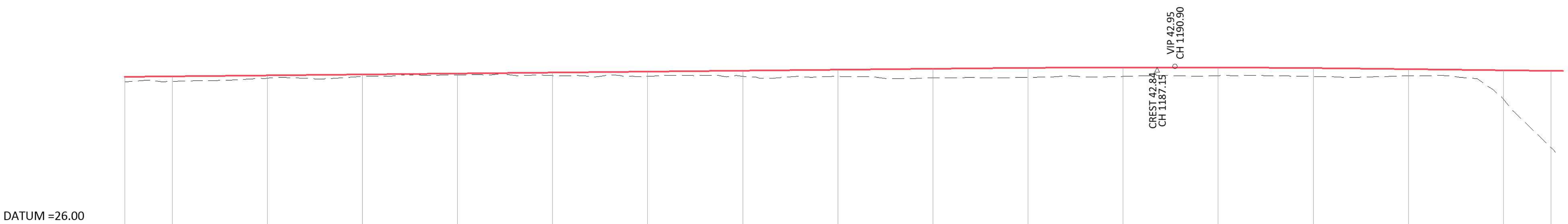
PROJECT: PEACOCKE
WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE
GENERAL ARRANGEMENT PLAN AND LONGSECTION
SHEET 2

STATUS: PRELIMINARY
DATE: 07.05.2021
SCALE (ORIGINAL SIZE A3): 1:1000
DRAWING NUMBER: 146000-002A-1202
REVISION: A

Version 4.0 - March 2020





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LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
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KEY: PLAN AND LONGSECTION

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- 100 DESIGN CENTRELINE
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LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council, Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 3

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DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-1203 | REVISION: A

Version 4.0 - March 2020

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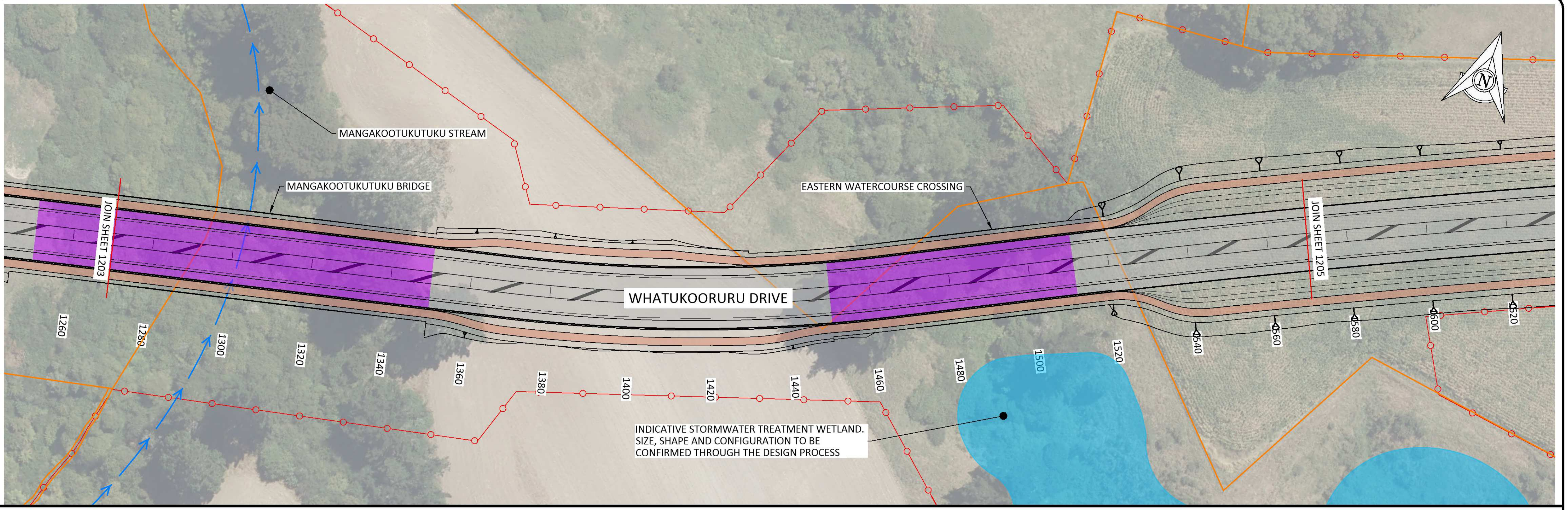

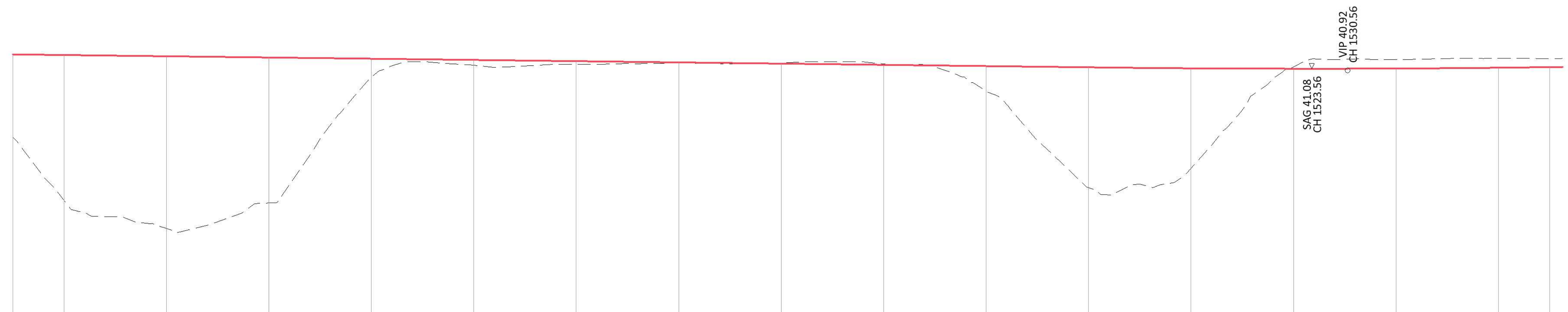

DATUM =17.00

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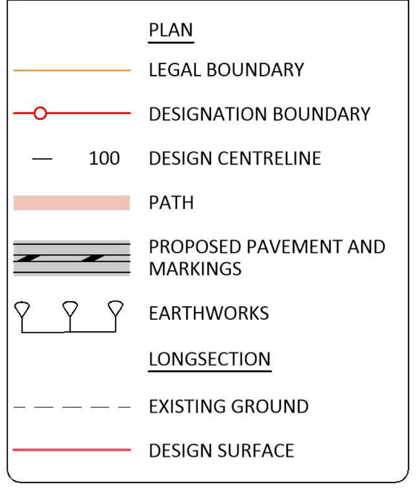
VERTICAL DATA: P=-0.60%, L=249.41 | K=70.00, L=98.00

CHAINAGE	CONTROL LEVELS	EXISTING GROUND	DEPTHS
1270.00	42.48	34.40	-8.08
1280.00	42.42	28.25	-14.17
1300.00	42.30	25.50	-16.80
1320.00	42.18	27.99	-14.19
1340.00	42.06	40.28	-1.78
1360.00	41.94	41.42	-0.52
1380.00	41.82	41.50	-0.32
1400.00	41.70	41.64	-0.06
1420.00	41.58	41.64	0.06
1440.00	41.46	41.55	0.09
1460.00	41.34	38.91	-2.43
1480.00	41.22	29.48	-11.74
1500.00	41.12	31.37	-9.76
1520.00	41.09	41.26	0.17
1540.00	41.10	41.98	0.88
1560.00	41.18	42.10	0.92
1570.00	41.24	42.07	0.84

LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION



REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 4

STATUS: PRELIMINARY

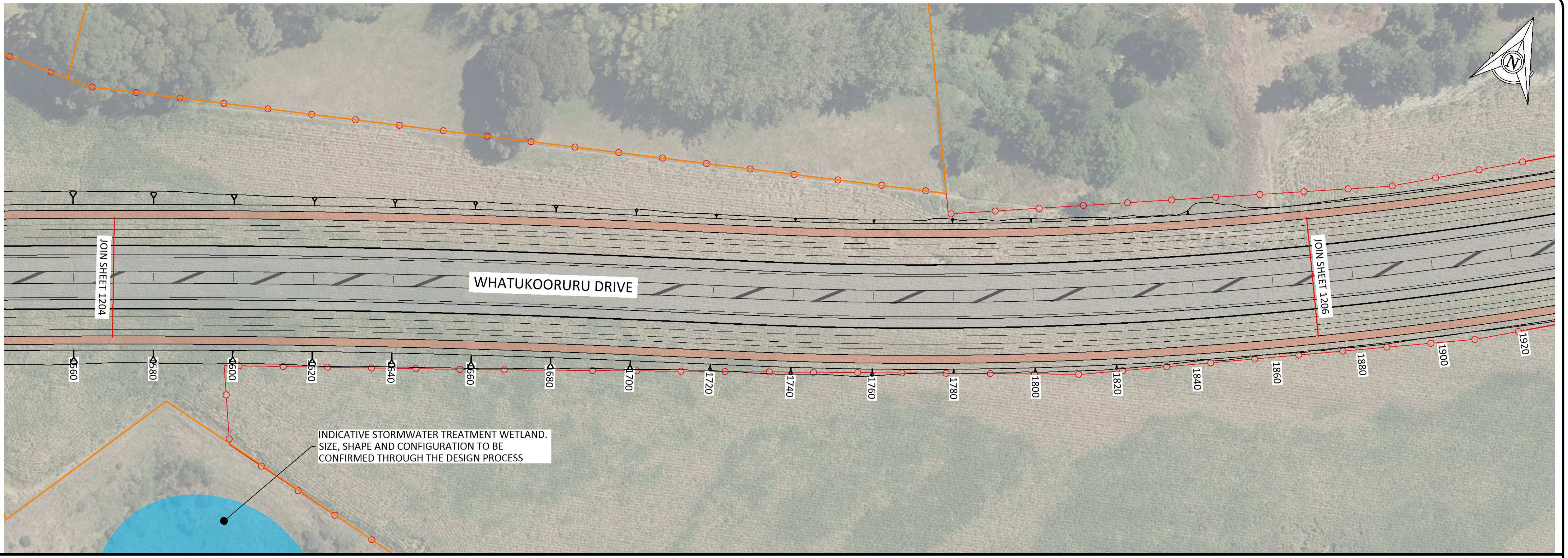
DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

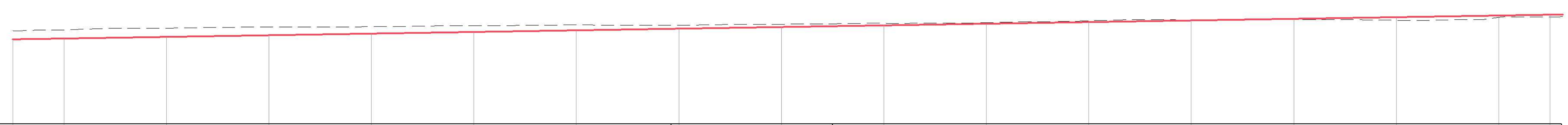
DRAWING NUMBER: 146000-002A-1204 | REVISION: A

Version 4.0 - March 2020

C:\12dsynergy\data\10.7.120.14\Peacocke - Design_4923\03 Drawings\146000-002A\146000-002A-1204.dwg 7/5/2021 2:45 pm ssutton Plotted: 07 May 2021 2:45 pm

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 0 100mm





DATUM =33.00

HORIZONTAL DATA: D=199.67m, R=3000.00, L=199.67 | D=31.54m | D=232.02m, R=-1000.00, L=232.02

VERTICAL DATA: K=70.00, L=98.00 | P=0.80%, L=290.68

CHAINAGE	CONTROL LEVELS	EXISTING GROUND	DEPTHS
1570.00	41.24	42.07	0.84
1580.00	41.31	42.16	0.84
1600.00	41.47	42.32	0.85
1620.00	41.63	42.44	0.81
1640.00	41.79	42.46	0.67
1660.00	41.95	42.56	0.61
1680.00	42.11	42.64	0.53
1700.00	42.27	42.60	0.33
1720.00	42.43	42.71	0.27
1740.00	42.59	42.80	0.21
1760.00	42.75	42.86	0.11
1780.00	42.91	43.03	0.12
1800.00	43.07	43.12	0.05
1820.00	43.23	43.16	-0.08
1840.00	43.39	43.08	-0.31
1860.00	43.55	43.37	-0.18
1870.00	43.63	43.42	-0.21

LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

PLAN
- LEGAL BOUNDARY
- DESIGNATION BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council, Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 5

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-1205 | REVISION: A

Version 4.0 - March 2020

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 100mm 0

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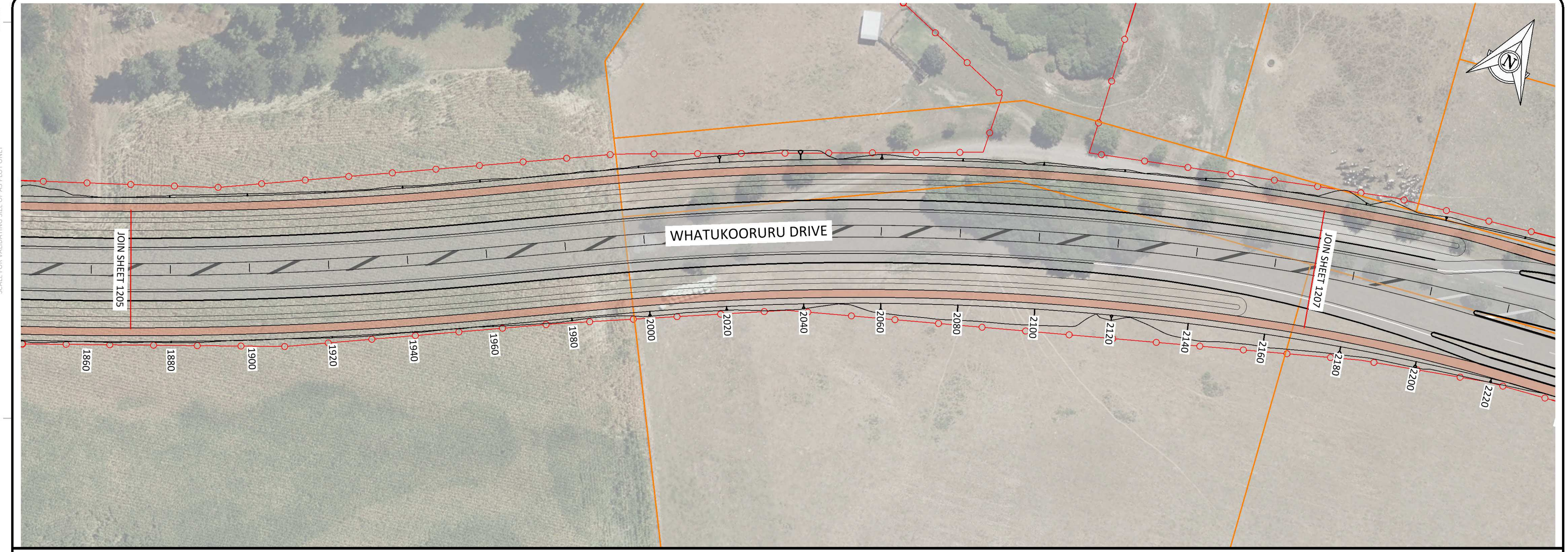
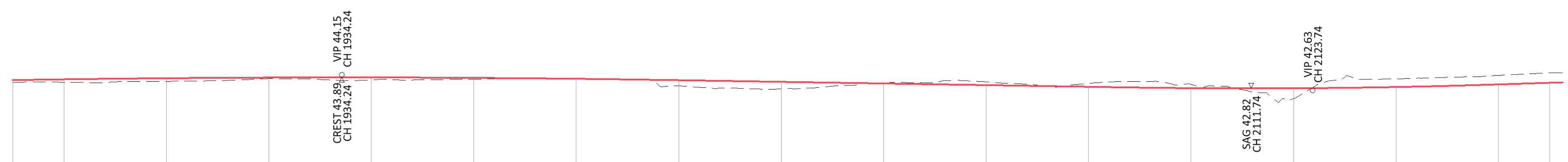




DATUM =33.00

HORIZONTAL DATA	D=232.02m R=-1000.00 L=232.02						D=28.06m	D=266.55m R=700.00 L=266.55									
VERTICAL DATA	P=0.80% L=290.68	K=80.00 L=128.00						P=-0.80% L=89.5					K=30.00 L=72.00			P=1.60% L=116.62	
CONTROL LEVELS	43.63	43.71	43.82	43.88	43.89	43.85	43.76	43.62	43.46	43.30	43.14	42.98	42.84	42.83	42.96	43.21	43.37
EXISTING GROUND	43.42	43.42	43.50	43.78	43.65	43.70	43.77	43.07	42.79	43.34	43.46	43.30	43.21	41.83	43.73	44.09	44.33
DEPTHS	-0.21	-0.28	-0.32	-0.10	-0.24	-0.15	0.01	-0.55	-0.67	0.04	0.32	0.32	0.36	-1.01	0.78	0.88	0.96
CHAINAGE	1870.00	1880.00	1900.00	1920.00	1940.00	1960.00	1980.00	2000.00	2020.00	2040.00	2060.00	2080.00	2100.00	2120.00	2140.00	2160.00	2170.00

LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

PLAN
- LEGAL BOUNDARY
- DESIGNATION BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED SS | CHECKED CM | DRAWN SS | APPROVED JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

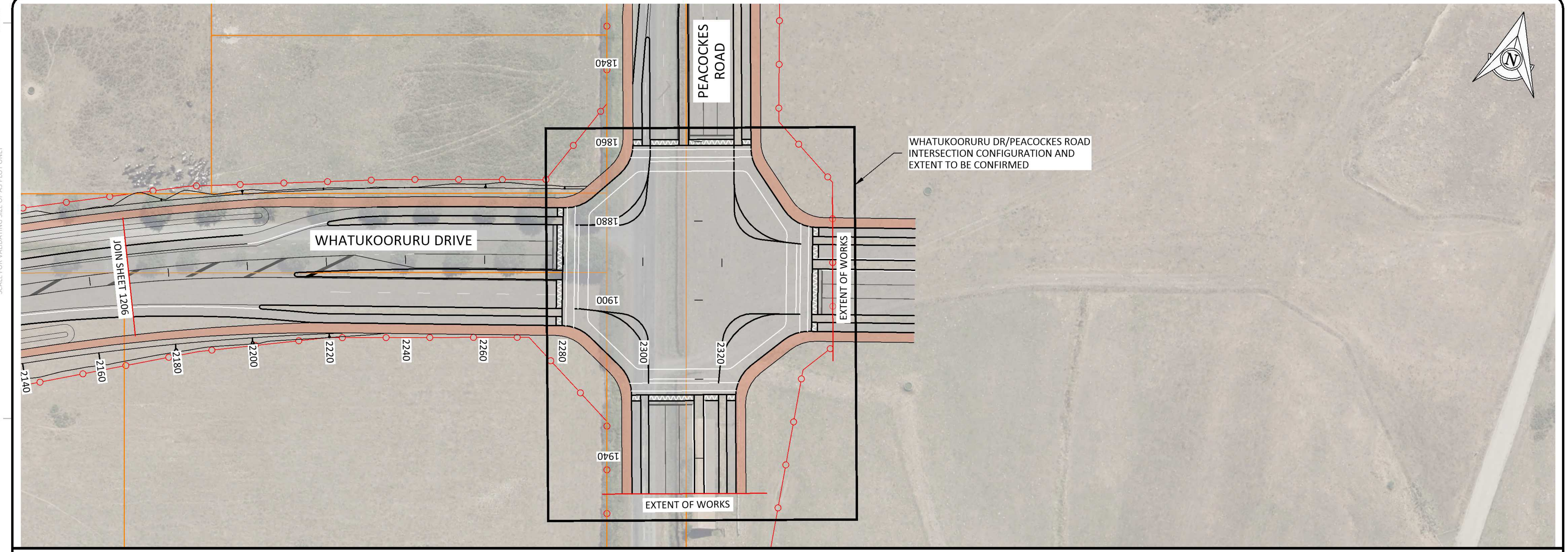
PROJECT: PEACOCKE WHATUKOORURU DRIVE

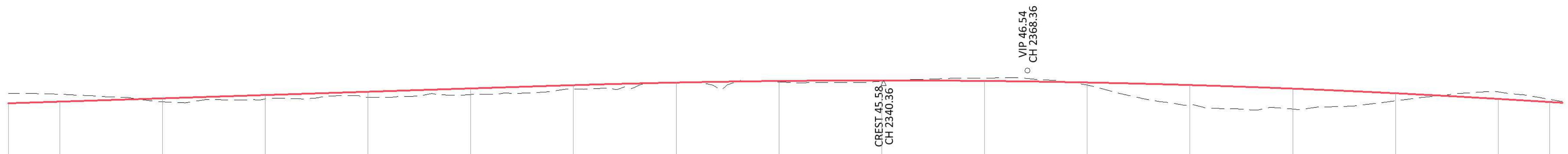
DRAWING: WHATUKOORURU DRIVE GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 6

STATUS: PRELIMINARY

DATE 07.05.2021 | SCALE (ORIGINAL SIZE A3) 1:1000

DRAWING NUMBER 146000-002A-1206 | REVISION A





DATUM =34.00

HORIZONTAL DATA	D=266.55m R=700.00 L=266.55	D=219.29m
VERTICAL DATA	P=1.60% L=116.62	K=40.00 L=184.00	P=-3.00% L=15.42

CHAINAGE	CONTROL LEVELS	EXISTING GROUND	DEPTHS
2170.00	43.37	44.33	0.96
2180.00	43.53	44.25	0.72
2200.00	43.85	43.51	-0.34
2220.00	44.17	43.79	-0.38
2240.00	44.49	43.95	-0.54
2260.00	44.81	44.21	-0.60
2280.00	45.13	44.74	-0.39
2300.00	45.38	45.34	-0.04
2320.00	45.53	45.44	-0.10
2340.00	45.58	45.51	-0.08
2360.00	45.54	45.82	0.28
2380.00	45.39	45.13	-0.26
2400.00	45.14	43.20	-1.93
2420.00	44.79	42.81	-1.98
2440.00	44.34	43.60	-0.74
2460.00	43.79	44.47	0.68
2470.00	43.49	43.75	0.26

LONGSECTION ALIGNMENT RS00

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

PLAN
- LEGAL BOUNDARY
- DESIGN BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED SS | CHECKED CM | DRAWN SS | APPROVED JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 7

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3) 1:1000

DRAWING NUMBER: 146000-002A-1207 | REVISION: A

Version 4.0 - March 2020

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 0 100mm

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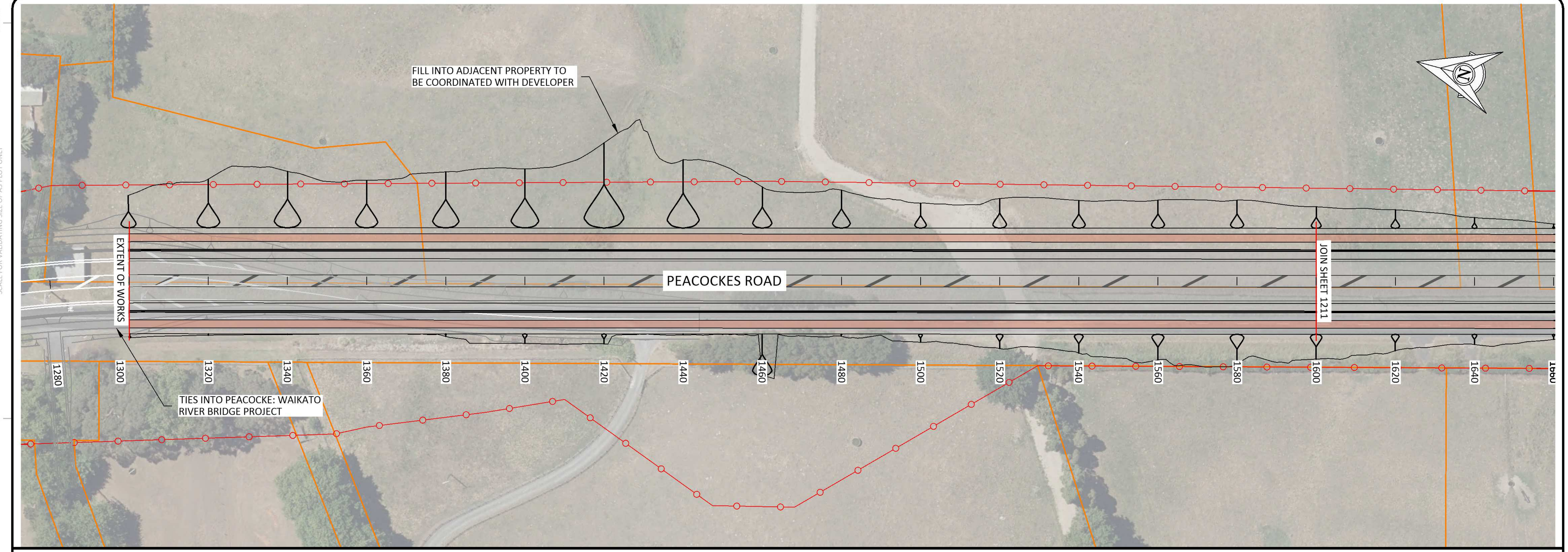
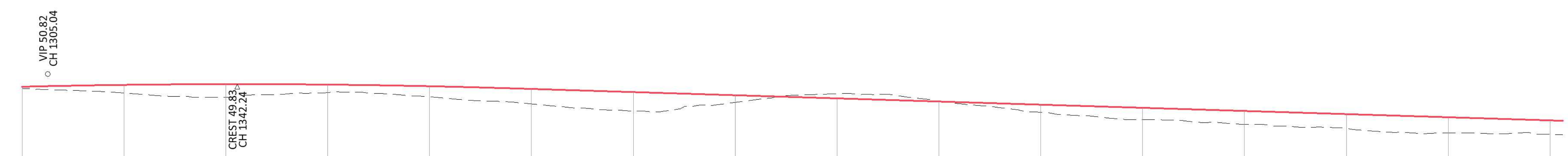




DATUM =36.00

HORIZONTAL DATA	D=372.9m R=280.00 L=372.90	D=672.18m														
VERTICAL DATA	K=35.00 L=182.91						P=-1.55% L=283.2									
CONTROL LEVELS	49.57	49.75	49.82	49.78	49.62	49.35	49.04	48.73	48.42	48.11	47.80	47.49	47.18	46.87	46.56	46.25
EXISTING GROUND	49.40	48.95	48.53	48.99	48.60	47.87	47.12	48.02	48.88	48.17	47.06	46.32	45.85	45.46	45.00	44.87
DEPTHS	-0.17	-0.81	-1.30	-0.79	-1.02	-1.48	-1.92	-0.71	0.46	0.05	-0.74	-1.17	-1.33	-1.41	-1.56	-1.39
CHAINAGE	1300.00	1320.00	1340.00	1360.00	1380.00	1400.00	1420.00	1440.00	1460.00	1480.00	1500.00	1520.00	1540.00	1560.00	1580.00	1600.00

LONGSECTION ALIGNMENT RS20

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

PLAN
- LEGAL BOUNDARY
- DESIGNATION BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED SS | CHECKED CM | DRAWN SS | APPROVED JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

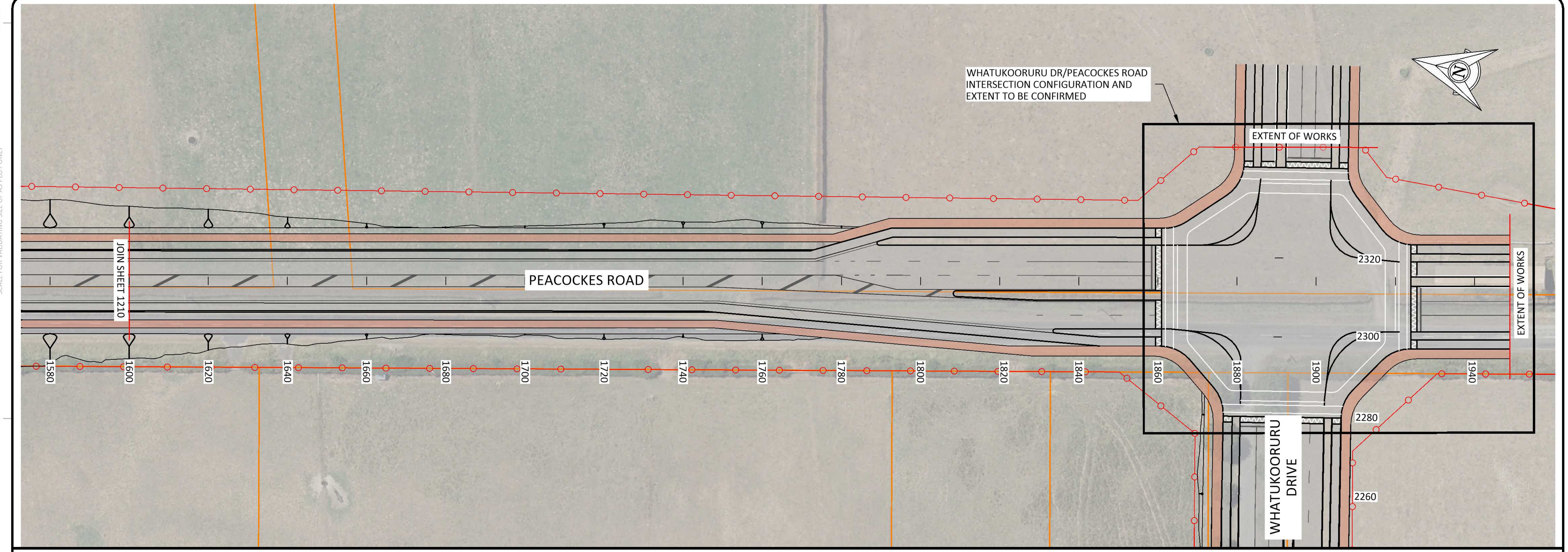
PROJECT: PEACOCKE WHATUKOORURU DRIVE

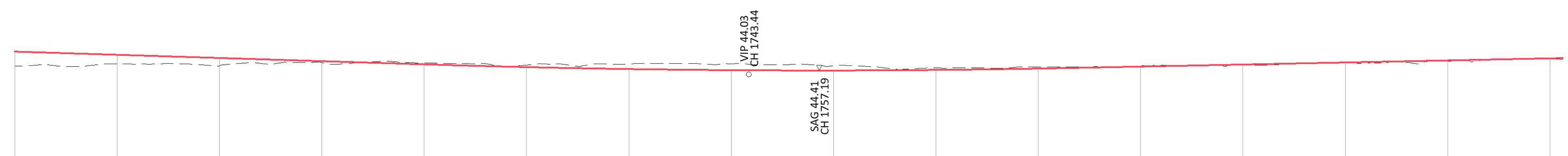
DRAWING: PEACOCKES ROAD GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 1

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-1210 | REVISION: A





DATUM =36.00

HORIZONTAL DATA	D=672.18m															
VERTICAL DATA	P=-1.55% L=283.2					K=50.00 L=127.50						P=1.00% L=133.29				
CONTROL LEVELS	46.25	45.94	45.63	45.32	45.01	44.74	44.55	44.44	44.42	44.47	44.60	44.79	44.99	45.19	45.39	45.59
EXISTING GROUND	44.87	45.05	44.84	45.18	45.14	44.93	45.03	45.07	44.87	44.67	44.75	44.87	44.95	45.14	45.32	45.56
DEPTHS	-1.39	-0.89	-0.79	-0.14	0.13	0.19	0.48	0.62	0.46	0.20	0.15	0.08	-0.04	-0.05	-0.08	-0.03
CHAINAGE	1600.00	1620.00	1640.00	1660.00	1680.00	1700.00	1720.00	1740.00	1760.00	1780.00	1800.00	1820.00	1840.00	1860.00	1880.00	1900.00

LONGSECTION ALIGNMENT RS20

HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:500

KEY: PLAN AND LONGSECTION

PLAN
- LEGAL BOUNDARY
- DESIGNATION BOUNDARY
- 100 DESIGN CENTRELINE
- PATH
- PROPOSED PAVEMENT AND MARKINGS
- EARTHWORKS

LONGSECTION
- EXISTING GROUND
- DESIGN SURFACE

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: PEACOCKES ROAD GENERAL ARRANGEMENT PLAN AND LONGSECTION SHEET 2

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-1211 | REVISION: A

Version 4.0 - March 2020

100mm 0 SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY

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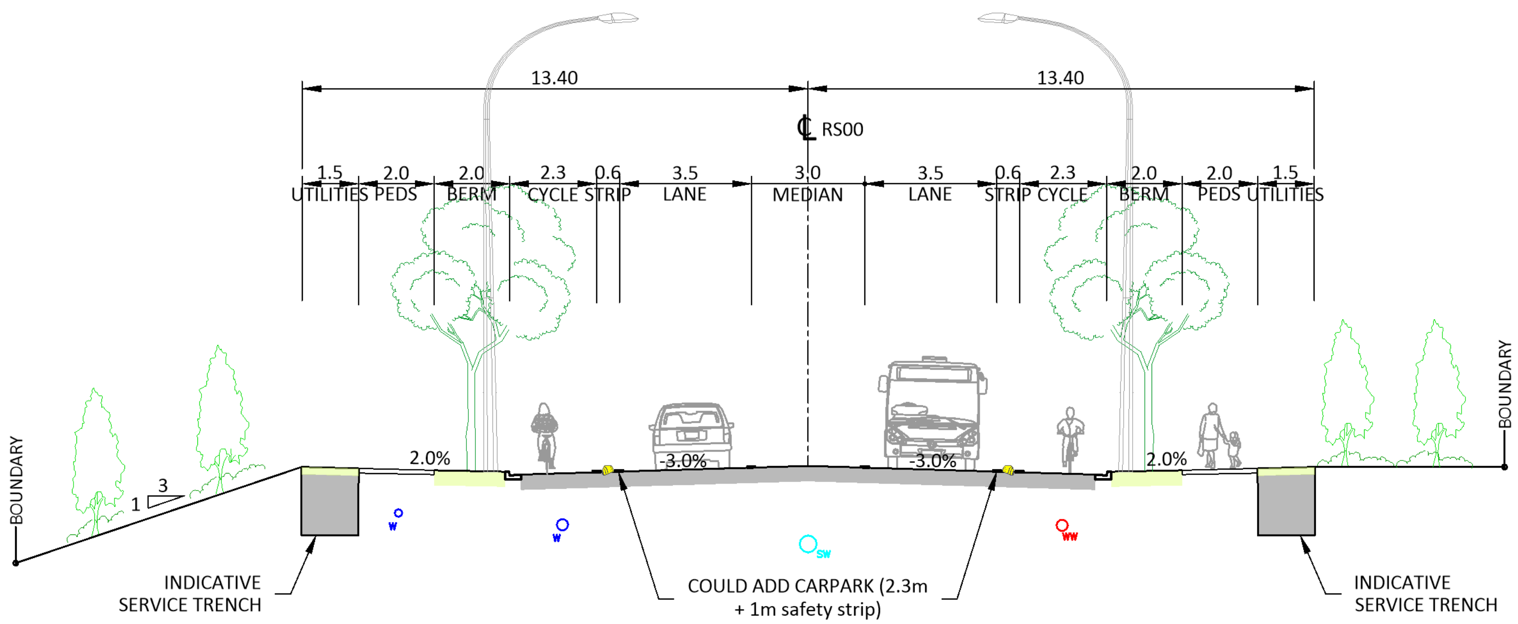
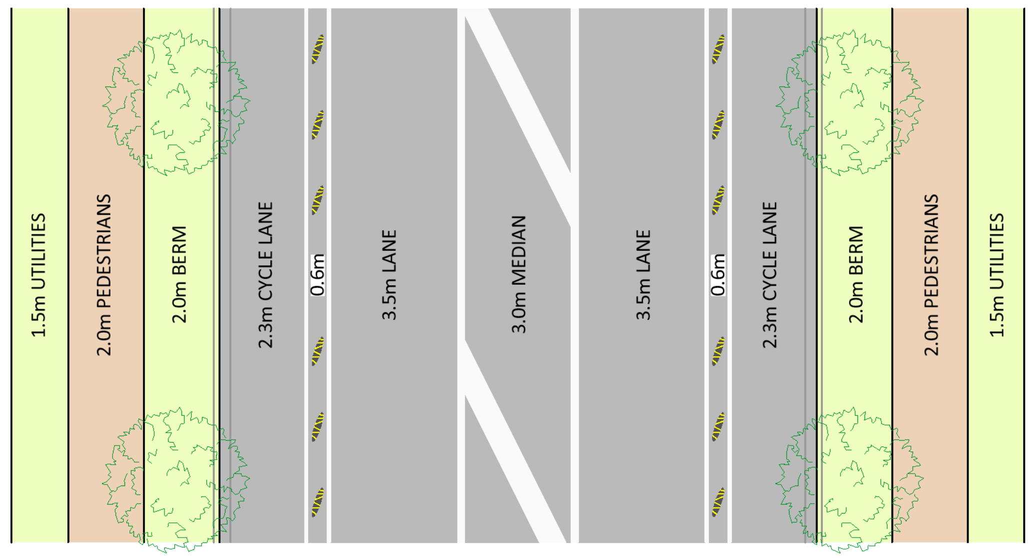
MINOR ARTERIALS (WHATUKOORURU DRIVE)



SERVICES ARE SHOWN INDICATIVELY. COORDINATION WITH SERVICE PROVIDERS AS TO NUMBER, SIZE AND DETAILS OF DUCTS REQUIRED THROUGH THE DESIGN PROCESS



REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE TYPICAL CROSS SECTION

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:200

DRAWING NUMBER: 146000-002A-1301 | REVISION: A

Version 3.0 - September 2017

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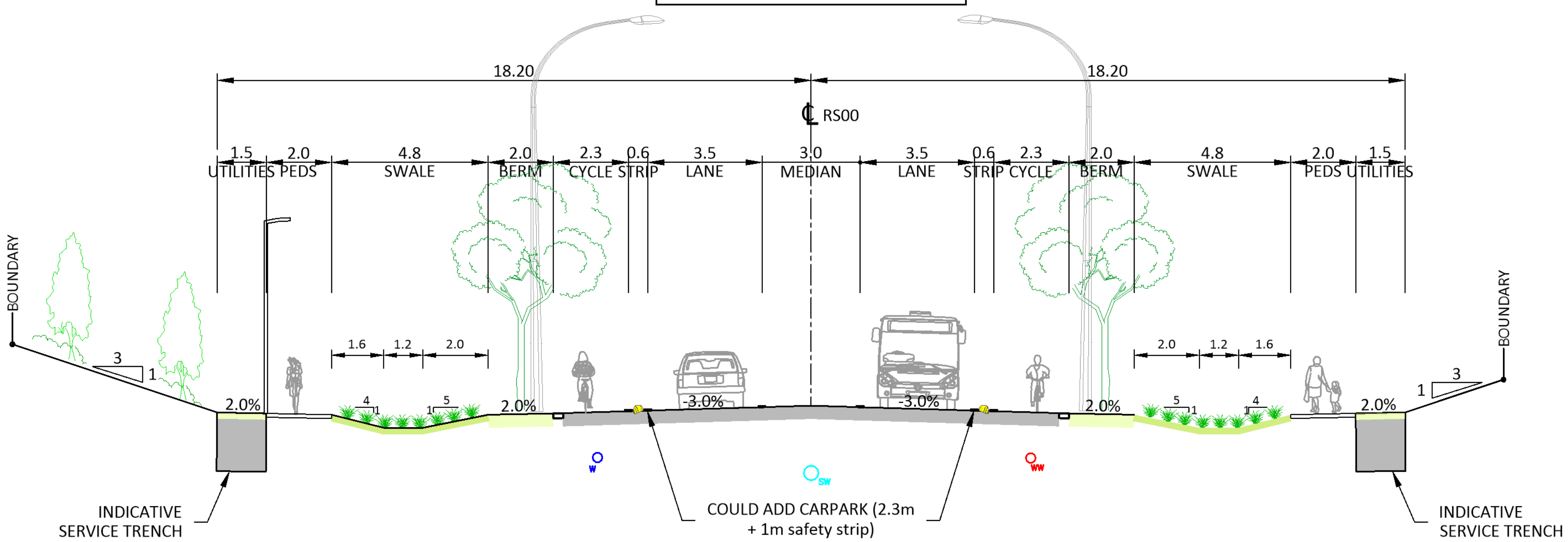
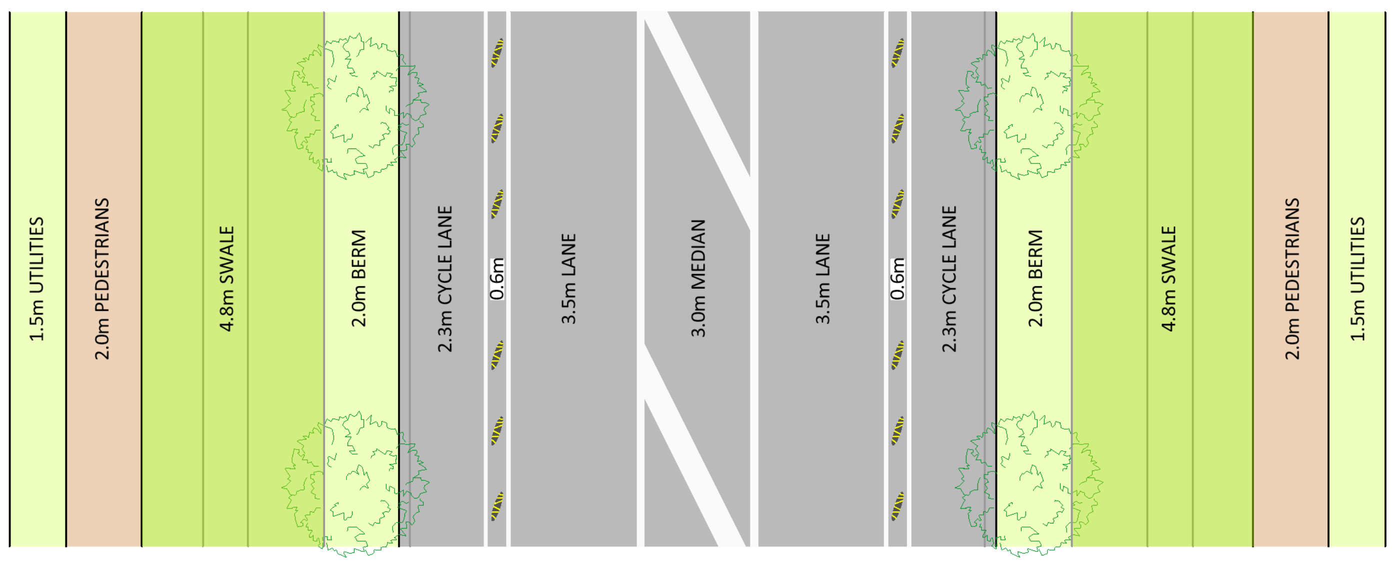
SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 100mm 0

MINOR ARTERIALS
(WHATUKOORURU DRIVE,
WITH SWALES)



SERVICES ARE SHOWN INDICATIVELY.
COORDINATION WITH SERVICE PROVIDERS
AS TO NUMBER, SIZE AND DETAILS OF DUCTS
REQUIRED THROUGH THE DESIGN PROCESS



REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED	SS
CHECKED	CM
DRAWN	SS
APPROVED	JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE TYPICAL CROSS SECTION WITH SWALES

STATUS: PRELIMINARY

DATE: 07.05.2021

SCALE (ORIGINAL SIZE A3): 1:200

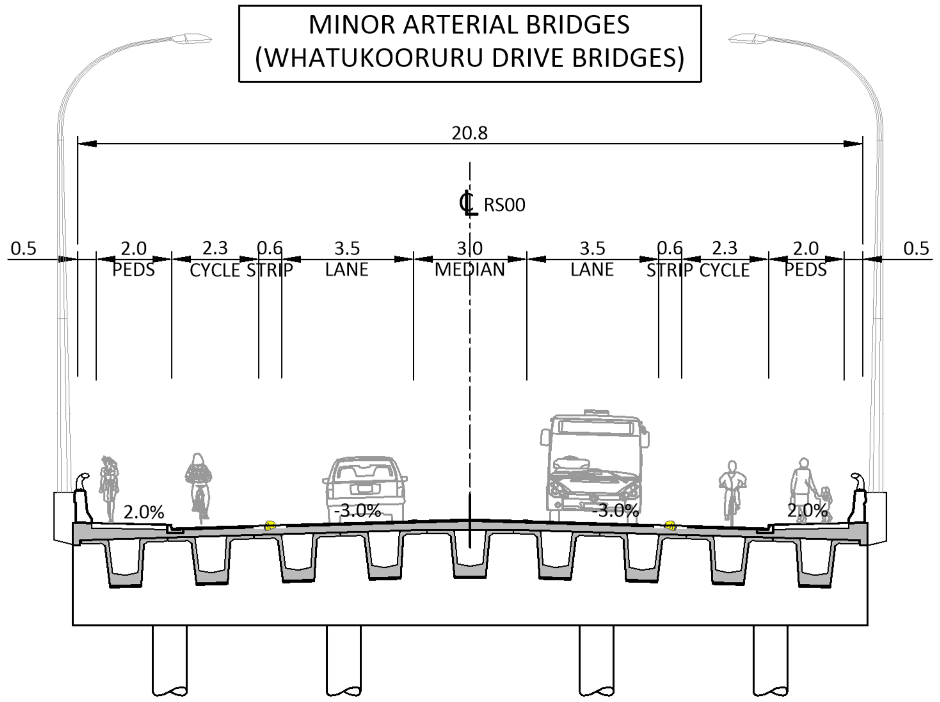
DRAWING NUMBER: 146000-002A-1302

REVISION: A

Version 3.0 - September 2017

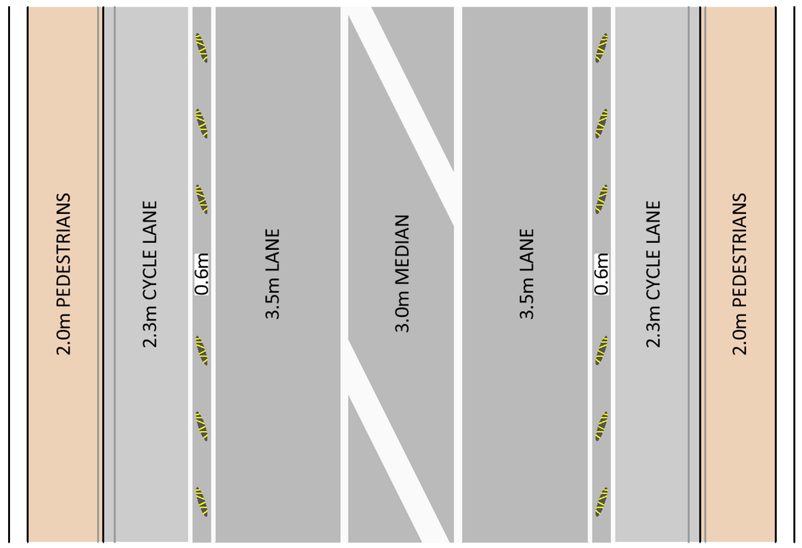
SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY

MINOR ARTERIAL BRIDGES
(WHATUKOORURU DRIVE BRIDGES)



NOTE: CROSS-SECTION MAY NEED TO BE ADJUSTED IN DETAILED DESIGN TO SUIT SIGHTLINE REQUIREMENTS.

COORDINATION WITH SERVICE PROVIDERS AS TO NUMBER, SIZE AND DETAILS OF DUCTS REQUIRED THROUGH THE DESIGN PROCESS



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REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED	CHECKED	DRAWN	APPROVED
SS	CM	SS	JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE TYPICAL CROSS SECTION BRIDGES

STATUS: PRELIMINARY

DATE: 07.05.2021

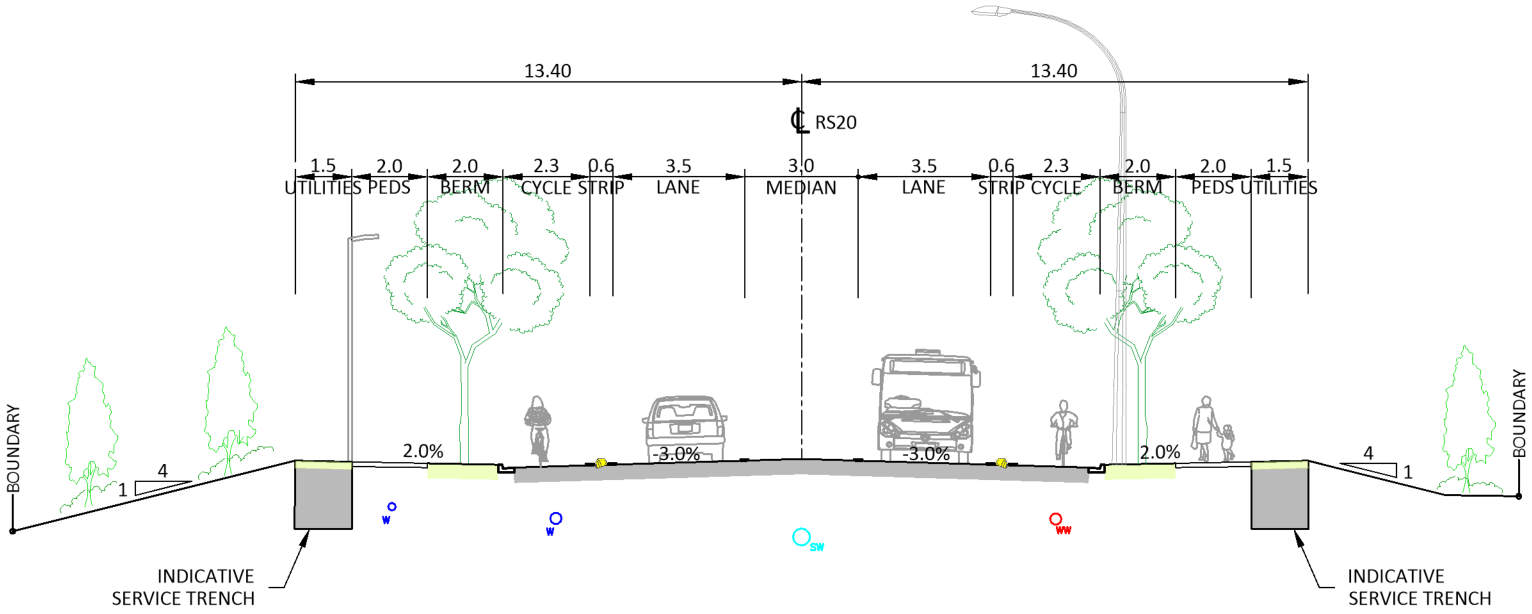
SCALE (ORIGINAL SIZE A3): 1:200

DRAWING NUMBER: 146000-002A-1303

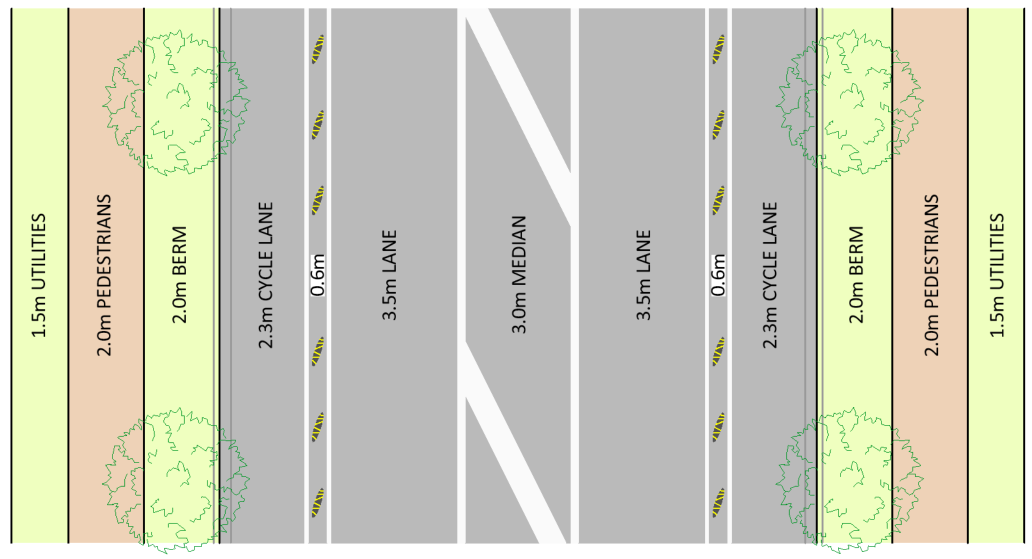
REVISION: A

Version 3.0 - September 2017

MINOR ARTERIALS
(PEACOCKES ROAD)



SERVICES ARE SHOWN INDICATIVELY.
COORDINATION WITH SERVICE PROVIDERS
AS TO NUMBER, SIZE AND DETAILS OF DUCTS
REQUIRED THROUGH THE DESIGN PROCESS



REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED SS | CHECKED CM
DRAWN SS | APPROVED JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council – Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE
WHATUKOORURU DRIVE

DRAWING: PEACOCKES ROAD
TYPICAL CROSS SECTION

STATUS: PRELIMINARY

DATE: 07.05.2021
SCALE (ORIGINAL SIZE A3): 1:200

DRAWING NUMBER: 146000-002A-1311
REVISION: A

Version 3.0 - September 2017

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SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY
100mm
0

NOTES:

1. WASTEWATER SHOWN INDICATIVELY. THE LOCATION AND SIZING OF ANY WASTEWATER PIPES WILL BE AS REQUIRED TO ACCOMMODATE THE WASTEWATER DESIGN BEING UNDERTAKEN BY WSP.

KEY:

- WASTEWATER RISING MAIN
- WATER MAIN - TWIN DN250
- WATER MAIN - DN350
- WATER MAIN - DN450

A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG
	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR

DESIGNED: SS | CHECKED: CM
DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WATER AND WASTEWATER OVERVIEW PLAN

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:5000

DRAWING NUMBER: 146000-002A-0201 | REVISION: A

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Version 4.0 - March 2020

100mm
SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY
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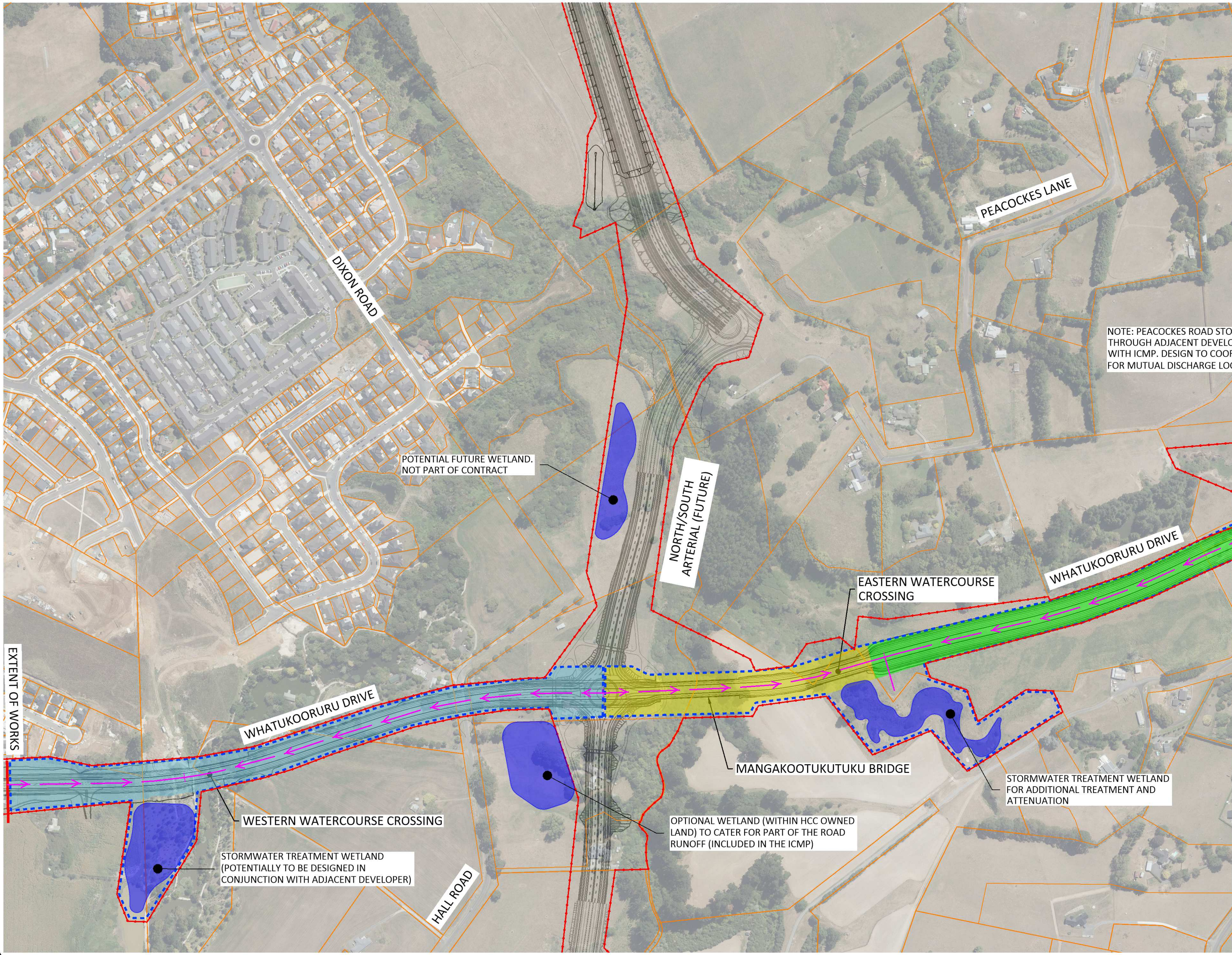


NOTES:

1. CATCHMENT BOUNDARIES ARE SHOWN INDICATIVELY ONLY.
2. RUNOFF FROM ROAD TO BE CONVEYED THROUGH TYPICAL KERB AND CHANNEL AND APPROPRIATELY SPACED CATCHPITS.
3. PIPED RETICULATION IS TO CONVEY STORMWATER RUNOFF TO THE APPROPRIATE STORMWATER MANAGEMENT DEVICE (TREATMENT WETLAND, WETLAND SWALE, RAIN GARDEN ETC.) TO PROVIDE ADEQUATE TREATMENT AND ATTENUATION.
4. STORMWATER MANAGEMENT DEVICES ARE SHOWN INDICATIVELY. STYLE, SIZE, LOCATION AND SHAPES TO BE CONFIRMED.

KEY:

- LEGAL BOUNDARY
- DESIGNATION BOUNDARY
- PROPOSED ROAD DESIGN
- SUBCATCHMNET BOUNDARY
- FLOW THROUGH PIPED RETICULATION STORMWATER MANAGEMENT DEVICE
- AREA TREATED VIA SWALE
- AREA TREATED VIA WETLAND
- AREA TREATED VIA RAINGARDEN

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 0 100mm

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED SS | CHECKED CM | DRAWN SS | APPROVED JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council Te kaunihera o Kirikiriroa

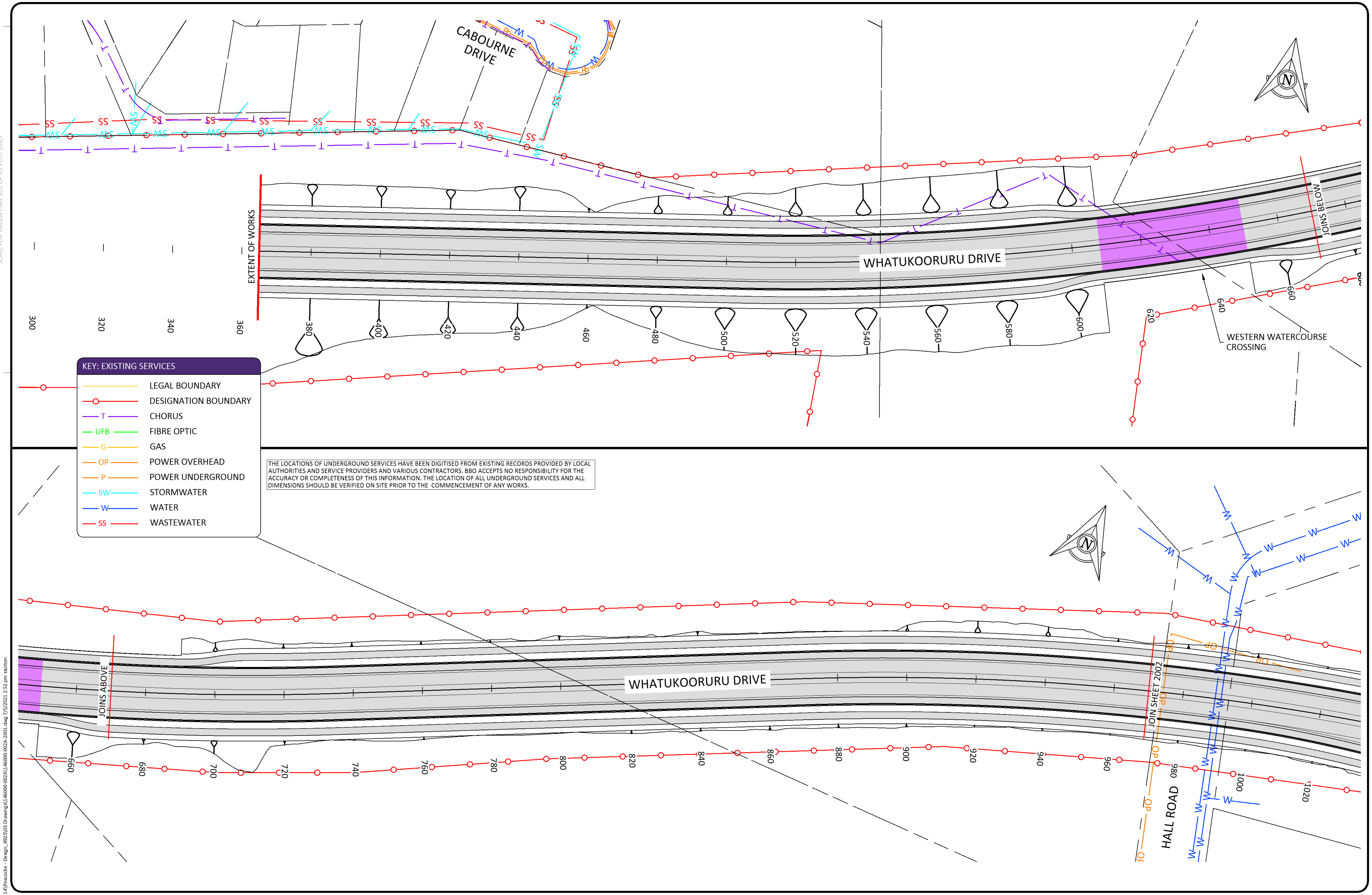
PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: STORMWATER OVERVIEW PLAN

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:5000

DRAWING NUMBER: 146000-002A-0202 | REVISION: A



A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG
	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR

DESIGNED SS — CHECKED CM
DRAWN SS — APPROVED JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

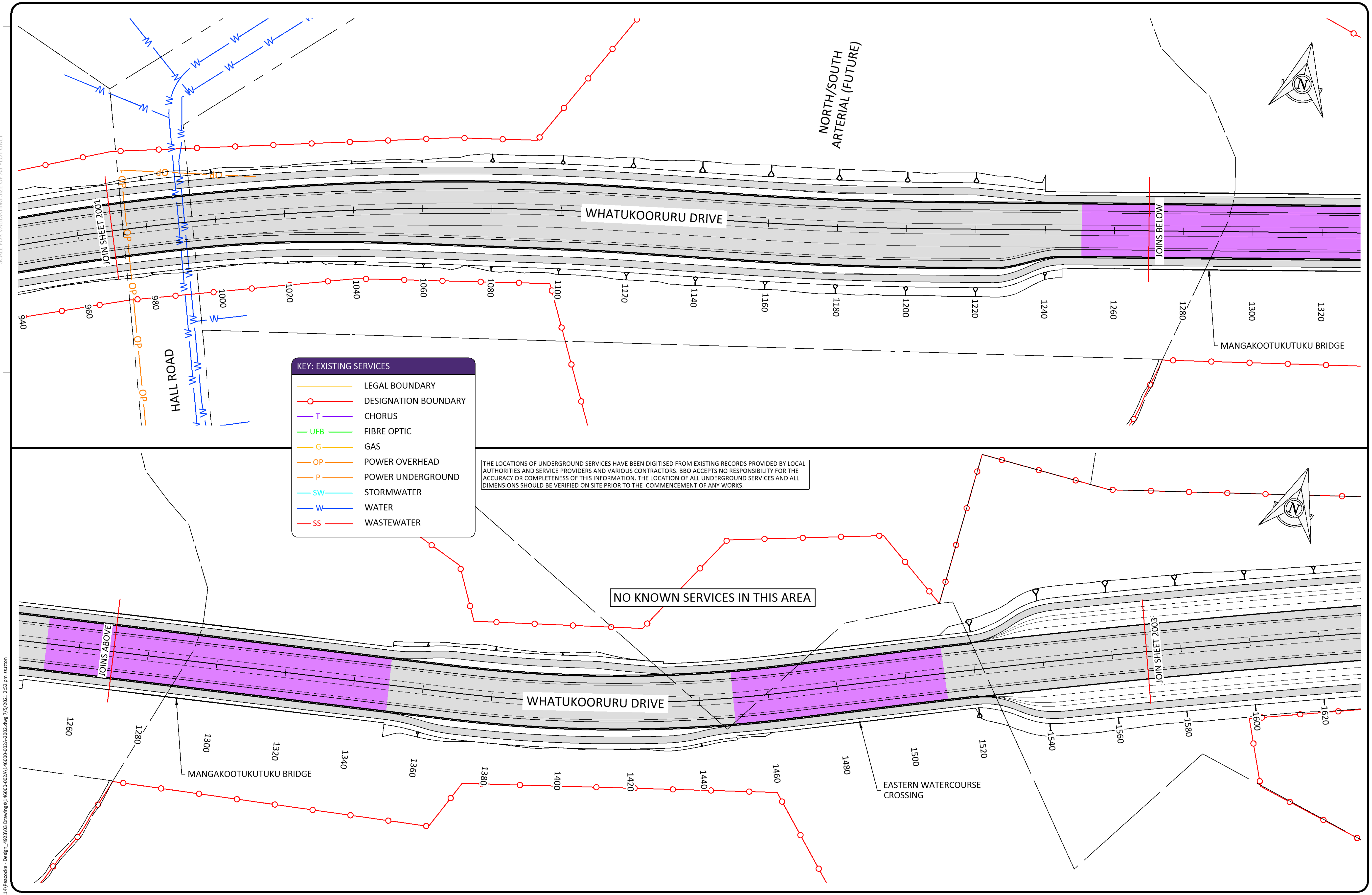
DRAWING: WHATUKOORURU DRIVE EXISTING SERVICES PLAN SHEET 1

STATUS: PRELIMINARY

DATE: 07.05.2021 — SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-2001 — REVISION: A

Version 3.0 - September 2017



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A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

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DRAWN: SS — APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE EXISTING SERVICES PLAN SHEET 2

STATUS: PRELIMINARY

DATE: 07.05.2021

SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-2002

REVISION: A

Version 3.0 - September 2017

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 0 100mm

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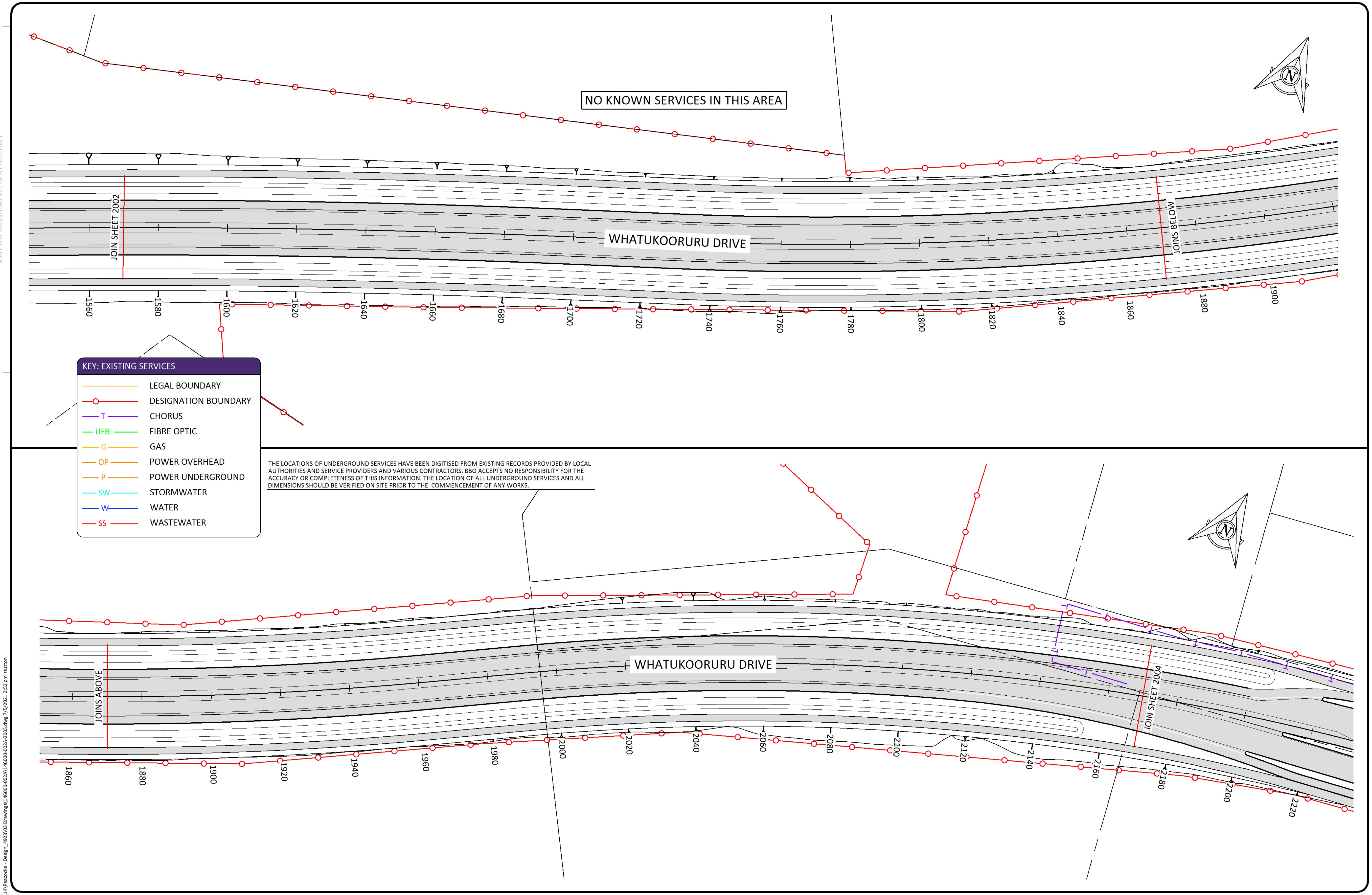


REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE EXISTING SERVICES PLAN SHEET 3

STATUS: PRELIMINARY

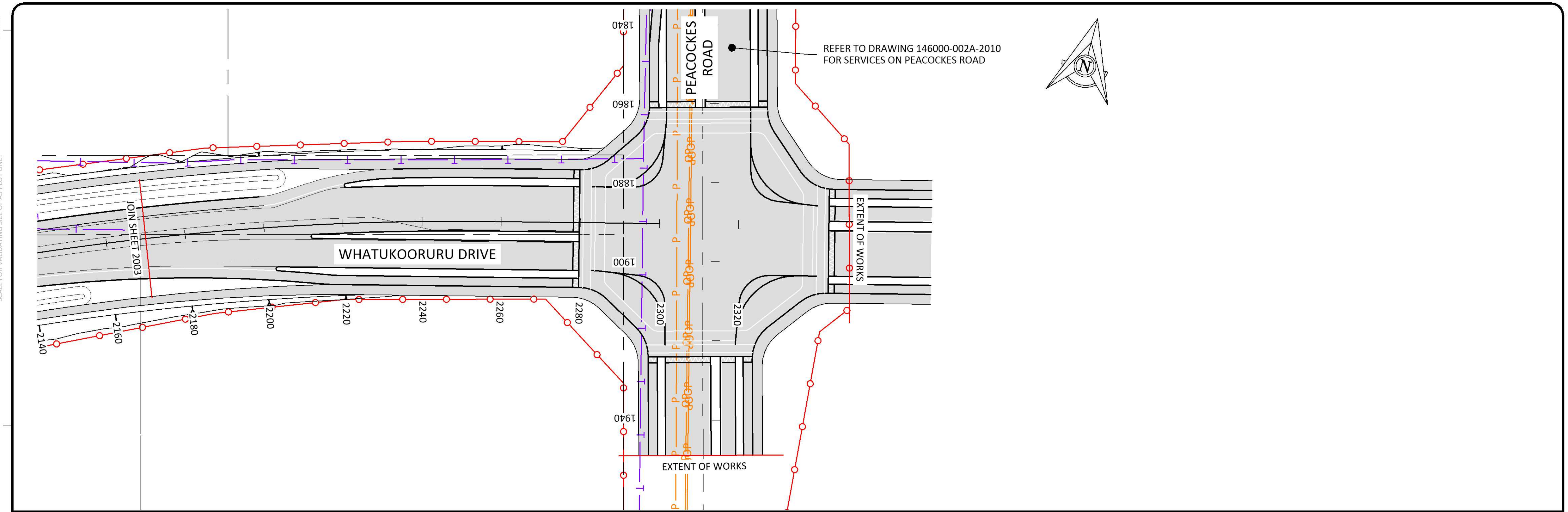
DATE: 07.05.2021

SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-2003

REVISION: A

Version 3.0 - September 2017



KEY: EXISTING SERVICES

——	LEGAL BOUNDARY
—o—	DESIGNATION BOUNDARY
— T —	CHORUS
— UFB —	FIBRE OPTIC
— G —	GAS
— OP —	POWER OVERHEAD
— P —	POWER UNDERGROUND
— SW —	STORMWATER
— W —	WATER
— SS —	WASTEWATER

THE LOCATIONS OF UNDERGROUND SERVICES HAVE BEEN DIGITISED FROM EXISTING RECORDS PROVIDED BY LOCAL AUTHORITIES AND SERVICE PROVIDERS AND VARIOUS CONTRACTORS. BBO ACCEPTS NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THIS INFORMATION. THE LOCATION OF ALL UNDERGROUND SERVICES AND ALL DIMENSIONS SHOULD BE VERIFIED ON SITE PRIOR TO THE COMMENCEMENT OF ANY WORKS.

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG

DESIGNED: SS | CHECKED: CM | DRAWN: SS | APPROVED: JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE EXISTING SERVICES PLAN SHEET 4

STATUS: PRELIMINARY

DATE: 07.05.2021 | SCALE (ORIGINAL SIZE A3): 1:1000

DRAWING NUMBER: 146000-002A-2004 | REVISION: A

Version 3.0 - September 2017

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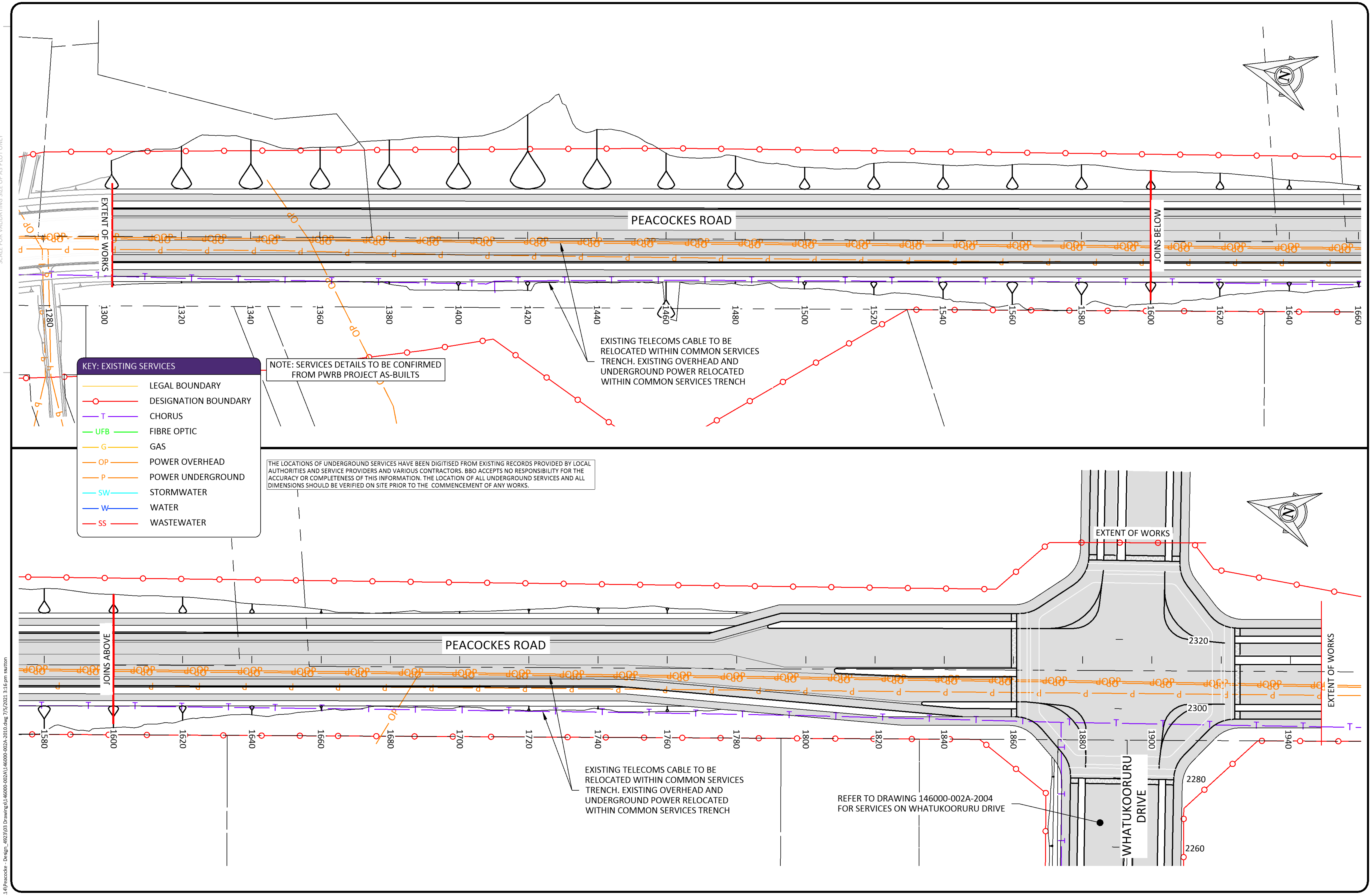
SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 100mm 0



A	07.05.2021	ISSUE FOR INFORMATION	SS	CM	JG
	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR

DESIGNED	SS
CHECKED	CM
DRAWN	SS
APPROVED	JG

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

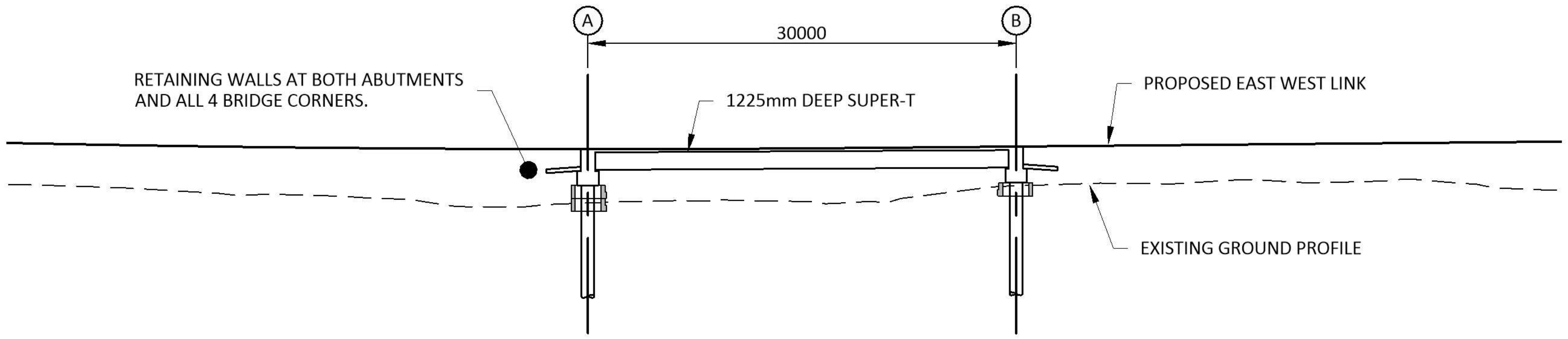
DRAWING: PEACOCKES ROAD EXISTING SERVICES PLAN

STATUS: PRELIMINARY

DATE	07.05.2021
SCALE (ORIGINAL SIZE A3)	1:1000
DRAWING NUMBER	146000-002A-2010
REVISION	A

Version 3.0 - September 2017

WESTERN WATERCOURSE CROSSING BRIDGE - PLAN
1:500



WESTERN WATERCOURSE CROSSING BRIDGE - LONG SECTION
1:500

1:500 (A3) 0 10 20 30m

NOT FOR CONSTRUCTION

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	CC	PCH	JG

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DRAWN: CC | APPROVED: JG
mx model version:

BLOXAM BURNETT & OLLIVER

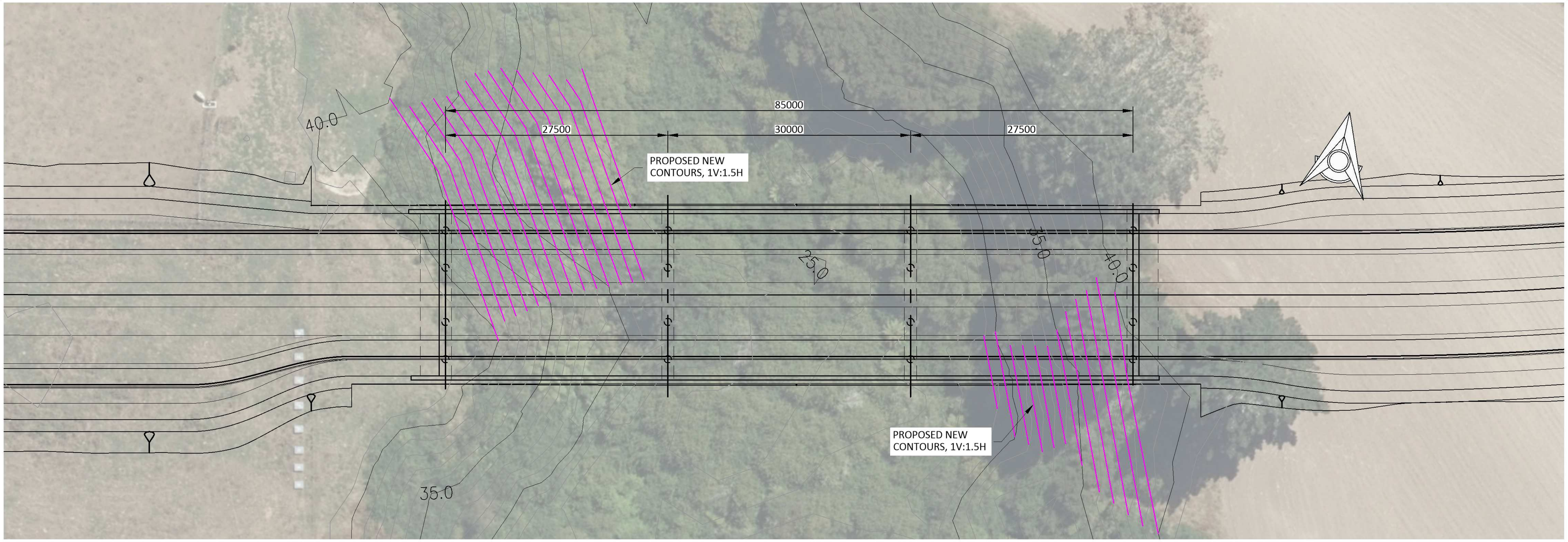
CLIENT: Hamilton City Council Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WESTERN WATERCOURSE BRIDGE GENERAL ARRANGEMENT PLAN AND LONG SECTION

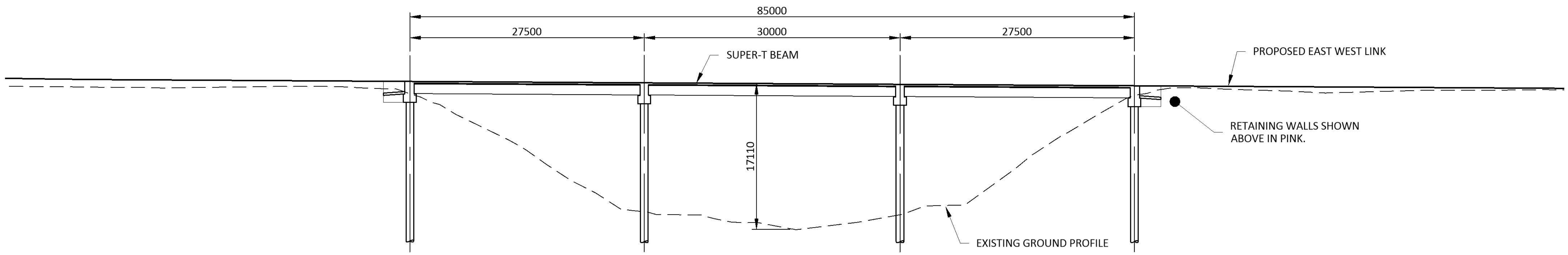
STATUS: PRELIMINARY
DATE: 04/2021
SCALE (ORIGINAL SIZE A3): AS SHOWN
DRAWING NUMBER: 146000-002A-0405
REVISION: A

Version 3.0 - September 2017



MANGAKOOTUKUTUKU GULLY BRIDGE - PLAN

1:500 (SUPER-T BEAM OPTION SHOWN)



MANGAKOOTUKUTUKU GULLY BRIDGE - LONG SECTION

1:500

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NOT FOR CONSTRUCTION

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	CC	PCH	JG

DESIGNED: PCH | CHECKED: PCH | DRAWN: CC | APPROVED: JG | mx model version:

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: MANGAKOTUKUTUKU GULLY BRIDGE GENERAL ARRANGEMENT PLAN AND LONG SECTION

STATUS: PRELIMINARY

DATE: 04/2021 | SCALE (ORIGINAL SIZE A3): AS SHOWN

DRAWING NUMBER: 146000-002A-0410 | REVISION: A

Version 3.0 - September 2017

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 100mm 0

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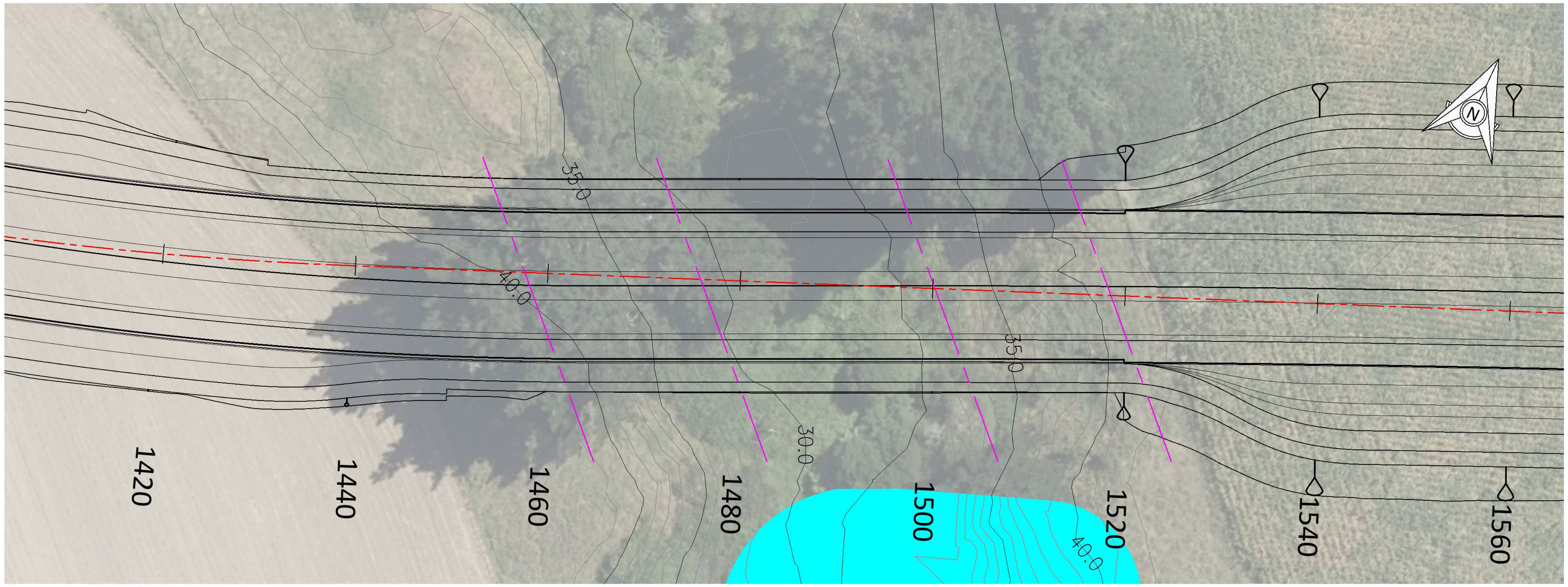
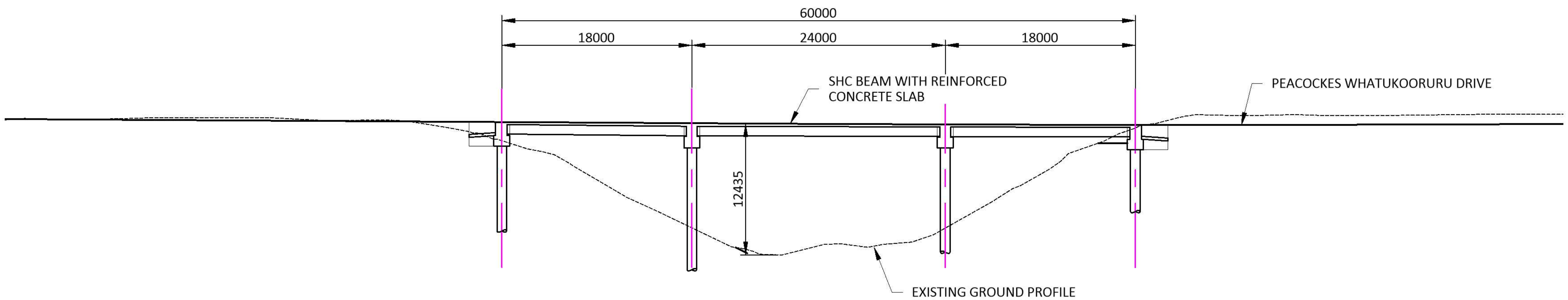


EASTERN WATERCOURSE CROSSING BRIDGE - PLAN
1:500



EASTERN WATERCOURSE CROSSING BRIDGE - LONG SECTION
1:500

07/05/2021
NOT FOR CONSTRUCTION

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	07.05.2021	ISSUE FOR INFORMATION	CC	PCH	JG

DESIGNED: PCH
CHECKED: PCH
DRAWN: CC
APPROVED: JG
mx model version:

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council, Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: EASTERN WATERCOURSE BRIDGE GENERAL ARRANGEMENT PLAN AND LONG SECTION

STATUS: PRELIMINARY
DATE: 03/2021
SCALE (ORIGINAL SIZE A3): AS SHOWN
DRAWING NUMBER: 146000-002A-0418
REVISION: A

Appendix B – Environmental Mitigation Statement

Environmental Mitigation Statement

This Environmental Mitigation Statement (EMS) has been prepared to identify the actual, potential and potential perceived environmental effects associated with the Peacocke: Whatukooruru Drive Project, and the means by which those effects will be mitigated through the detailed design process. The EMS takes into account the design, designation, consenting objectives for the project as well as a preliminary Environmental and Social Responsibility Screen used to identify high level themes and issues. The EMS which follows comprises a combination of 'embedded mitigation' (i.e. mitigatory features incorporated into the design of the development) and 'mitigation measures' (i.e. measures to prevent, reduce and offset any remaining adverse effects e.g. consent conditions).

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
Landscape and Visual Impacts	An integrated 'green network'. A transport network that is sympathetic to the wider landscape and integrates with the landscape and land uses. A robust and integrated planting design that is ecologically beneficial, attractive, coherent, durable and innovative.	Visual change to landscape and gully environments	The alignment has been designed to be sympathetic with surrounding natural landform and existing landscape features. As far as practically possible, it minimises encroachment into gullies and areas of indigenous vegetation and avoids water courses.
			Bridges are proposed for the three main gully/watercourse crossings to minimise and eliminate environmental effects.
		Adverse change in character arising from the proposed development and the permanent presence of roading	Detailed design is required to align with the approved Concept Landscape Management Plan. The CLMP promotes an informal environment whereby the transport network is 'woven' through open spaces and existing landscape features.
			Steep cut and fill batters are generally avoided. Max slopes are 1v:2h but are flatter where possible (unconstrainted). All slopes steeper than 1v:4h are planted/mulched. Earthworks to align with

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
			adjacent development where information is available.
			Designation conditions impose a requirement for a Landscape Management Plan prior to construction works commencing.
			Supplementary planting to be carried out as part of landscaping works, including gully rehabilitation and adjacent to streams. Planting to be designed to enhance existing views and vistas and to integrate the road form into the surrounding landform.
			Management and maintenance methodologies to ensure the survival of new or replacement plantings.
			Tree protection where retained specimens are within proximity of construction works (i.e. fencing of root protection zone).
			Use of transportation corridors for key utilities infrastructure thereby avoiding the need for duplicate corridors.
			Underground service facilities to be located within soft landscape areas to avoid the hard surface areas of roads, pedestrian and cycle facilities.
			Where possible, planting will be utilised at the top and bottom of retaining walls to help soften and anchor structures within the landscape.
			Ecological planting to link with and complement the fragmented nature of the existing habitats.

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
Social	Connect, retain and improve access between the existing built environment, open spaces and future development areas. Incorporation of a safe, user friendly cycling and pedestrian network that links to existing and proposed facilities.	Potential social effects include either temporary or permanent severance from community facilities.	Designation conditions impose a requirement for a Transport Network Management Plan prior to lodgement of an Outline Plan of Works.
		Community cohesion and accessibility, including vehicular connectivity with the local road network.	The design will ensure that connectivity with the local road network is maintained for all landowners, both during and after construction.
		Perceived personal security for pedestrians and cyclists.	CPTED principles have been incorporated into the approved Concept Landscape Management Plan.
			The has been designed to support a wide range of transport choices through the provision of safe and user-friendly cycle and pedestrian facilities as well as aiming to prioritise public transport.
Human Health		Potential for human health impacts cause by construction effects (such as noise and dust).	Designation conditions are in place requiring a Construction Noise and Vibration Management Plan as part of a Construction Management Plan, and a Dust Management Plan prior to construction works commencing on site.
		Potential for HAIL sites to be located either within the designation, or within the construction area of interest. This is a potential health risk for construction workers.	Preliminary Site Investigation Report (PSI) to be completed as a means of informing treatment methodology.
		Risk to human health through the handling of hazardous substances during the construction phase.	Designation conditions are in place requiring a Contaminated Soil Management Plan and a Hazardous Substances Management Plan prior to construction works commencing on site.
		Operational noise following completion of the roading network.	A Designation condition is in place requiring a Road Traffic Noise Assessment Report 6 months prior to construction works commencing. The report is to

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
			address compliance with NZS 6806:2010 – Acoustics – Road Traffic Noise – New and Altered Roads (i.e. low noise road surfacing and / or noise barriers as necessary).
		Road User Safety.	Incorporation of Vison Zero principles (e.g. design speed controls relative to geometrics and road user types).
Culture and Historic Heritage	Protection of archaeology and sites of cultural significance as far as is practically possible. A cultural narrative that is reflected in the design of transport infrastructure and which celebrates the historic gardening, settlement patterns and trade and transport networks traditionally associated with the area.	Disturbance or removal of archaeological sites could lead to permanent loss of heritage asset.	Selection of route alignment has taken into consideration the avoidance of archaeological sites, as far as is practically possible.
			Access to work areas will use existing access routes as far as possible to minimise unnecessary disturbance of high probability locations.
			Harm to or loss of archaeological interest will be mitigated by archaeological investigation and the adherence of archaeological discovery protocols.
			A precautionary global archaeological authority will be applied for concurrently with regional consents and prior to construction works commencing on site.
			Designation condition in place requiring a Heritage and Archaeological Site Management Plan prior to construction works commencing.
			Potentially a requirement for a Conservation Plan if an archaeological site has sufficient significance, based on the cultural heritage assessment criteria under the Waikato Regional Policy Statement.

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
		Potential for cultural significance to be overlooked in the design of roading and the proposed watercourse crossing bridges.	Detailed design is required to align with the approved CLMP. The CLMP promotes a cultural narrative that responds to the iwi and hapu of the area.
			Retaining walls will incorporate wall patterns developed in consultation with the TWWG.
			The bridge designs will avoid the placement of piers within the watercourses.
		Potential for environmental and cultural management to be perceived as 'incremental' rather than integrated and holistic.	Ecological mitigation has been developed as a 'whole of catchment ecological restoration strategy', as per recommendation of the Southern Links Tangata Whenua Working Group.
Ecology – General	A no-net-loss of terrestrial, wetland and stream biodiversity values. A robust and integrated planting design that is ecologically beneficial, attractive, coherent, durable and innovative. Designing structures for fauna	Loss or damage to ecological habitats.	Designation condition in place requiring an Ecological Management and Monitoring Plan (EMMP) prior to works commencing on site. EMMP includes: - Avoidance of habitat where possible. - Consideration of stock proof fencing around restoration / mitigation planting. - Salvaging of indigenous flora and fauna where practicable. - Offset mitigation (habitat restoration / enhancement, habitat creation, improving water quality, designing for fauna).
		Potential loss of habitat, roosts and bats.	Designation conditions are in place requiring the monitoring, management and mitigation of

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
Ecology – Long Tailed Bats	Protection and enhancement of long-tailed bat habitat.		significant adverse effects on bats to be detailed in EMMP. EMMP includes: - Minimum 1:1 restoration ratio for areas of gully, bat habitat and river margin affected by the designation. - Animal pest control for a period of 20 years to protect significant bat roost sites. - Measures to avoid, minimise and monitor roost removal and habitat loss, as well as habitat replacement and enhancement. - Details of alternative roosting sites, including the installation of artificial roots in advance of construction works. - Measures to minimise habitat fragmentation and alteration to bat movement. - Bat crossing points which are integrated into bridge design(s). - Reduced road lighting effects through the creation of 'dark zones' at key bat habitats. - Baffles to be considered on lighting columns to reduce spill away from roads.
			Establishment of buffer zones and bat hop-overs along specific locations of the project route in advance of construction.

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
			Street lighting to comprise warm white LED luminaries to minimise effects on bats.
			Avoidance of aesthetic lighting in specific locations to minimise adverse effects on bats.
Ecology – Avifauna	Enhance extent and quality of habitat for native species	Potential loss of habitat and species	Designation condition - Monitoring, management and mitigation of significant adverse effects on avifauna is detailed in EMMP.
Ecology – Lizards	Enhance extent and quality of habitat for native species	Potential loss of habitat and species	Designation condition - Monitoring, management and mitigation of significant adverse effects on lizards is detailed in EMMP.
Ecology - Indigenous vegetation, aquatic and wetland	Protection and restoration of wetlands, lakes, rivers or streams and their margins. A robust and integrated planting design that is ecologically beneficial, attractive, coherent, durable and innovative.	Potential loss of habitat and species.	Designation condition - Monitoring, management and mitigation of significant adverse effects on indigenous vegetation, aquatic and wetland species is detailed in EMMP. EMMP includes: - Minimum 3:1 offset restoration ratio for significant indigenous habitats and wetlands affected by the designation. - Opportunities to integrate existing restoration planting on public and private land with restoration / mitigation planting. - Provision for the legal protection of restored areas.
			Where appropriate, stock proof fencing around restoration / mitigation planting.
			Salvaging of indigenous flora and fauna where practicable.

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
			Eco sourcing of planting species from the Waikato Ecological District, where applicable.
			Landscape design will allow for the extension of existing gully vegetation patterns as close to the carriageway as possible.
Traffic and Transport	An integrated, high performing strategic road network that delivers the best possible service for all users.	Impacts on the localised transport network	CMP will include methodology for the management of construction traffic effects
			Temporary Traffic Management Plan to be prepared and approved prior to construction.
			Road sweeping / wheel washing to avoid the transfer of debris onto the surrounding road network.
			Regular communications and engagement with residents and developers within the wider Peacocke Development area.
		Perceived reduction in safety for pedestrians and cyclists at intersections and roundabouts.	Pedestrian and cycling facilities to be integrated into the design of roundabouts with pedestrian/cycle priority systems at intersections.
			Suitable ground markings, kerb let-down facilities and signage to be provided for pedestrians and cyclists including entry and exit points for cyclists to access shared path facilities.
			Design to consider grade separation of pedestrian and cycle facilities where practicable.
			All intersections to incorporate suitable hard landscape features such as paths, crossings, safe

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
			zone islands, hold railings and flush kerbs to promote safety.
		Impacts on property access.	Property access is not prohibited from the minor arterial roads; however, individual lot connections is to be discouraged.
			Any property accesses severed by the project will be re-established in a safe and practical location.
Construction Noise and Vibration		Temporary increase in ambient noise during construction works	Designation condition in place requiring a Construction Noise and Vibration Management Plan as part of CMP
			Construction noise limits imposed as condition of designation.
			Regular monitoring of noise levels to ensure compliance with conditions.
			Limitations on the hours of operation, in noise sensitive locations.
			Plant to be regularly serviced, maintained and operated in accordance with manufacturers' instructions.
Operational Noise		Increase in operational traffic noise once additional roading is constructed.	Primary mitigation of road noise is use of asphalt surface in urban areas.
			Localised use of acoustic barriers may be required in discreet urban locations but is subject to further noise investigation studies.
Air Quality		Potential for localised air quality impacts during construction	Designation condition in place requiring a Dust Management Plan prior to construction works commencing. The Dust Management Plan will form

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
			part of the CMP developed to support regional consent applications.
			Best practice emissions management as part of CMP.
			HCVs only use designated routes.
			Maintain haulage roads to avoid unnecessary dust discharge.
Water Quality		Perceived risk to water quality due to construction activities over surface water (e.g. falling debris).	An Erosion and Sediment Control Plan (ESCP) will be developed to support application for Regional Consents. An ESCP will also form part of the CMP.
		Potential for adverse water quality effects caused by the discharge of contaminant run off.	Design to ensure appropriate stormwater runoff treatment devices incorporated to manage stormwater onsite prior to discharging to natural watercourses.
		Potential for contamination of surface water through vehicle servicing and refuelling.	CMP will include methodologies for the servicing and refuelling of vehicles.
Hydrology and Drainage	Integrate stormwater design and ecological planting in an informal / natural manner.	Increased run off and risk of flooding due to increased permeable area and changes to drainage regimes.	Design to include provision for attenuation and treatment in accordance with ICMP
			Where utilised, and where practical, swales will be planted with appropriate [native] plant species to reduce flow rates, filter water and improve the area's ecology.
			The bridge design to include collection and reticulation mechanisms to transfer storm water beyond bridge abutments to appropriate treatment and attenuation devices.

Effects Category	Objectives	Predicted Changes and Potential Effects	Incorporated Measures to Avoid, Remedy or Mitigate Potentially Adverse Environmental Effects
		Increased erosion risk in existing natural watercourses	An Erosion and Sediment Control Plan (ESCP) will be developed to support application for Regional Consents. The ESCP will also form part of the CMP.
			Outfalls into natural (and engineered) watercourses to be appropriately designed
Bridges	Urban design treatments of bridges and abutment structures to contribute to the character of the area.	Potential safety hazard to pedestrians and cyclists using the bridges due to the possibility of falling / jumping off the bridge	Effect minimised through the bridge design which incorporates a minimum 1.4m barrier along the pedestrian / cycle lane. The design will satisfy Safety from Falling requirements as detailed within the Building Act
	Design earthworks and structures to complement the surrounding landform.	Perceived safety risks for other transport modes (e.g. pedestrians and cyclists).	Bridge cross sections to incorporate suitable space for cyclists and footpath for pedestrians.
			Bridges to incorporate lighting for road and personal safety.
	Short and long term maintenance requirements are an integral part of bridge design.	Operational and maintenance constraints impacting on design of bridge and associated structures.	Design will ensure that all parts of the bridge are accessible and maintainable using traditional maintenance and inspection methods.
			Piers, MSE walls and barriers will be coated with anti-graffiti finishes.

Appendix C – Environmental and Social Responsibility Screen

ENVIRONMENTAL AND SOCIAL RESPONSIBILITY SCREEN V2.FEBRUARY 2016

NZ TRANSPORT AGENCY WAKA KOTAHI

Peacocke: Whatukooruru Drive and Peacocke Road Urbanisation

Hamilton City Council Te kaunihera o Kirikiriroa

PROJECT LOCATION:	PROJECT PURPOSE:	DATE:	OPTION DESCRIPTION:
Peacockes, Hamilton	Strategic Transport	May 2021	N/A

CATEGORY		QUESTION	ANSWER	
GENERAL	G1	What is the zoning of adjacent land? Are there any encumbrances on the land? e.g. Maori Reserve or other reserve/covenants	Rural ☐	Commercial ☐
			Industrial ☐	Residential ☒
			High density residential ☐	Parks/open space ☒
	G2	Does the option disturb previously undisturbed land?	Y	N
	G3	What is the construction timeframe?	>18 months	<18 months
NATURAL ENVIRONMENT	NE1	Are there any outstanding/significant natural features (e.g. geological or geothermal)/landscapes?	Y	N
	NE2	Will the option affect the coastal marine area, wetlands, lakes, rivers, streams or their margins?	Y	N
	NE3	Will the option affect areas of the conservation estate, or areas of known significance for biodiversity or known habitats of uncommon or threatened species?	Y	N
	NE4	Is the option in an area of potential hazard risk e.g. fault lines, significant erosion, flooding, sea level rise etc?	Y	N
	NE5	Will more than 0.5 hectares of vegetation be removed?	Y	N
		What type? Exotic pasture and indigenous vegetation		
CULTURAL AND HISTORIC HERITAGE	CH1	Are there sites/areas of significance to Maori within 200m of the area of interest?	Y	N
	CH2	Are any recorded, scheduled or listed archaeological sites within 200m of the area of interest?	Y	N
	CH3	Are any scheduled, listed or other important heritage buildings/ structures within 200m of the area of interest?	Y	N
	CH4	Will the option affect the setting of any historic building/structure or archaeological site?	Y	N
	CH5	Is a group of archaeological sites or an area of historic built environment (even partially) within 200m of the area of interest?	Y	N
HUMAN HEALTH	HH1	What is the One Network Road Classification?	National ☐	Regional ☐
			Arterial ☒	Collector ☐
	HH2	Is the area of interest designated as a non-compliant airshed?	Y	N
	HH3	Are there medical sites, rest homes, schools, child care sites, residential properties, maraes or other sensitive receivers located within 200m of the area of interest?	Y	N
	HH4	Does land use within 200m of the area of interest include industrial sites, chemical manufacturing or storage, petrol stations, vehicle maintenance, timber processing/treatment, substations, rail yards, landfills or involve other activities that may result in ground contamination?	Y	N
		OR Are there HAIL or SLUR (contaminated) sites within 200m of the area of interest?	Y	N Not yet Known
SOCIAL	S1	Does the option affect access to community facilities i.e. libraries, open space etc (either temporarily or permanently)?	Y	N
			Which? Improved connectivity for Peacocke area	
	S2	Does the option affect community cohesion and accessibility including vehicular connectivity on the local road network?	Y	N
URBAN AND LANDSCAPE DESIGN	ULD 1	Are there opportunities to enhance infrastructure for, and/or improve access to, public transport and/or active modes of travel such as as walking and cycling?	Y	N
	ULD2	Does the option enhance the development potential of adjacent land where appropriate?	Y	N
	ULD3	Is the option located on a themed highway? Is the option part of or near a national cycle or walking route?	Y	N
	ULD4	Are there opportunities to enhance the urban character, landscape character and visual amenity?	Y	N

Answers and Comments	Refer to screen questions explanation to help complete this part.

1. **Summarize the potential environmental and social risks/impacts associated with this option. Consider short and long term risks and impacts.**

NATURAL ENVIRONMENT:	The project area is a peri-rural environment which has been heavily modified for farming, lifestyle and rural residential purposes. The Operative Hamilton City District Plan identifies the land as being Peacocke Character Zone. The area is dominated by the Mangakootukutuku gully which supports a variety of native birds, invertebrate and reptile species and provides important habitat for long tailed bats.The landscape within the project areas is predominantly undulating. Varied soil types occur across the area and typically comprise soft silt and organic material which overlay Hinuera formation.
CULTURAL AND HISTORIC HERITAGE:	A number of archaeological features are located within the project area with sites S14/210 and S14/326 being recorded within the NZ Archaeological Association database. Both of these sites refer to the presence of Maori-made soils (Tamahere series soils) and borrow pits. These recordings are relatively common within the Waikato basin and illustrate the extent of pre-European Maaori habitation within this area. Whatukororu Pa is an historic reserve located between two arms of the Mangakotukutuku Gully near the end of Peacockes Lane. Some visible remnants of the Nokuhau Pa can be found near Stubbs / Gainsford Road. Historically, the project area is synonymous with gardening, settlement patterns and trade and transport networks. No heritage buildings are located within the project area.
HUMAN HEALTH:	The project area contains multiple rural residential properties, lifestyle blocks and small farm holdings: the residential component associated with these activities are the only sensitive receivers. Residential activity will nonetheless intensify within the Peacocke area because the locality is zoned as a Future Urban Area.
SOCIAL:	There are currently no schools, hospitals or community facilities within the Peacocke area, though the Peacocke Structure Plan provides for a future suburban centre at the intersection of Peacockes road and Whatukooruru Drive. Relative to the status quo, this project will improve community cohesion and accessibility by providing alternative routes into and out of Hamilton city, and by providing connectivity with Southern Links.
URBAN AND LANDSCAPE DESIGN:	This project will help enable urbanisation of the area. Relative to the status quo, the project will provide a landscape and urban design that facilitates and enhances the natural environment, cultural and historic heritage, human health and social outcomes..

2. **What are the environmental, social integration, landscape design or urban design benefits or opportunities presented by this option? Particularly record opportunities that could be lost if not considered early in the design process.**

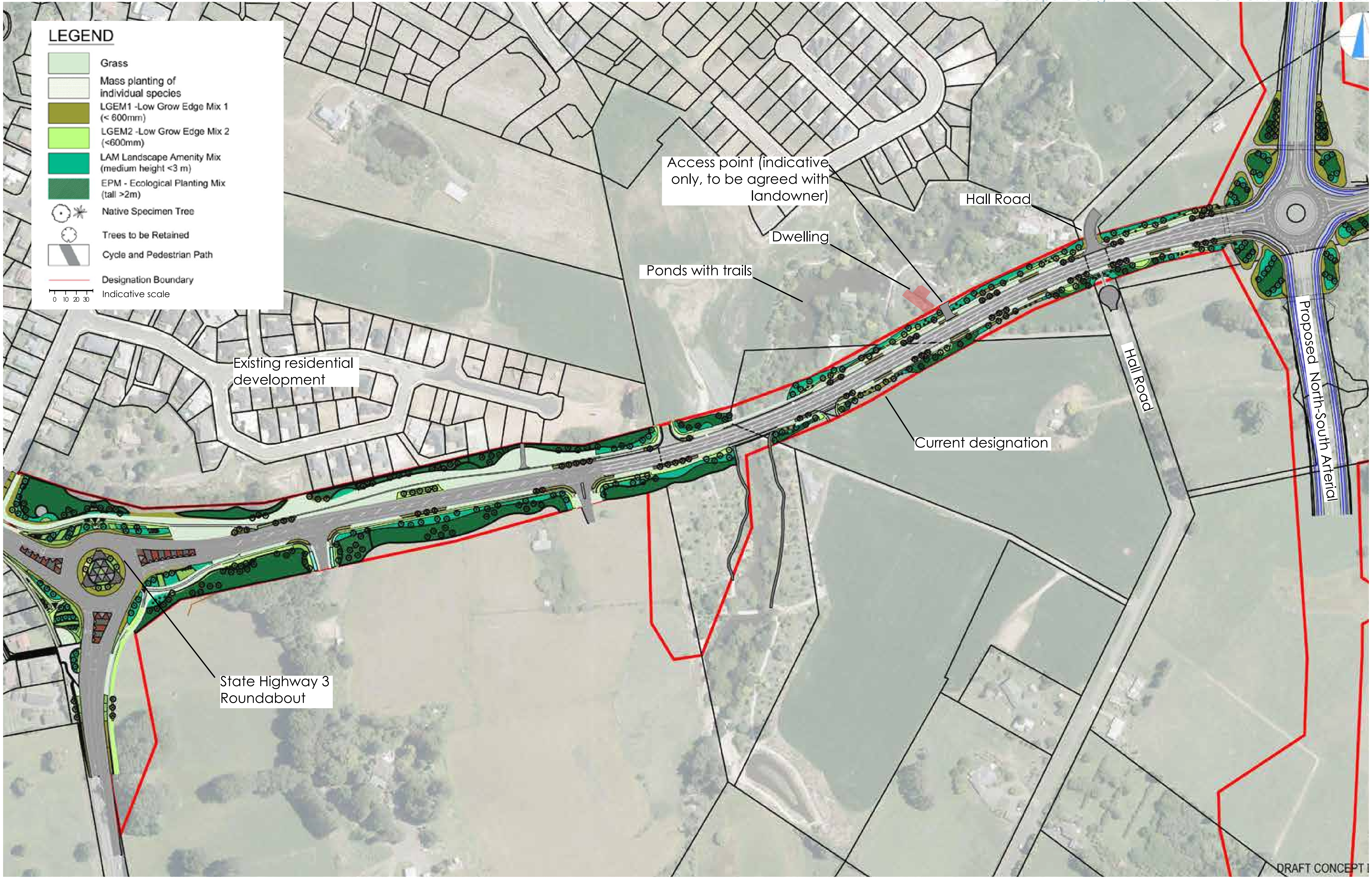
3. **Are there any impacts, risks or opportunities which require preliminary technical assessments to help understand risks or opportunities? Is further information required to support the development of the detailed business case or can it be left until the detailed business case/pre-implementation?**

N/A

Completed by	
Reviewed by Project Manager	

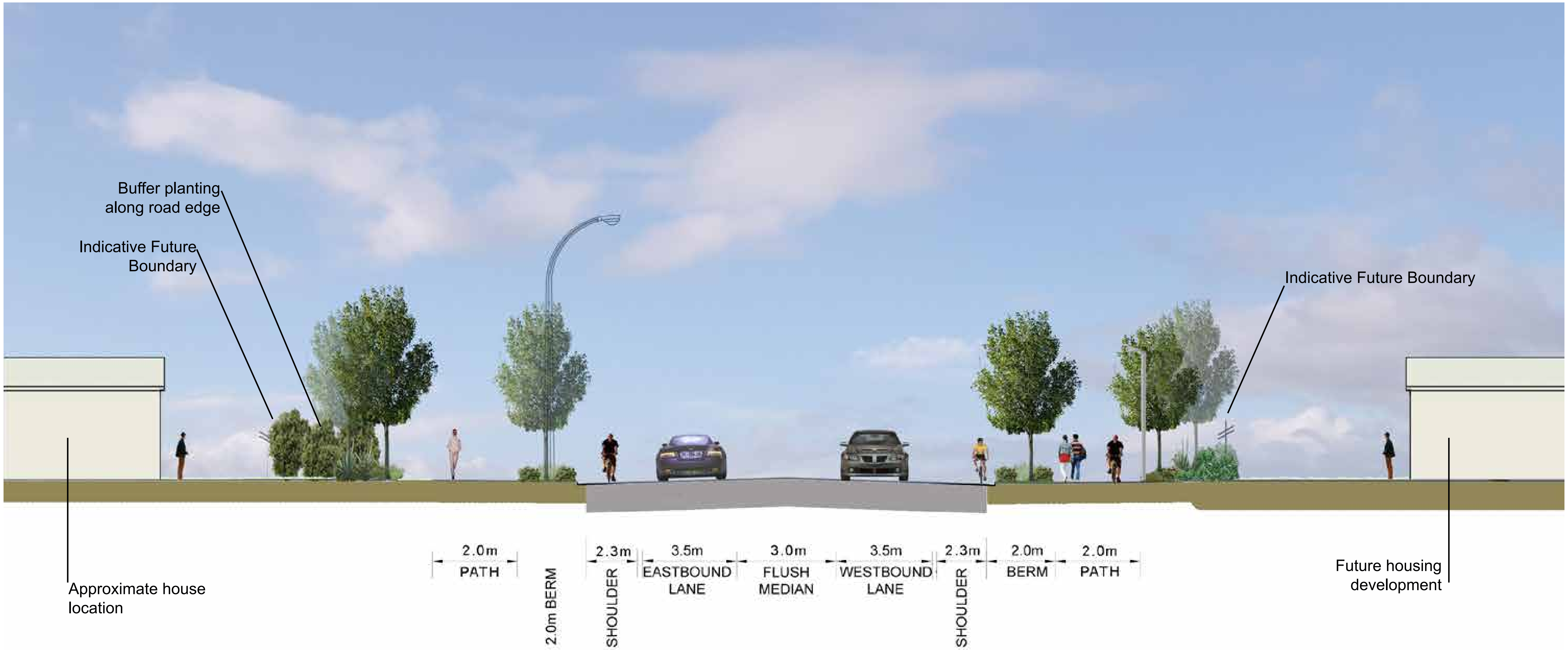
Appendix D – Landscaping concepts for design aspects 'beyond the pavement' (to integrate neighbouring land uses)

A1 - Concept Design Overview - Current Designation



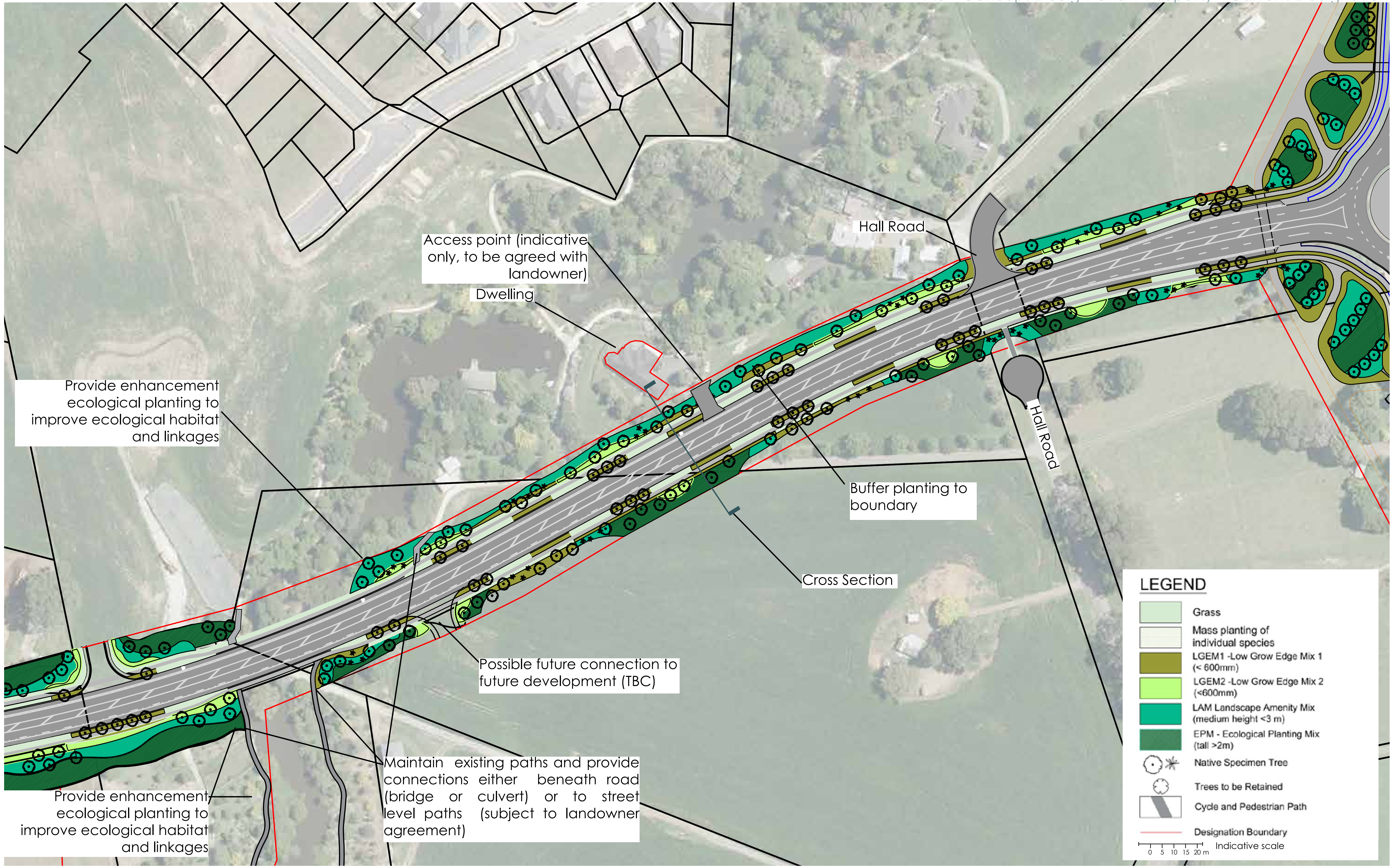
Concept Design for Discussion Only

A2 - Concept Design Cross Section - Current Designation



EAST-WEST ARTERIAL TYPICAL SECTION
SCALE: NTS

A3 - Concept Design Shaw Property - Current Designation



Concept Design for Discussion Only

C1 - Concept Design Indicative Suporting Images


Indicative pathway planting


Indicative boundary planting


Paving design to integrate paths with street furniture to create inviting environment


Indicative wetland pond planting

Interpretation signage


Bird hide

PATH INTEGRATION

The Project would look at providing suitable path connections to incorporate the ponds for public access and community feature. Other associated design features could include:

- Enhanced ecological planting to strengthen biodiversity
- Ecological enhancement (insect hotels and stumperies)
- Inclusion of interpretive signage and seating facilities
- Bird hide facilities


Insect hotel / refuge

PATH CONNECTIVITY

Maintain path connections by incorporating the following options:

- Pedestrian crossings
- Arched or box culvert
- Bridge crossing of gully with sufficient head room for path connections beneath

Safe island crossing points

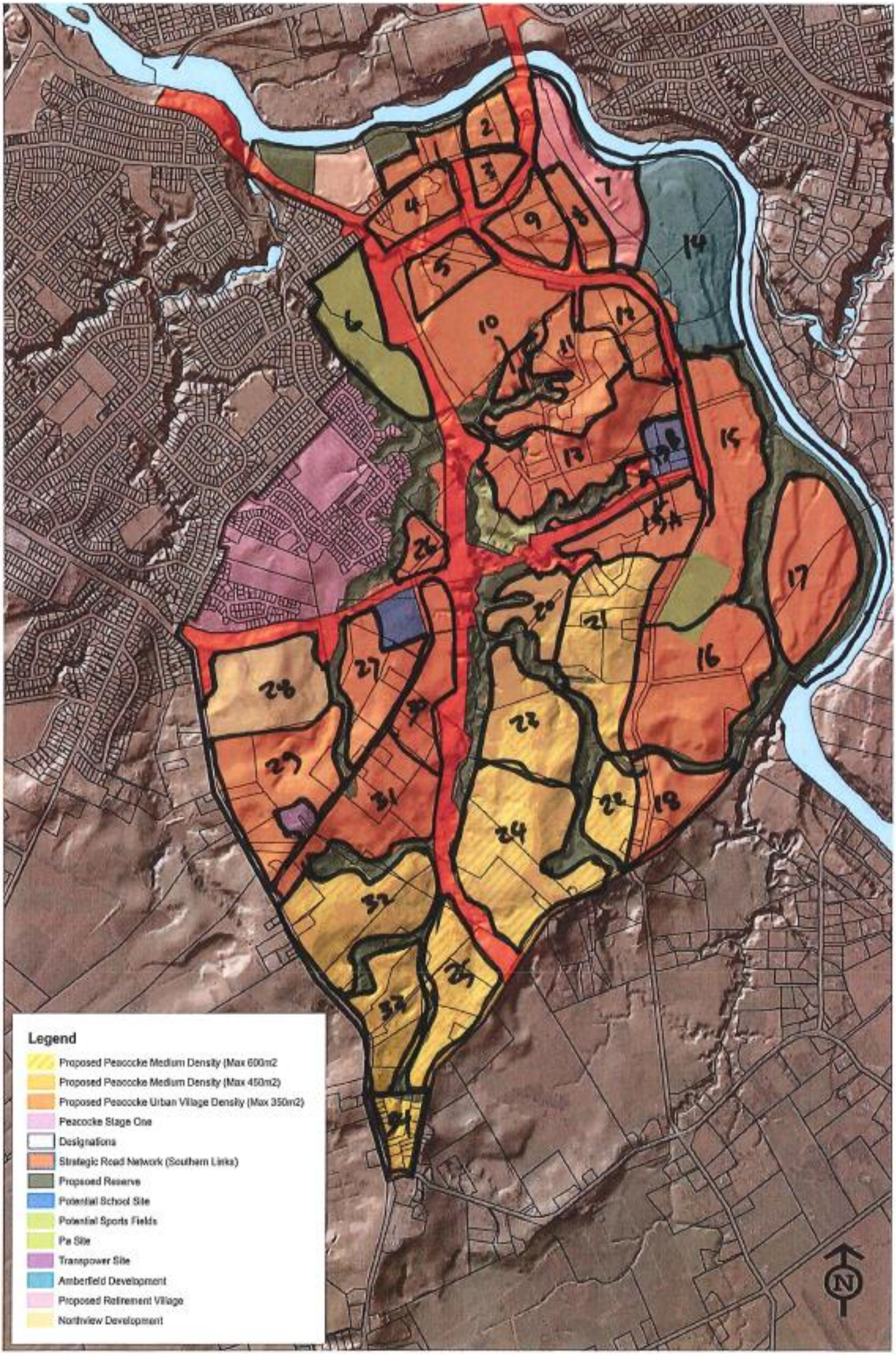

Box culvert underpass


Arched culvert underpass


Box culvert underpass


Bridge crossing with paths under

Appendix C – Peacocke Developable Areas Zone Sketch (HCC)


Legend
Proposed Peacocke Medium Density (Max 600m2)
Proposed Peacocke Medium Density (Max 450m2)
Proposed Peacocke Urban Village Density (Max 350m2)
Peacocke Stage One
Designations
Strategic Road Network (Southern Links)
Proposed Reserve
Potential School Site
Potential Sports Fields
Pa Site
Transpower Site
Amberfield Development
Proposed Retirement Village
Northview Development
N

Appendix D –Peacockes Rd - Whatukooruru Dr Signal Operations Memo

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Memo

To	John Kinghorn, Hamilton City Council
From	Cameron Inder / Siva Balachandran
Date	31 March 2022
Job No.	146000
Job name	Peacocke Whatukooruru Drive
Subject	**Peacocke Road / Whatukooruru Drive Signal Operations**

1. Introduction

The Peacocke Whatukooruru Drive project involves the extension of Whatukooruru Drive, a Minor Arterial transport corridor, from the new roundabout on State Highway 3 (Ohaupo Road) through to Peacocke Road and the upgrade of 600 m of existing Peacocke Road from a rural to urban environment.

A new four-leg "cyclist and pedestrian protected" signalised intersection will be constructed at the junction of Peacocke Road and Whatukooruru Drive. This document is designed to assist all interested parties in understanding the intended signal operations of the Peacocke Road / Whatukooruru Drive intersection.

The design of the traffic signal plans (in **Attachment A**) has been undertaken in accordance with the following standards and guidelines:

- NZTA P43 Specifications for Traffic Signals (June 2020)
- Hamilton City Council Regional Special Conditions 2021
- Road Traffic Standards (RTS) 14

2. Proposed Phase Sequence

The proposed phase sequence is a standard double diamond overlap sequence.

It involves left turns and right turns operating together in a signal phase separate from adjacent through movements.

The bicycle and pedestrian crossings run separately from conflicting turning traffic movement phases, yet concurrent with the parallel vehicular through phases as shown in Figure 1. This phase sequence provides full protection for cyclists and pedestrians through time separation from turning movements. Vehicles are not required to give way to cyclists in this phase sequence.

No bus priority measures are included within the signal operation.

A more detailed explanation of the proposed phases is provided below.

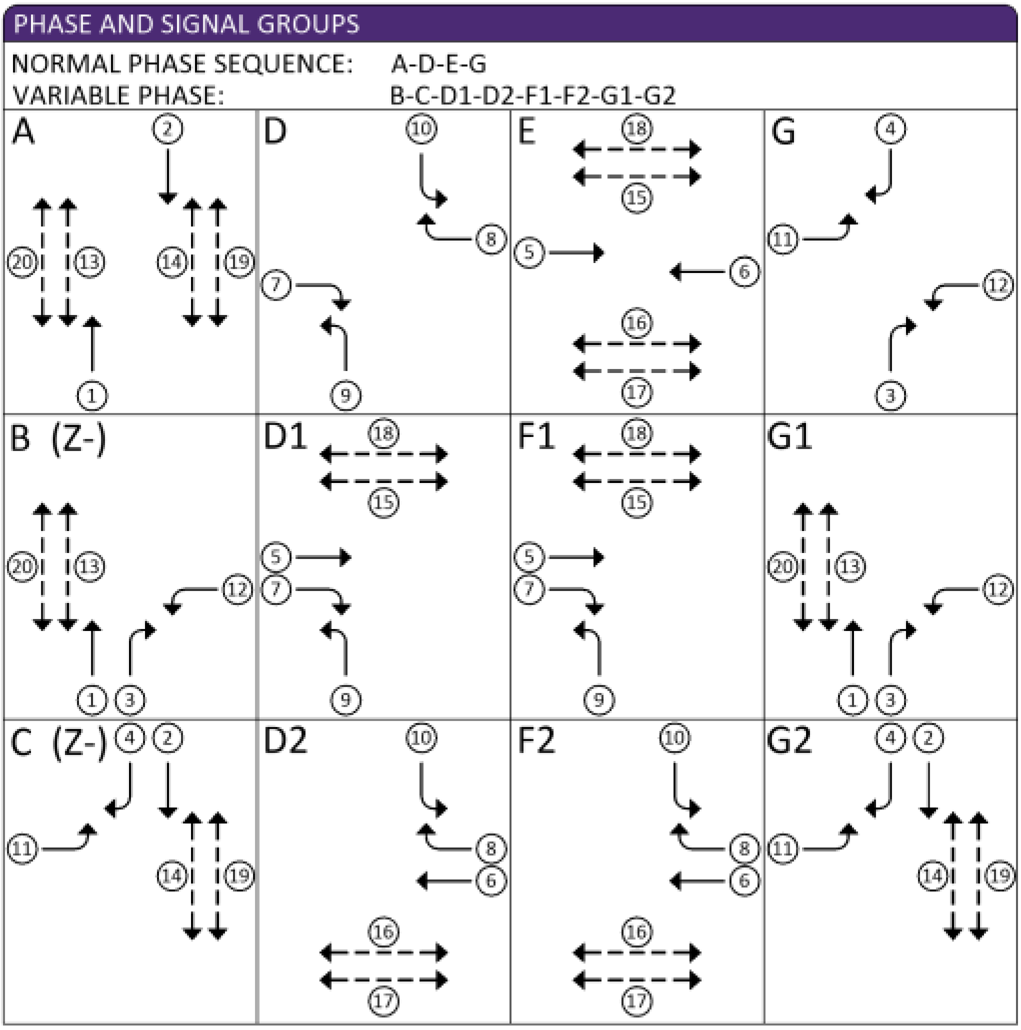

Figure 1: Proposed Phase Sequence

__A Phase__

- Signal group (SG) 1, SG2, pedestrian movements (P) 1, P2, cycle movement (C) 1 and C2 run in this phase.
- Left turn movements from Peacocke Road are not permitted.
- Filtering (right turn movements) shall not be permitted.

__B Phase__

- SG1, SG3, P1 and C1 run in this phase. Left turn movement (SG12) is also included.
- Phase introduction controlled through introduction of a Z- flag.

__C Phase__

- SG2, SG4, P2 and C2 run in this phase. Left turn movement (SG11) is also included.
- Phase introduction controlled through introduction of a Z+ flag.

__D Phase__

- SG7, SG8, SG9 and SG10 run in this phase.

D1 Phase

- SG5, SG7, P3 and C3 run in this phase. Left turn movement (SG9) is also included.

D2 Phase

- SG6, SG8, P4 and C4 run in this phase. Left turn movement (SG10) is also included.

E Phase

- SG5, SG6, P3, P4, C3 and C4 run in this phase.
- Left turn movements from Whatukooruru Drive are not permitted.
- Filtering (right turn movements) shall not be permitted.

F1 Phase

- SG5, SG7, P3 and C3 run in this phase. Left turn movement (SG9) is also included.
- Phase introduction controlled through introduction of XSF 5 Bit.

F2 Phase

- SG6, SG8, P4 and C4 run in this phase. Left turn movement (SG10) is also included.
- Phase introduction controlled through introduction of XSF 6 Bit.

G Phase

- SG3, SG4, SG11 and SG12 run in this phase.

G1 Phase

- SG1, SG3, P1 and C1 run in this phase. Left turn movement (SG12) is also included.

G2 Phase

- SG2, SG4, P2 and C2 run in this phase. Left turn movement (SG11) is also included.

3. Other Considerations

All the variable phases (i.e. B, C, D1, D2, F1, F2, G1 and G2) have the potential to run in two further scenarios:

- These phases can run if the pedestrian and cycle movements in their respective phases do not run (no demand from push button). Then the left turn movement (from the approach that is allowing the through and right turn movements) can be permitted to allow vehicles to turn left throughout the phase. Reintroduction of the pedestrian and cycle movements can occur if:
  - There is no further demand from the left turn movement (from the approach that is allowing the through and right turn movements); and
  - The pedestrian and cycle movements are triggered (demand from push button) and sufficient phase time remains for their crossing and clearance periods to run.

OR;

- If the pedestrian and cycle movements do run, then the left turn movement (from the approach that is allowing the through and right turn movements) can run after the pedestrian / cycle crossing is finished. The left turn red arrow will stay up until the pedestrian and cycle movement clearance times have finished and then it will turn green for left turn traffic.

It may also be appropriate for left-turn arrow lanterns (for the left turn movements from the approach that is allowing the through and right turn movements) to dwell-on-red until triggered by turning vehicles. This also ensures low vehicular speeds through the low radius turn.

Yours sincerely,
Bloxam Burnett & Olliver

pp

Siva Balachandran
Traffic & Transportation Engineer
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siva@bbo.co.nz

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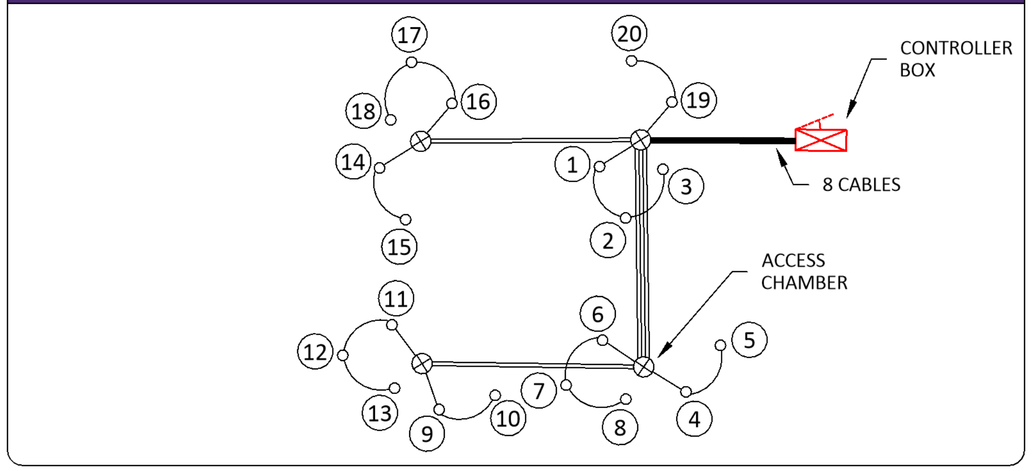
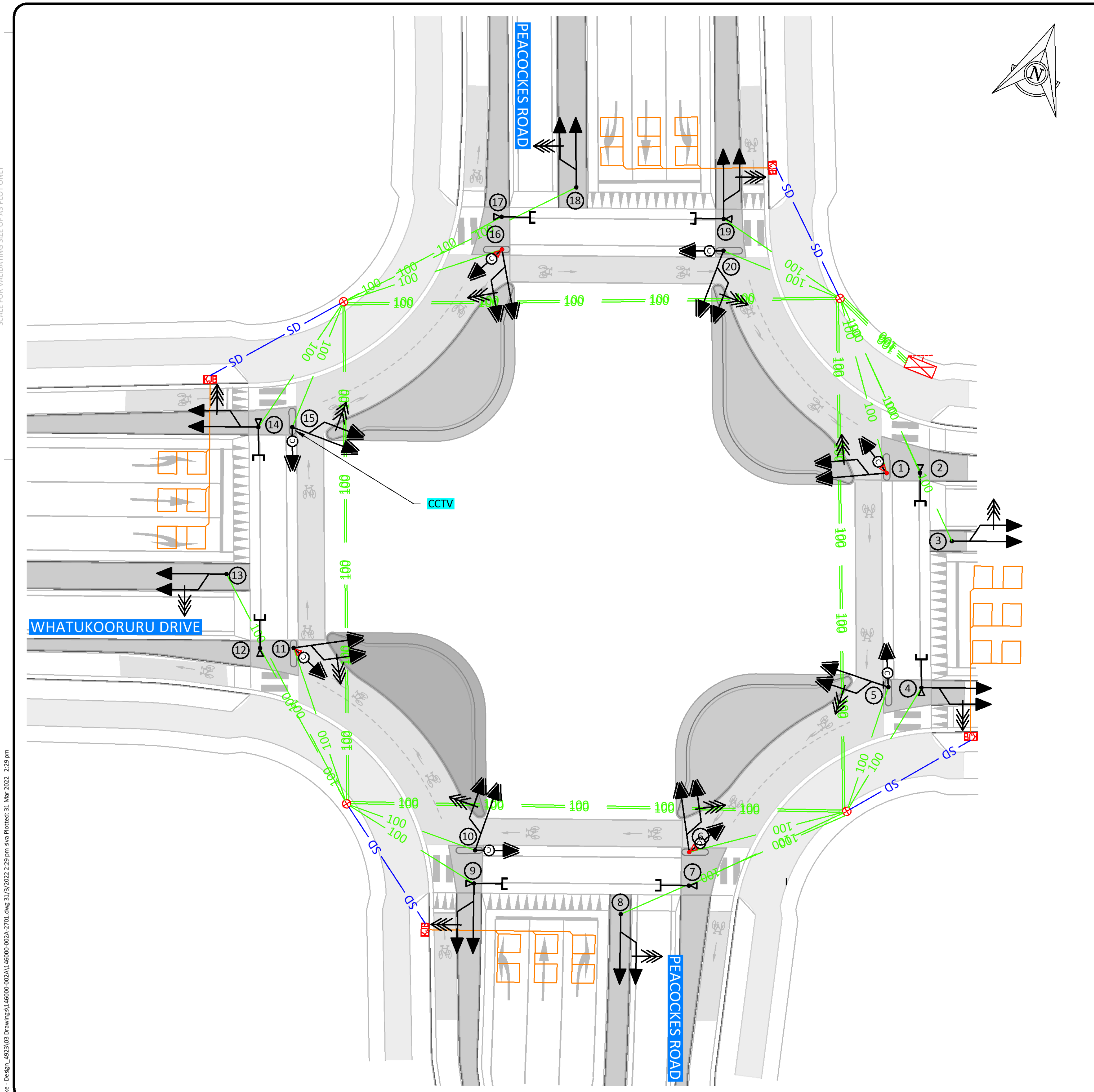
Attachment A

CABLING DIAGRAM





KEY

STANDARD 5m SIGNAL POLE AND POLE NUMBER	200mm ASPECTS - OPEN VISOR
JUSP — JOINT USE STREETLIGHT POLE (JUSP)	200mm ASPECTS - CLOSED VISOR
JUMA — JOINT USE MAST ARM (JUMA)	300mm ASPECTS - OPEN VISOR
ELV VC6 CONTROLLER BOX	300mm ASPECTS - CLOSED VISOR
KJB — KERB SIDE JUNCTION BOX	3 ASPECT DISPLAY
SIGNAL DUCT ACCESS CHAMBER	TWO COLUMN 6 ASPECT DISPLAY (RIGHT TURN ARROWS)
DETECTOR LOOP CABLE CUT INTO PAVEMENT AND KERB	TWO COLUMN 6 ASPECT DISPLAY (LEFT TURN ARROWS)
SD — 1 X 50mmØ DUCTING	
100 — 1 X 100mmØ DUCTING	
TOP OF KERB	
CYCLE 3 ASPECT WITH CYCLIST PUSH BUTTON	
CYCLE 3 ASPECT (NO PUSH BUTTON)	
PEDESTRIAN ASPECT WITH PEDESTRIAN PUSH BUTTON	
CCTV — CCTV CAMERA SIGNAL POLE	

NOTES

1. SIGNAL INFRASTRUCTURE TO BE INSTALLED IN ACCORDANCE WITH NZTA P43 SPECIFICATION FOR TRAFFIC SIGNALS, HCC P43 REGIONAL SPECIAL CONDITIONS AND THE REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. SIGNAL POLE POSITIONS TO BE CONFIRMED ON-SITE WITH HAMILTON CITY COUNCIL SIGNAL ENGINEER.
3. CONTROLLER TO BE LOCATED ADJACENT TO THE FOOTPATH, FINAL POSITION TO BE DETERMINED ON-SITE DURING CONSTRUCTION WITH HAMILTON CITY COUNCIL SIGNAL ENGINEER. ENSURE CABINET DOOR OPENS WITHOUT OBSTRUCTING PATH.
4. CONTROLLER ACCESS TO FACE AWAY FROM THE INTERSECTION. CONTROLLER MUST BE VC6 COMPLIANT AND EXTRA LOW VOLTAGE (ELV).
5. DUCT ROUTES MAY BE MODIFIED BY THE CONTRACTOR TO SUIT SITE REQUIREMENTS SUBJECT TO AVOIDING CLASHES WITH OTHER SERVICES. MODIFICATIONS TO BE APPROVED BY THE ENGINEER ON-SITE PRIOR TO INSTALLATION.
6. LED LANTERNS SHALL BE USED ON ALL ASPECT DISPLAYS, INCLUDING PEDESTRIAN AND CYCLE DISPLAYS.
7. CONTRACTOR SHALL PROVIDE POWER SUPPLY DESIGN, INSTALLATION AND CONNECTION. CONTRACTOR SHALL INCLUDE FIBRE CONNECTION TO CONTROLLER BOX.

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	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
C	18.03.2022	FOR TENDER	SB	CI	JS
B	22.12.2021	90% DESIGN ISSUE FOR REVIEW	AA	CMC	JS
A	02.11.2021	ISSUED FOR ROAD SAFETY AUDIT	LB	CI	JS

DESIGNED: LB | CHECKED: CI | DRAWN: LB | APPROVED: JS | mx model version:

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE / PEACOCKES ROAD SIGNALISED INTERSECTION ASPECT AND CABLING DIAGRAM

STATUS: PRELIMINARY

DATE: 05.10.2021 | SCALE (ORIGINAL SIZE A3): 1:400

DRAWING NUMBER: 146000-002A-2701 | REVISION: -

Version 4.0 - March 2020

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY 0 100mm

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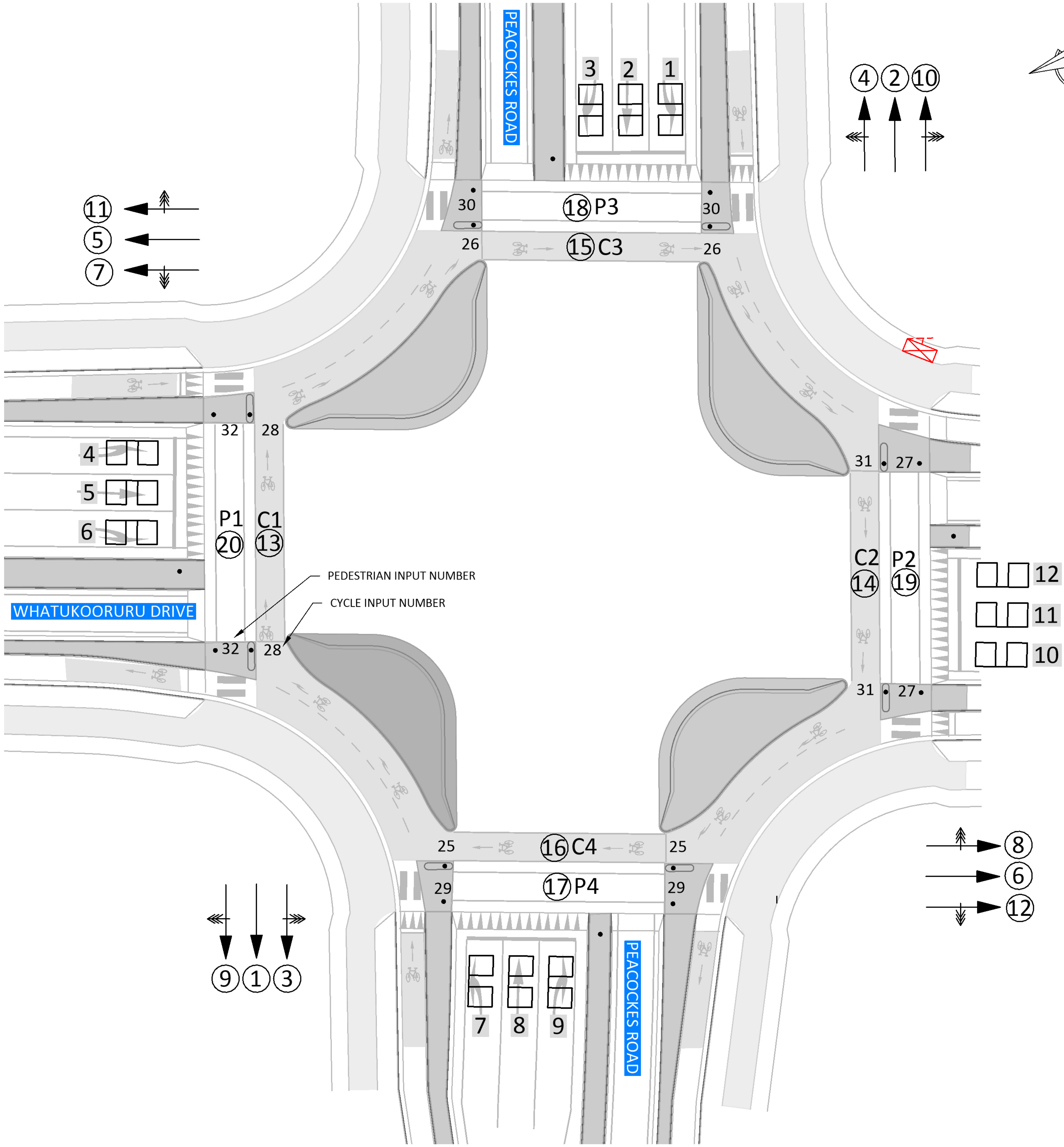

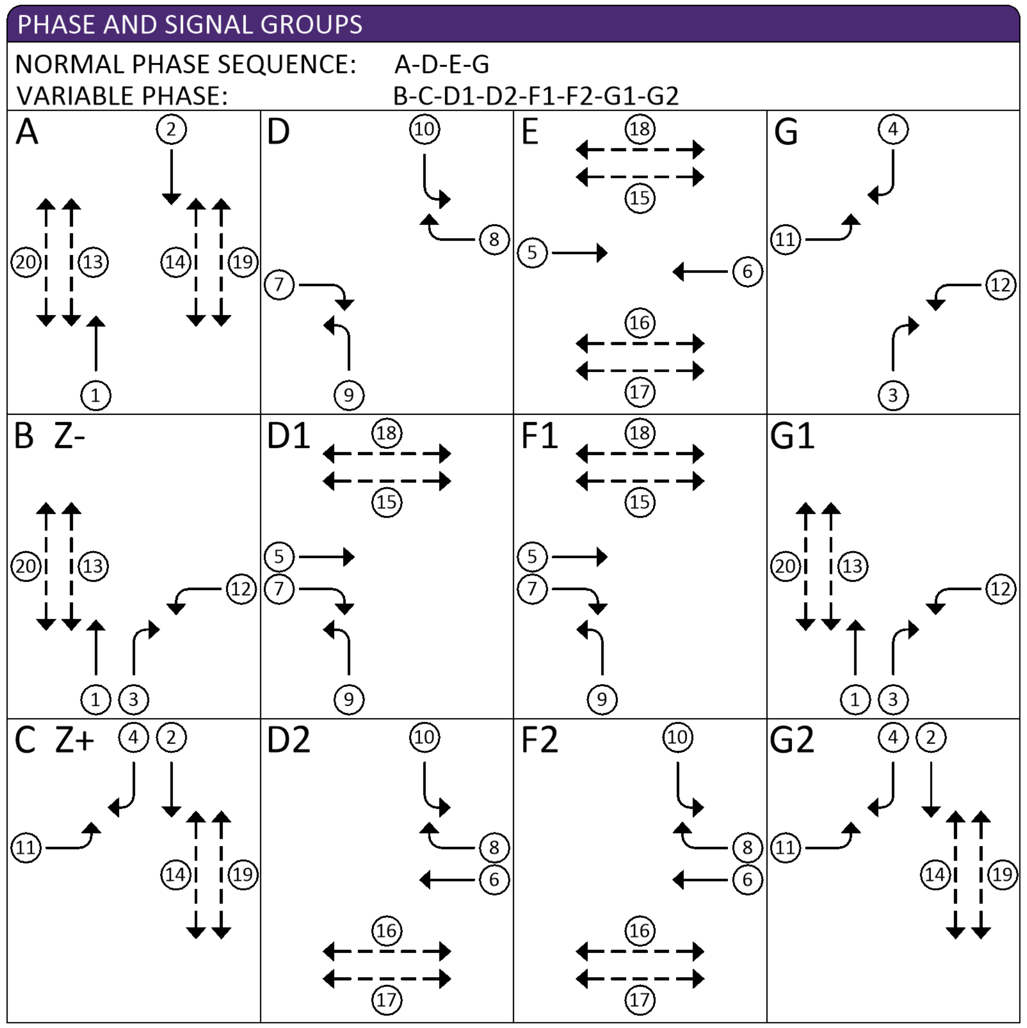

KEY

▭▭	SCATS DETECTOR LOOP
⊠	ELV VC6 CONTROLLER BOX
•	STANDARD 5m SIGNAL POLE
—	TOP OF KERB

NOTES

1. DEPTH AND LOCATION OF INDUCTIVE LOOPS TO BE IN ACCORDANCE WITH NZTA P43 SPECIFICATION FOR TRAFFIC SIGNALS AND HAMILTON CITY COUNCIL REGIONAL SPECIAL CONDITIONS.

	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
C	18.03.2022	FOR TENDER	SB	CI	JS
B	22.12.2021	90% DESIGN ISSUE FOR REVIEW	AA	CMC	JS
A	02.11.2021	ISSUED FOR ROAD SAFETY AUDIT	LB	CI	JS

Version 4.0 - March 2020

DESIGNED LB | CHECKED CI | DRAWN LB | APPROVED JS

mx model version:

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE / PEACOCKE ROAD SIGNAL PHASING AND DETECTOR NUMBERING

STATUS: PRELIMINARY

DRAFT COPY NOT APPROVED

DATE: 05.10.2021

SCALE (ORIGINAL SIZE A3): 1:400

DRAWING NUMBER: 146000-002A-2702

REVISION: -

Appendix E – Peacocke Whatukooruru Dr T-intersection Signal Operations Memo

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www.bbo.co.nz

Memo

To	John Kinghorn, Hamilton City Council
From	Cameron Inder / Siva Balachandran
Date	31 March 2022
Job No.	146000
Job name	Peacocke Whatukooruru Drive
Subject	**Typical T-intersection Signal Operations**

1. Introduction

The Peacocke Whatukooruru Drive project involves the extension of Whatukooruru Drive, a Minor Arterial transport corridor, from the new roundabout on State Highway 3 (Ohaupo Road) through to Peacocke Road and the upgrade of 600 m of existing Peacocke Road from a rural to urban environment.

Four "cyclist and pedestrian protected" signalised T-intersections will be constructed along Peacockes Road and Whatukooruru Drive. This document is designed to assist all interested parties to understand the signal operations at a typical T-intersection.

The design of the traffic signal plans (in **Attachment A)** has been undertaken in accordance with the following standards and guidelines:

- NZTA P43 Specifications for Traffic Signals (June 2020)
- Hamilton City Council Regional Special Conditions 2021
- Road Traffic Standards (RTS) 14

2. Proposed Phase Sequence

The proposed phase sequence involves bicycle and pedestrian crossing stages running separately from conflicting turning traffic movement phases. This phase sequence provides full protection for cyclists and pedestrians through time separation from turning movements. Vehicles are not required to give way to cyclists in this phase sequence.

No bus priority measures are included within the signal operation.

A more detailed explanation of the proposed phases is provided below.

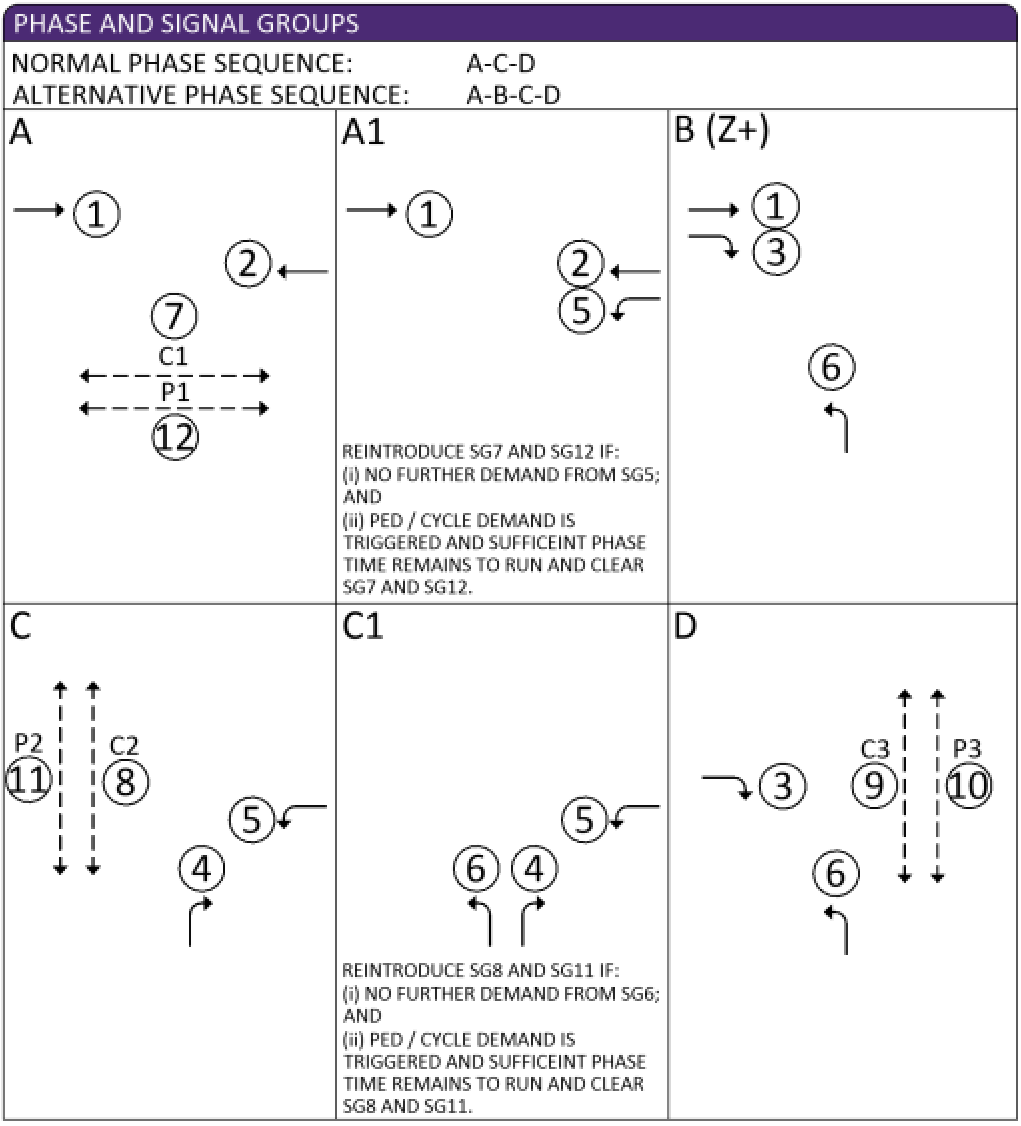

Figure 1: Proposed Phase Sequence

<u>A Phase</u>

- Signal group (SG) 1, SG2, pedestrian movements (P) 1 and cycle movement (C1) 1 run in this phase.
- Left turn movements from main road are not permitted.
- Filtering (right turn movements) are not permitted.

<u>A1 Phase</u>

- There are two scenarios in which this phase can run:
    - This phase runs if P1 and C1 do not run (no demand from push button). Then SG5 allows vehicles to turn left throughout the phase. Reintroduction of P1 and C1 can be considered if:
        - There is no further demand from SG5; and
        - P1 and C1 is triggered (demand from push button) and sufficient phase time remains for their crossing and clearance periods to run.

    OR;

- If P1 and C1 do run, then SG5 can run after the pedestrian / cycle crossing is finished. The left turn red arrow (LTRA) will stay up until P1 and C1 clearance times have finished and then it will turn green for left turn traffic.

- It may be appropriate for left-turn arrow lanterns to dwell-on-red until triggered by turning vehicles. This also ensures low vehicular speeds through the low radius turn.

B Phase

- SG1 and SG3 run in this phase. Left turn movement from side road (SG6) is also included.
- Phase introduction is controlled through introduction of Z+ flag.

C Phase

- SG4, SG5, P2 and C2 run in this phase.

C1 Phase

- There are two scenarios in which this phase can run:
  - This phase runs if P2 and C2 do not run (no demand from push button). Then SG6 allows vehicles to turn left throughout the phase. Reintroduction of P2 and C2 can be considered if:
    - There is no further demand from SG6; and
    - P2 and C2 is triggered (demand from push button) and sufficient phase time remains for crossing and clearance periods to run.

    OR;
  - If P2 and C2 do run, then SG6 can run after the pedestrian / cycle crossing is finished. The LTRA will stay up until P2 and C2 clearance times have finished and then it will turn green for left turn traffic.
- It may be appropriate for left-turn arrow lanterns to dwell-on-red until triggered by turning vehicles. This also ensures low vehicular speeds through the low radius turn.

D Phase

- SG3, SG6, P3 and C3 run in this phase.

Yours sincerely,
Bloxam Burnett & Olliver

pp

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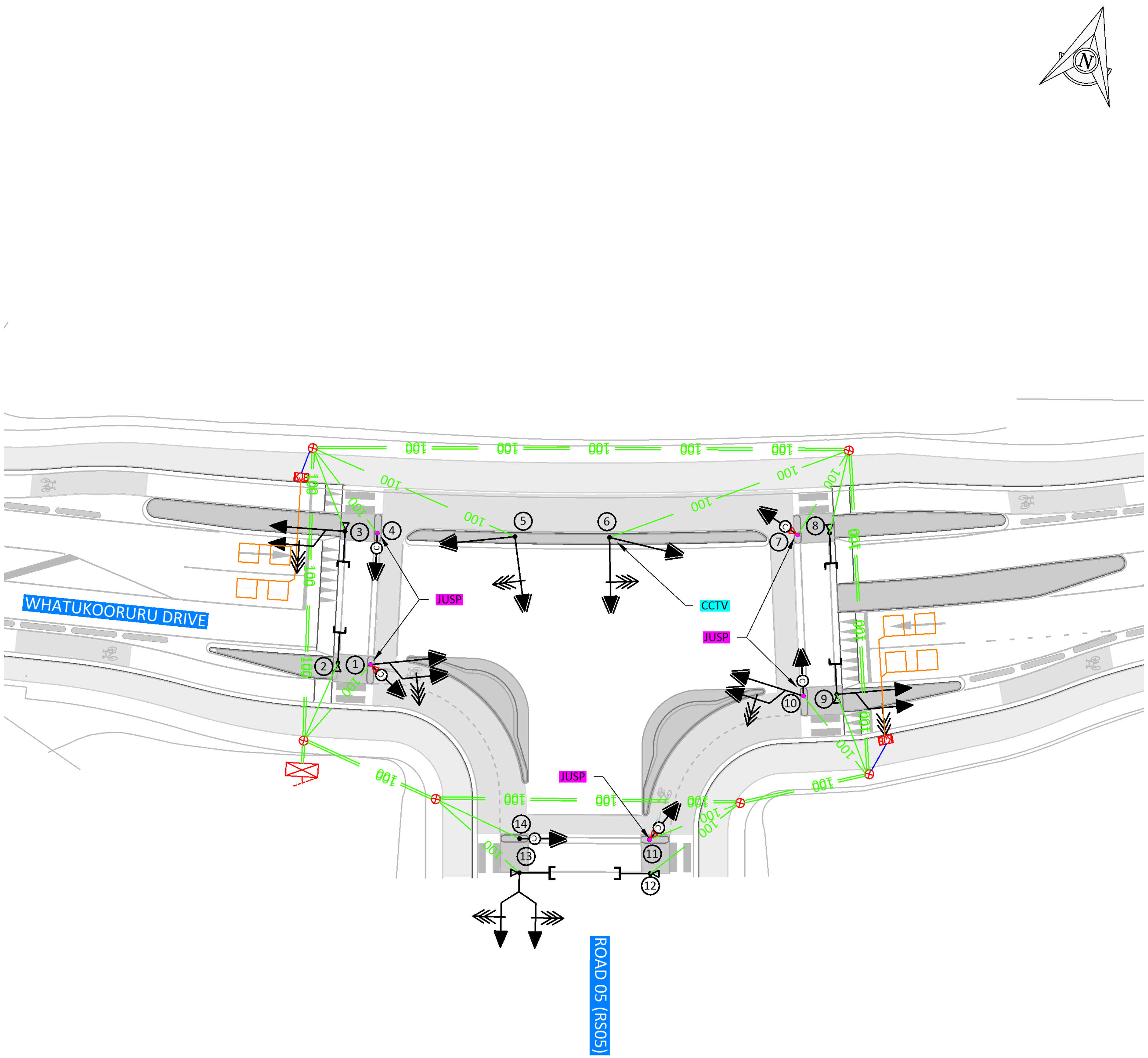
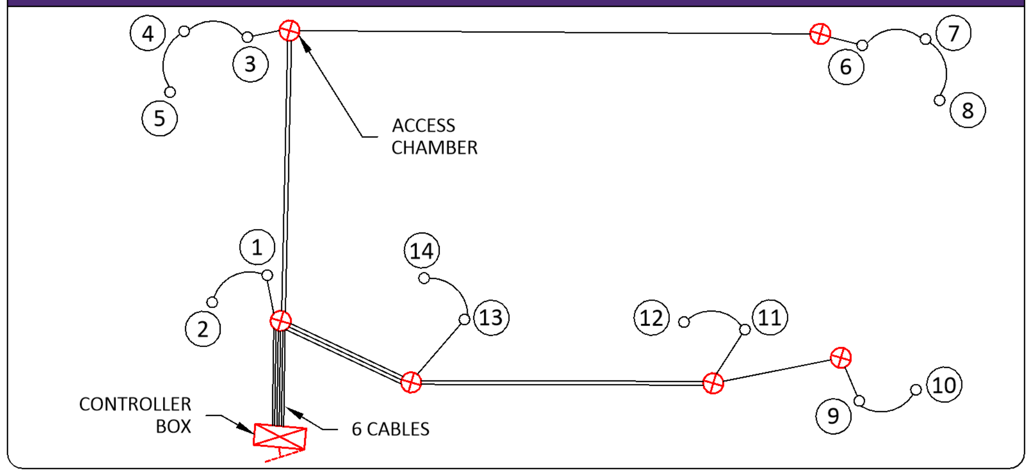
Attachment A



CABLING DIAGRAM



KEY

- STANDARD 5m SIGNAL POLE AND POLE NUMBER
- JUSP — JOINT USE STREETLIGHT POLE (JUSP)
- JUMA — JOINT USE MAST ARM (JUMA)
- ELV VC6 CONTROLLER BOX
- KJB — KERB SIDE JUNCTION BOX
- SIGNAL DUCT ACCESS CHAMBER
- DETECTOR LOOP CABLE CUT INTO PAVEMENT AND KERB
- SD — 1 X 50mmØ DUCTING
- 100 — 1 X 100mmØ DUCTING
- TOP OF KERB
- CYCLE 3 ASPECT WITH CYCLIST PUSH BUTTON
- CYCLE 3 ASPECT (NO PUSH BUTTON)
- PEDESTRIAN ASPECT WITH PEDESTRIAN PUSH BUTTON
- CCTV — CCTV CAMERA SIGNAL POLE
- 200mm ASPECTS - OPEN VISOR
- 200mm ASPECTS - CLOSED VISOR
- 300mm ASPECTS - OPEN VISOR
- 300mm ASPECTS - CLOSED VISOR
- 3 ASPECT DISPLAY
- TWO COLUMN 6 ASPECT DISPLAY (RIGHT TURN ARROWS)
- TWO COLUMN 6 ASPECT DISPLAY (LEFT TURN ARROWS)
- SINGLE COLUMN 3 ASPECT (TURN ARROWS)
- TWO COLUMN 6 ASPECT (RIGHT AND LEFT TURN ARROWS)

NOTES

1. SIGNAL INFRASTRUCTURE TO BE INSTALLED IN ACCORDANCE WITH NZTA P43 SPECIFICATION FOR TRAFFIC SIGNALS, HCC P43 REGIONAL SPECIAL CONDITIONS AND THE REGIONAL INFRASTRUCTURE TECHNICAL SPECIFICATIONS.
2. SIGNAL POLE POSITIONS TO BE CONFIRMED ON-SITE WITH HAMILTON CITY COUNCIL SIGNAL ENGINEER.
3. CONTROLLER TO BE LOCATED ADJACENT TO THE FOOTPATH, FINAL POSITION TO BE DETERMINED ON-SITE DURING CONSTRUCTION WITH HAMILTON CITY COUNCIL SIGNAL ENGINEER. ENSURE CABINET DOOR OPENS WITHOUT OBSTRUCTING PATH.
4. CONTROLLER ACCESS TO FACE AWAY FROM THE INTERSECTION. CONTROLLER MUST BE VC6 COMPLIANT AND EXTRA LOW VOLTAGE (ELV).
5. DUCT ROUTES MAY BE MODIFIED BY THE CONTRACTOR TO SUIT SITE REQUIREMENTS SUBJECT TO AVOIDING CLASHES WITH OTHER SERVICES. MODIFICATIONS TO BE APPROVED BY THE ENGINEER ON-SITE PRIOR TO INSTALLATION.
6. LED LANTERNS SHALL BE USED ON ALL ASPECT DISPLAYS, INCLUDING PEDESTRIAN AND CYCLE DISPLAYS.
7. CONTRACTOR SHALL PROVIDE POWER SUPPLY DESIGN, INSTALLATION AND CONNECTION. CONTRACTOR SHALL INCLUDE FIBRE CONNECTION TO CONTROLLER BOX.

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REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	18.03.2022	FOR INFORMATION	SB	CI	JS

DESIGNED: SB · CHECKED: CI · DRAWN: SB · APPROVED: JS · mx model version:

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE / RS05 SIGNALISED INTERSECTION ASPECT AND CABLING DIAGRAM SHEET 1

STATUS: PRELIMINARY

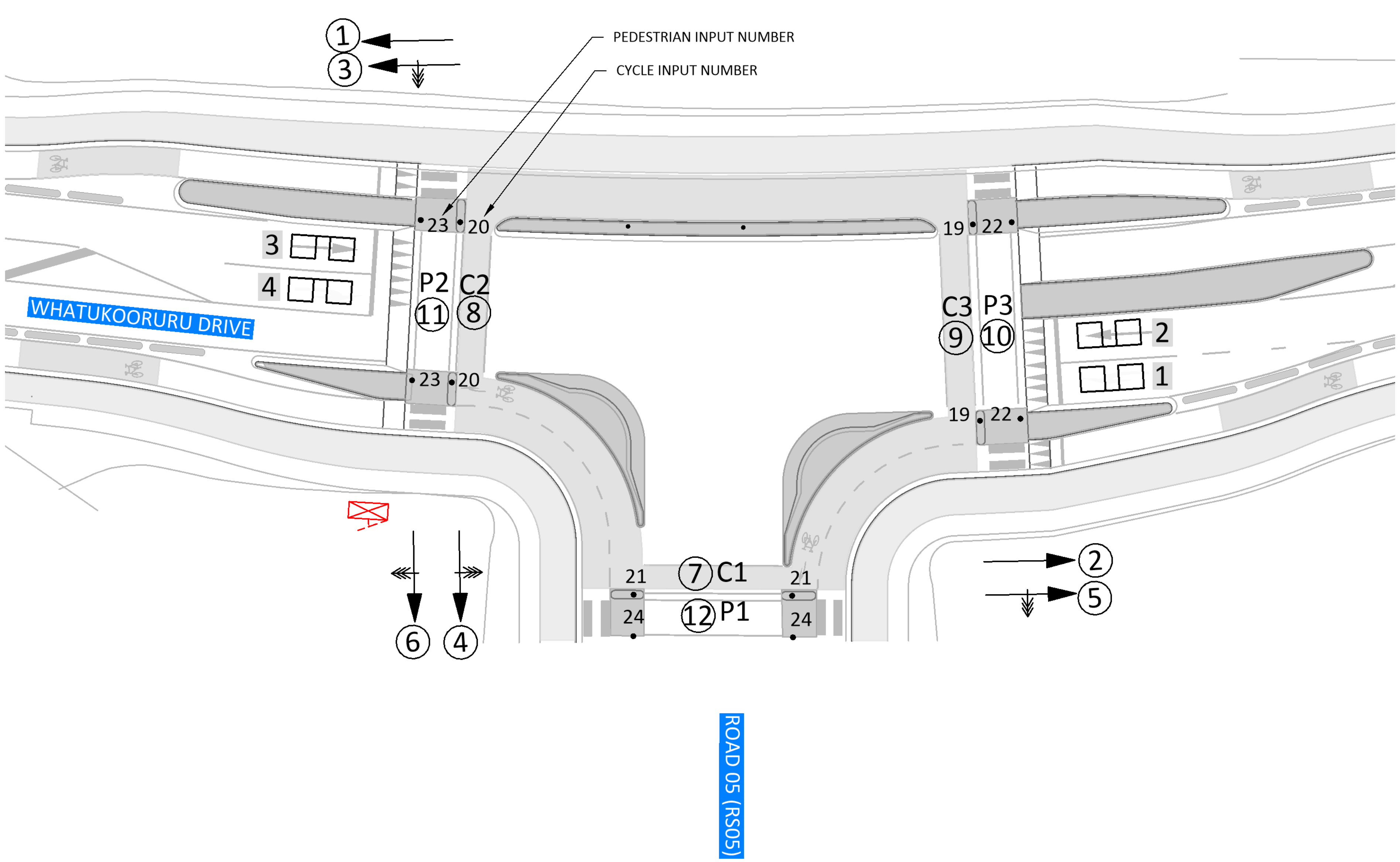
DATE: 18.03.2022 · SCALE (ORIGINAL SIZE A3): 1:400

DRAWING NUMBER: 146000-002A-2741 · REVISION: -

Version 4.0 - March 2020

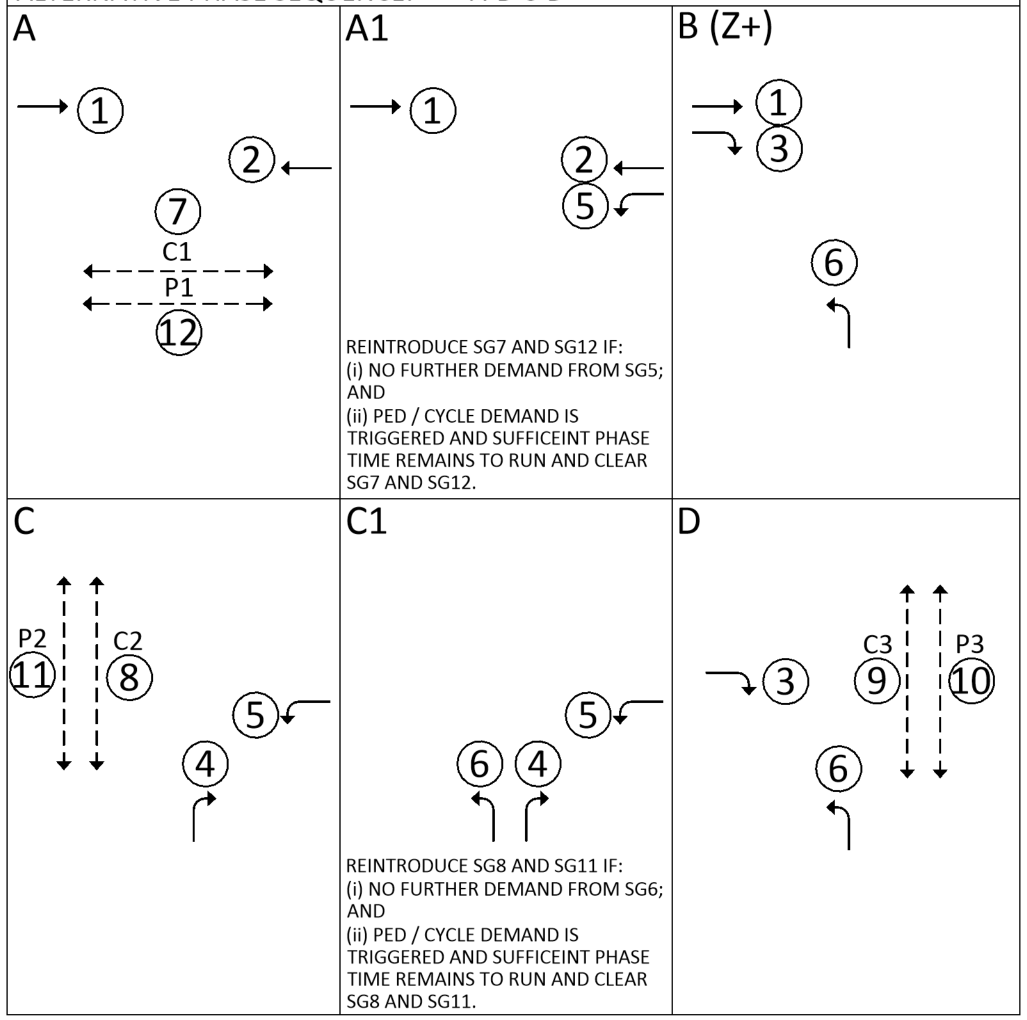
SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY · 100mm · 0

C:\12d\data\10.7.120.14\Peacocke - Design_4923\03 Drawing\146000-002A\146000-002A-2741.dwg 31/3/2022 2:33 pm siva Plotted: 31 Mar 2022 2:33 pm



PHASE AND SIGNAL GROUPS

NORMAL PHASE SEQUENCE: A-C-D
ALTERNATIVE PHASE SEQUENCE: A-B-C-D



KEY

- SCATS DETECTOR LOOP
- ELV VC6 CONTROLLER BOX
- STANDARD 5m SIGNAL POLE
- TOP OF KERB

NOTES

1. DEPTH AND LOCATION OF INDUCTIVE LOOPS TO BE IN ACCORDANCE WITH NZTA P43 SPECIFICATION FOR TRAFFIC SIGNALS AND HAMILTON CITY COUNCIL REGIONAL SPECIAL CONDITIONS.

REV	DATE	ISSUE/REVISION DETAIL	BY	CHK	APPR
A	18.03.2022	FOR INFORMATION	SB	CI	JS

DESIGNED: SB | CHECKED: CI | DRAWN: SB | APPROVED: JS
mx model version:

BLOXAM BURNETT & OLLIVER

CLIENT: Hamilton City Council — Te kaunihera o Kirikiriroa

PROJECT: PEACOCKE WHATUKOORURU DRIVE

DRAWING: WHATUKOORURU DRIVE / RS05 SIGNAL PHASING AND DETECTOR NUMBERING SHEET 2

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STATUS: PRELIMINARY
DATE: 18.03.2022
SCALE (ORIGINAL SIZE A3): 1:400
DRAWING NUMBER: 146000-002A-2742
REVISION: -