IN THE MATTER of the Resource Management Act 1991 ("RMA" or "the Act")

AND

IN THE MATTER of a submission in respect of the **PROPOSED WAIKATO DISTRICT PLAN** by **KIRRIEMUIR TRUSTEE LIMITED** pursuant to Clause 6 of Schedule 1 of the Act

STATEMENT OF EVIDENCE OF SIVA BALACHANDRAN

1. INTRODUCTION

Qualifications and experience

1.1 My name is Siva Balachandran. I am a traffic and transportation engineer at Bloxam Burnett & Olliver (BBO), a firm of consulting engineers, planners and surveyors based in Hamilton. I have been employed by BBO since 2017.

1.2 I hold a Bachelor of Engineering (Honours) degree in Civil Engineering from Nanyang Technological University, Singapore (2014). I am a Member of Engineering New Zealand (MEngNZ) and a member of the Engineering Transportation Group.

1.3 I have six years of experience in the field of transportation and traffic engineering gained through three years of employment in New Zealand with BBO and three years of employment in Singapore with Mott Macdonald Singapore Pte Ltd.

1.4 I have experience in transportation and traffic engineering matters associated with resource management, including effects assessment for resource consents, plan changes and structure plans. I also have experience in the design of traffic infrastructure and facilities, traffic calming, subdivision design, and traffic modelling.

Involvement in project

1.5 I was engaged by Kirriemuir Trustee Limited ("KTL") in 2020 to provide traffic engineering related input and advice in relation to its submission on

the Proposed Waikato District Plan (PWDP) for the rezoning of approximately 38 hectares (ha) of land located to the west of Geraghtys Road, Tuakau ("the Site") from the current rural zoning to residential zoning.

1.6 I have visited the Site on two occasions in relation to the transportation aspects of the proposal. My first visit was conducted on 29 October 2020 and the most recent visit was on 19 November 2020.

1.7 In preparing this statement I have reviewed:

(a) The Integrated Transportation Assessment for Tuakau Structure Plan prepared by Aecom New Zealand Limited dated 18 June 2014.

Purpose and scope of evidence

1.8 The purpose of my evidence is to provide an overview of the transport characteristics of the rezoning proposal, the potential effects of the proposal on the transport environment, the mitigation measures that I recommend to address the potential adverse effects and other measures proposed to ensure a safe and efficient transportation network for pedestrians, cyclists, motorist and public transport.

1.9 Specifically, my evidence will:

(a) Provide an overview of the Site (Section 3);

(b) Provide a summary of the existing traffic environment (Section 4);

(c) Provide summary of the transport assessment that was undertaken for the current Tuakau Structure Plan (Section 5);

(d) Provide a brief summary of the proposal (Section 6);

(e) Provide an overview of the predicted traffic generation as a result of the proposed rezoning (Section 7);

(f) Provide a summary of the traffic and transportation effects of the proposed rezoning and the recommended upgrades to the existing transport network to mitigate the potential effects (Section 8);

(g) Provide an overview of the compliance with national and regional transport strategies and policies (Section 9);

(h) Provide a brief conclusion (Section 10).

1.10 A summary of my evidence is contained in Section 2.

1.11 My evidence should be read together with the evidence of Jonathan Broekhuysen, who provides an overview of the proposed Geraghtys Road Structure Plan, including the design philosophy behind the internal transport connections and layout adopted for the Site, and John Olliver who describes the proposal in more detail and addresses the planning issues.

Expert Witness Code of Conduct

1.12 I have read the Code of Conduct for Expert Witnesses, contained in the Environment Court Consolidated Practice Note (2014) and I agree to comply with it. I can confirm that the issues addressed in this statement are within my area of expertise and that in preparing my evidence I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

2. SUMMARY OF EVIDENCE

Background to the rezoning proposal

2.1 KTL seeks to change the zoning of approximately 38 ha of land located in Tuakau from the current rural zoning to residential zoning. This is predicted to accommodate up to 425 dwellings when completed.

2.2 Figure 1 shows the locality and extent of the Site. The Site is bordered by Geraghtys Road to the east and is located approximately 1.2 km southwest of Tuakau Town Centre. The Site is currently zoned Rural.

Figure 1: Site Locality

2.3 Geraghtys Road is situated along the eastern boundary of the Site and is classified as a Local Transport Corridor in the PWDP. It has an estimated Annual Average Daily Traffic (AADT) of 125 vehicles per day (vpd) with 4% Heavy Commercial Vehicles (HCV). Geraghtys Road currently provides access to a number of residential properties on either side of the road and has a posted speed limit of 50 km/h. Geraghtys Road connects to Buckland Road approximately 350 m to the north of the site.

2.4 Buckland Road operates as the primary roading connection between Tuakau and Pukekohe. The road is identified as an Arterial Transport Corridor in the PWDP and has an estimated AADT of 7,917 vpd with 8% HCV. The existing posted speed limit on this corridor is 50 km/h.

2.5 St Johns Avenue, which intersects with Geraghtys Road about 165 m north of the site, is classified as a Local Transport Corridor in the PWDP and provides east-west connectivity between Thorn Road and Geraghtys Road. It has an estimated AADT of 370 vpd with 4% HCV.

2.6 Four public bus services currently operate within and through the Tuakau area. The 21 Northern Connector provides bus travel between Pukekohe, Tuakau and Hamilton. The bus service 44 provides travel between Pokeno and Pukekohe via Tuakau and bus travel between Tuakau, Pukekohe and Papakura in Auckland is provided by Auckland Transport limited services 398 and 399. The closest bus stop is approximately 800 m walking distance from the nearest boundary of the site.

2.7 There are presently no existing pedestrian facilities adjacent to the Site on Geraghtys Road, although a footpath exists on the eastern side of Geraghtys Road, north of its intersection with St Johns Avenue. This footpath connects to and continues along the northern side of St Johns Avenue. Meanwhile, a narrow footpath exists on either side of Buckland Road.

2.8 There are no formal on or off street facilities for cyclists on Geraghtys Road, St Johns Avenue or Buckland Road and from my observations, cycling is not common in the area at present.

Proposed rezoning trip generation predictions

2.9 The site once fully developed with housing is likely to generate approximately 470 vehicle movements in the peak hours, and a daily volume of about 3,600 vehicle movements.

Assessment of transportation effects due to proposed rezoning

2.10 Access to the proposed Site is via two new priority-controlled intersections fronting directly onto Geraghtys Road.

2.11 The location of the proposed access intersections outlined within the proposed Geraghtys Road Structure Plan will comply with PWDP's minimum requirements for separation distances to other intersections and accessways.

2.12 They will also satisfy the recommended minimum sight distance criteria in the PWDP.

Recommended transportation infrastructure improvements to support the rezoning

2.13 Due to the limited transport infrastructure that presently exists, the overall transportation effects of the proposed rezoning on the adjoining road network are likely to be minor to moderate if no transport mitigation measures are implemented.

2.14 Therefore, I recommend that suitable planning rules are included in the PWDP to assess the cumulative effects of traffic generated from the various areas that are rezoned, and provision is made for the following intersection upgrades to be funded and built, potentially through a combination of District Plan provisions and development contributions:

(a) Buckland Road / Geraghtys Road intersection be upgraded to an urban compact roundabout.

(b) Geraghtys Road / St Johns Avenue be upgraded to an urban compact roundabout when the proposed fourth leg to the intersection is to be constructed.

(c) George Street / Buckland Road intersection be upgraded to an urban compact roundabout.

2.15 Moreover, Access 1 (refer to Figure 2) will be a cul-de-sac until the neighbouring land to the north is developed at which time, a connection should be made through to the cul-de-sac road in accordance with the Tuakau Structure Plan. Therefore, I recommend an area of land suitable for continuing the road into the neighbouring site should be excluded from development.

2.16 During the interim stage (i.e. before Geraghtys Road traffic volume exceeds 160 vph), both Access 2 and Access 3 intersections (refer to Figure 2) to the site would be priority controlled 'Tee' intersections. However, a right turn bay is warranted for the Site (for at least one access) when the total through traffic volume (both directions) on Geraghtys Road exceeds 160 vph.

2.17 With the recommended infrastructure upgrades, I consider that the transportation effects of the rezoning will be sufficiently mitigated to an acceptable level, which is generally no more than minor.

3. DESCRIPTION OF THE PROPOSAL

Overview

3.1 KTL seeks, through submissions to the PWDP, to rezone approximately 38 ha of land located in Tuakau from the current rural zoning to residential zoning. Development of the Site will be guided by a proposed Geraghtys Road Structure Plan (attached to the evidence of Jonathan Broekhuysen) that sets out the framework for the development.

3.2 My evidence focusses on the KTL submission, but my assessment is also undertaken in the context of the land immediately to the north of the site, and on both sides of Buckland Road, being rezoned residential in the PWDP as notified.

3.3 Several potential site layout options had been considered in the development of the Geraghtys Road Structure Plan which included various internal and external roading iterations. The current preferred arrangement for the internal road network and transportation connections to the external road network is shown in Figure 2. This proposed Geraghtys Road Structure Plan layout has formed the basis of my assessment of effects (outlined within Section 8).

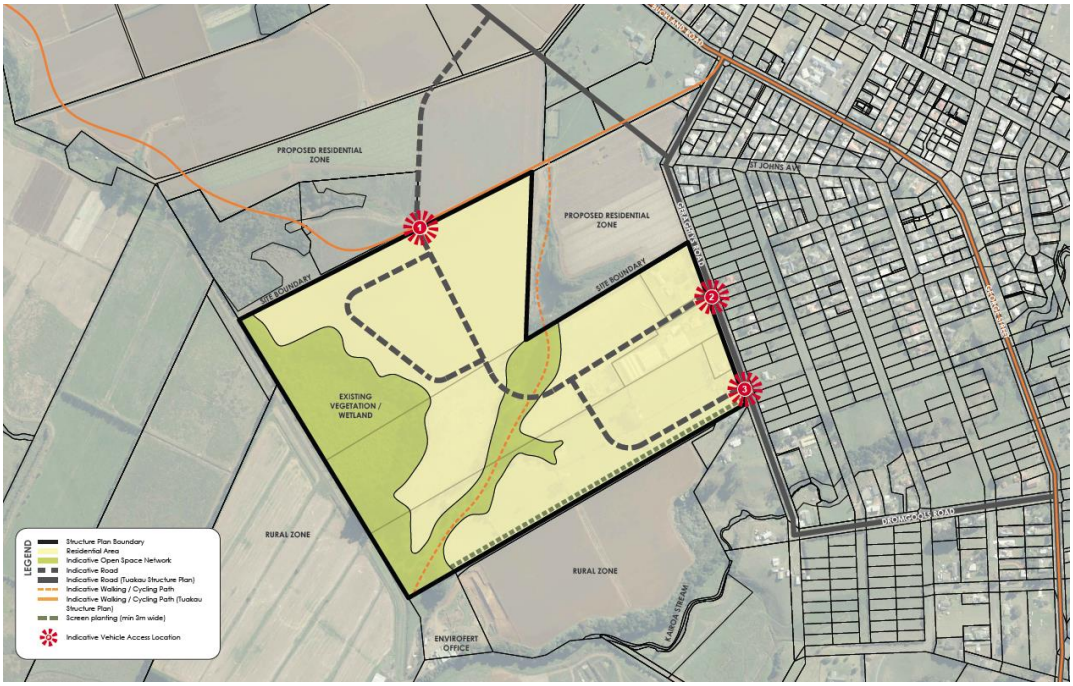

Figure 2: Proposed Geraghtys Road Structure Plan

3.4 Key elements of the proposed Structure Plan layout considered pertinent to the transport assessment include:

(a) The Site has a potential yield of up to 425 residential allotments, as well as the retention of the existing open spaces.

(b) The provision of a coherent and connected internal roading network, including the provision of a new spine road connecting Access 1 to Access 2. Access 1 will be a cul-de-sac until the neighbouring land to the north is developed at which time a connection should be made through to the cul-de-sac road in accordance with the Tuakau Structure Plan. Therefore, an area of land suitable for continuing the road into the neighbouring site should be excluded from development.

(c) Access to the proposed Site being facilitated through the conversion of two existing property accesses (Access 2 and Access 3) into two new priority-controlled (i.e. Stop or Give Way controlled) intersections fronting directly onto Geraghtys Road to the east of the proposed Site.

(d) The provision of a new walking and cycling path along the existing open space (gully network), providing connections to proposed future walking and cycling routes which are part of the Tuakau Structure Plan.

Site Description and Location

3.5 The Site currently contains six large residential and lifestyle lots ranging from 2,800 m^2 to 10.5 ha in size, with much of the site operating as farmland.

3.6 Access to the existing properties within the Site is via private vehicle accesses on Geraghtys Road. No public road exists through the Site.

3.7 As shown in Figure 3, the Site is shown as zoned Rural in the Tuakau Structure Plan. The land adjacent to the Site to the east and land on the opposite site of Geraghtys Road are zoned residential in the PWDP. The land south of the site is zoned rural.

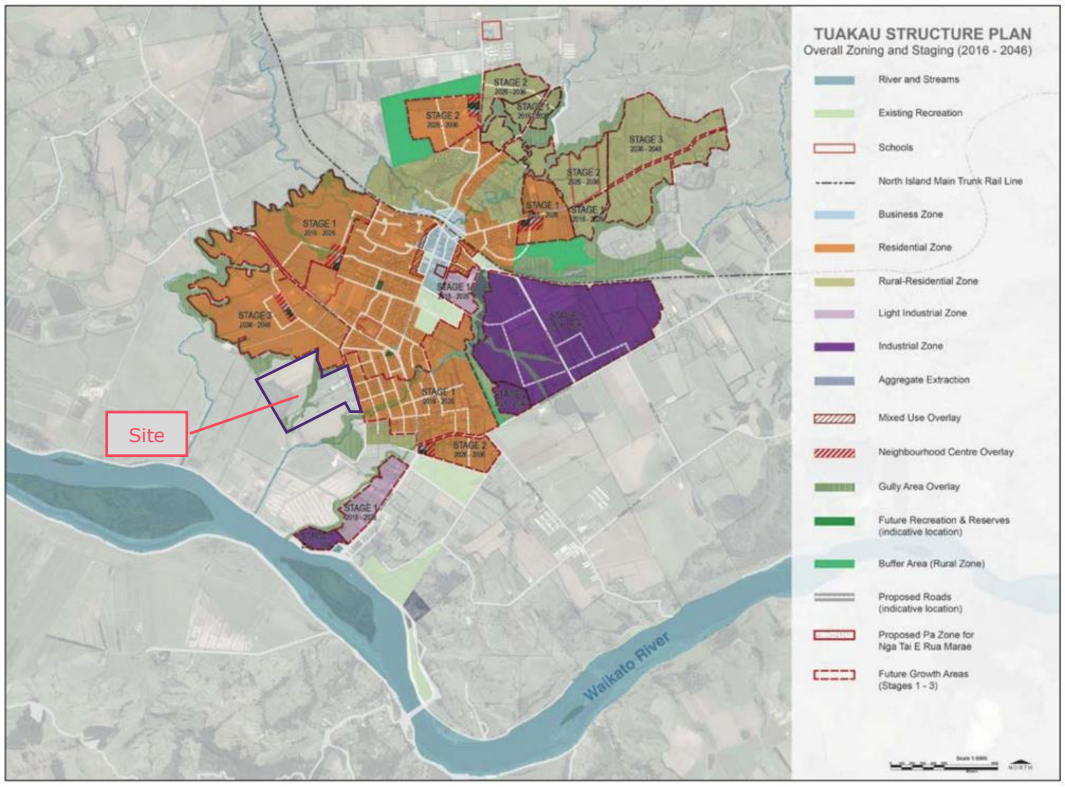

Figure 3: Tuakau Structure Plan

4. EXISTING TRAFFIC ENVIRONMENT

Existing transport infrastructure

4.1 The existing network of roads surrounding the Site includes Geraghtys Road, St Johns Avenue and Buckland Road. Access to the Site is proposed directly from Geraghtys Road.

4.2 Geraghtys Road is situated along the eastern boundary of the Site. It is classified as a Local Transport Corridor in the PWDP road hierarchy and provides north-south connectivity between Dromgools Road and Buckland

Road. Geraghtys Road is an unmarked road with a 6.5 m sealed carriageway. According to the 'Mobile Road' website, it has an estimated AADT of 125 vpd with 4% HCV. Geraghtys Road has a general northward incline of approximately 2% towards St Johns Avenue, however, a sharp southward decline is present towards Dromgools Road. Geraghtys Road currently provides access to a number of residential properties on either side of the road and has a posted speed limit of 50 km/h.

4.3 Geraghtys Road connects to Buckland Road about 350 m to the north of the site. Buckland Road operates as the primary connection between Tuakau and Pukekohe. The road is formed of one general traffic lane in each direction, with sealed shoulders on either side to accommodate on-street parking. Total sealed width is approximately 11.6 m. There is no median separation between traffic lanes on this section of Buckland Road. The road is identified as an Arterial Transport Corridor in the PWDP road hierarchy and has an estimated AADT of 7,917 vpd with 8% HCV according to the 'Mobile Road' website. The existing posted speed limit on this corridor is 50 km/h.

4.4 St Johns Avenue is classified as a Local Transport Corridor in the PWDP road hierarchy and provides east-west connectivity between Thorn Road and Geraghtys Road. St Johns Avenue is an unmarked road with a 7.5 m sealed carriageway. According to the 'Mobile Road' website, it has an estimated AADT of 370 vpd with 4% HCV.

Existing transport modes

4.5 Four public bus services currently operate within the Tuakau area. The bus services are the Northern Connector which operates between Hamilton and Pukekohe, service 44 which provides travel between Pokeno and Pukekohe via Tuakau and the Auckland Transport (AT) services 398 and 399 which operate between Pukekohe and Tuakau. The Northern Connector, service 44 and AT service 398 currently only operate on weekdays whereas the AT service 399 operates only on Thursdays.

4.6 The nearest bus stops to the Site are located at 151 and 152 George Street which are approximately 800 m walking distance from the closest boundary of the Site. This bus stop is currently served by only the Northern Connector.

4.7 Given the current rural zoning in the area, there are no existing pedestrian facilities adjacent to the Site on Geraghtys Road which reflects the current low density of development on the transport corridor. However, a 1.2 m wide footpath is provided on the eastern side of Geraghtys Road, north of its

intersection with St Johns Avenue. This footpath connects and continues to the northern side of St Johns Avenue.

4.8 A 1.2 m wide footpath also exists on either side of Buckland Road. The existing volume of pedestrians is high along Buckland Road which is due to Tuakau Primary School and Tuakau College that are located approximately 115 m southeast and 375 m northwest of the Buckland Road / Geraghtys Road intersection. A pedestrian crossing facility is provided approximately 185 m southeast of the Buckland Road / Geraghtys Road intersection. I note that 1.2 m is a particularly narrow footpath width relative to current day standards, of 1.8 m (desirable) and an absolute minimum of 1.5 m.

4.9 From my observations, cycling is not a common form of transport in the area at present. This is further supported by 2018 census data in which only 0.6% of the population cycled to work. There are no formal facilities for cyclists on Geraghtys Road, St Johns Avenue or Buckland Road. However, cyclists are accommodated on the wide shoulders of Buckland Road in both east and west directions.

4.10 In my opinion, the addition of this area to the community in Tuakau, together with other rezoning nearby, will create the need for high quality, safe connections serving the predominant walking and cycling desire lines, so that active mode travel is an attractive and viable option for future residents and school children.

Road safety environment

4.11 Crash data was sourced from the Waka Kotahi NZ Transport Agency's Crash Analysis System (CAS) over a five-year period from 2015 – 2019 and has included available data for 2020. Figure 4 provides heat-maps indicating the location and severity of crashes recorded on the network of roads within the vicinity of the Site over the previous five-year period. The most pertinent road safety issues are summarised below.

Figure 4: Crash Locations Within the Vicinity of the Site

4.12 As shown in Figure 4, a total of six crashes were recorded along Buckland Road (between Tuakau College and Buckland Road / George Street intersection) in the last five years, one of which was a serious crash, and the rest were non-injury crashes. Of the six crashes:

(a) The serious injury crash involved a vehicle traveling eastbound on Buckland Road and colliding with a pedestrian (school student) who ran out from two parked vehicles to cross the road.

(b) One crash was due to a vehicle failing to give way to through traffic on Buckland Road when exiting Geraghtys Road towards Church Street.

(c) The remaining four crashes were due to drivers' negligence.

4.13 Just one crash was recorded along the section of Geraghtys Road between Dromgools Road and Buckland Road over the last five years which involved a police pursuit.

4.14 Findings from my road safety assessment indicate that:

(a) The Buckland Road / Geraghtys Road intersection should be upgraded for safety as a result of the anticipated residential development associated with the Tuakau Structure Plan and PWDP rezoning. The upgrade should be in accordance with modern Safe System design principles, recognizing that priority-controlled crossroads intersections pose the greatest safety risk to users (as demonstrated in paragraphs 4.12(b)). There is a need to include improved pedestrian facilities including safe road crossing points over Buckland Road with actively reduced vehicle speeds (possibly through raised safety platforms) to enable survivable impact forces for pedestrians.

(b) There are no apparent road safety concerns along the section of Geraghtys Road fronting the Site.

5. AECOM INTEGRATED TRANSPORT ASSESSMENT

5.1 An Integrated Transport Assessment (ITA) was prepared by AECOM in June 2014 for the Tuakau Structure Plan. This section summarises the key elements of that report, with particular focus on the residential growth to the west which might have direct implications on this rezoning proposal. The western residential area includes the area south of Buckland Road as far as Dromgools Road. A notable point is that the Site was included as part of the proposed residential zones in the ITA, but ultimately it was not rezoned in the PWDP for reasons unrelated to transport. The Tuakau Structure Plan ITA identified:

(a) Pukekohe as a major generator of trips to and from Tuakau, providing employment, retail and servicing activities.

(b) The crash history at Buckland Road / George Street at that time suggested there may be cause for making the intersection safer. The report recommended that this intersection may require a change from a priority-controlled intersection to a roundabout or signalised intersection.

(c) Figure 5 illustrates the proposed roads that would enhance connectivity within the west side of Tuakau. St Johns Avenue is proposed to be extended from its intersection with Geraghtys Road with a link connecting to Buckland Road in the vicinity of Tuakau

College. This would extend residential development along Buckland Road up to the college, bringing the college into the urban area.

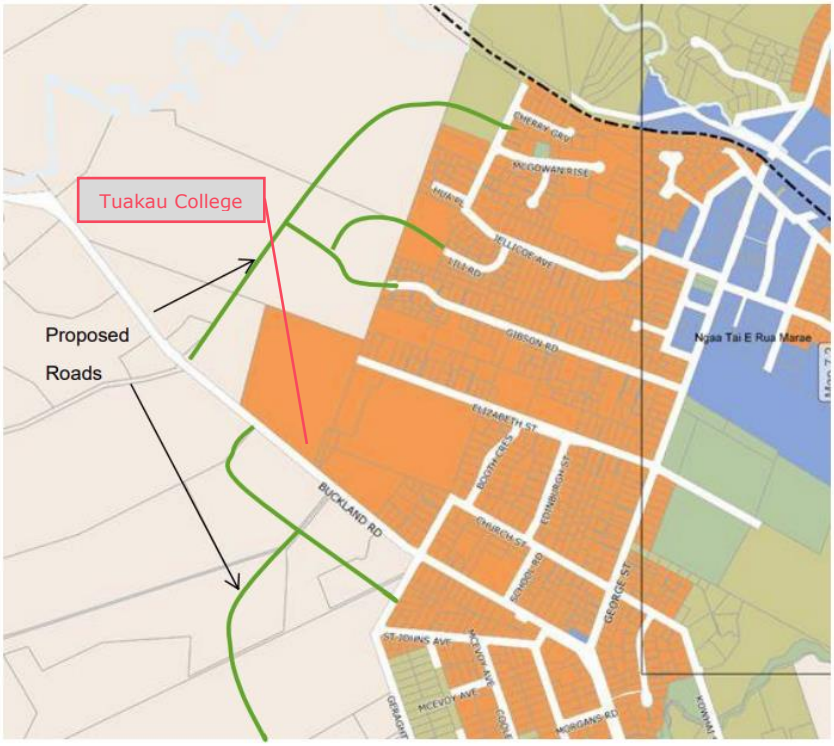

Figure 5: Proposed Roads in AECOM ITA

(d) The ITA recommended Buckland Road be upgraded with wider shoulders and pedestrian and cyclist facilities be extended as development progress along the western side of town. This upgrading should be undertaken in consultation with Auckland Council to ensure consistent standards are achieved along the route between Tuakau and Pukekohe.

(e) The ITA also recommended that development on the south side of Buckland Road should be staged and infilling between Geraghtys Road and George Street should be substantially completed before developing further residential land west of Geraghtys Road.

6. THE PROPOSAL

Proposed access strategy

6.1 The preferred Geraghtys Road Structure Plan arrangement outlines the provision of two new priority-controlled intersections, connecting the internal local road network within the Site to Geraghtys Road to the east. Geraghtys Road would form the major approach arm at both intersections.

6.2 The proposed Geraghtys Road Structure Plan indicates that these accesses would be located as follows:

(a) Access 1: This access will be designed as a cul-de-sac until the neighbouring land to the north is developed, at which time a connection should be introduced through to the cul-de-sac road to complete the network in accordance with the Tuakau Structure Plan. Therefore, the 20 m wide strip should connect to the boundary and be protected as road reserve.

(b) Access 2: This access would form the northern access road and would be located approximately 270 m south of the Geraghtys Road / St Johns Avenue intersection, roughly aligning with the existing residential driveway servicing 46 Geraghtys Road.

(c) Access 3: Forms the southernmost connection for the site, on the south side of the existing residential driveway to 54 Geraghtys Road approximately 180 m south of Access 2.

6.3 The initial provision of two access points, and long-term three access points, aims to support efficient, safe and effective distribution of trips onto the adjoining road network.

7. PREDICTED TRAFFIC GENERATION

7.1 Trip generation associated with the residential activities within the Site have been determined on a per dwelling basis. The exact lot yield for the development will not be known until subdivision consent stage, however, the proposed Geraghtys Road Structure Plan estimates the site may provide an upper yield of 425 dwellings.

7.2 For the basis of this assessment, the following trip generation rates have been used:

(a) Peak period trip generation rate of 1.1 vehicle trips (on average) per dwelling; and

(b) All-day average trip generation rate of 8.5 vehicle trips per dwelling.

7.3 The adopted trip generation rates have been determined from the industry recognised NZ Transport Agency research report 453: Trips and parking related to land use Appendix C (November 2011). The rates are generally aligned with the trip generation rate calculated on McEvoy Avenue, east of

the Site, which accommodates approximately 250 vpd and provides access to about 32 dwellings (i.e. 250 / 32 = 7.8 trips per dwelling).

7.4 Based on the trip generation assumptions outlined above, and as a worst case assuming that all trips are by private vehicles, approximately 470 vehicle movements per peak hour could be generated by the site during the peak hours. The total daily traffic generation is likely to be around 3,610 vehicle movements (refer to Table 1).

7.5 The ITE Trip Generation Manual (Seventh Edition) has been used to determine the proportion of inbound / outbound trips generated by the Site with respect to peak periods and all-day traffic volumes.

Table No. 1

Trip Generation Assessment		
Factor	**Rates**	**Trip Generation**
Dwellings	425	-
AM Peak Hour	Total (1.1 per dwelling)	470 Trips
	Trips In (25%)	118 Trips
	Trips Out (75%)	352 Trips
PM Peak Hour	Total (1.1 per dwelling)	470 Trips
	Trips In (63%)	296 Trips
	Trips Out (37%)	174 Trips
All Day	Total (8.5 per dwelling)	3,610 Trips
	Trips In (50%)	1,805 Trips
	Trips Out (50%)	1,805 Trips

Trip distribution

7.6 This section explains the likely distribution of generated trips on to the network via each access point, using the direction splits outlined within Table 1, in order to assess any potential foreseeable effects on the wider network.

7.7 Trip distribution has been based on the Waikato Regional Transportation Model (WRTM), 2017 version, future volume predictions (Year 2021) at the following intersections:

(a) Buckland Road / Geraghtys Road intersection;

(b) Buckland Road / George Street intersection;

(c) Gibson Road / George Street intersection; and

(d) St Johns Avenue / McEvoy Avenue.

7.8 The turning movement percentages at these intersections provide a reasonable proxy to anticipate the percentage of trips that would be heading either northwards towards Pukekohe / Auckland or eastwards / southwards towards the greater Waikato region during the peak periods.

7.9 The WRTM turning movement volumes at these intersections indicate the following trip distribution patterns:

Table No. 2

Trip Distribution – Peak Periods				
To / From	Pukehoke / Auckland	Waikato	Tuakau Town Centre	Residential Area near the Site
Pukehoke / Auckland	-	70%	20%	10%
Waikato	70%	-	20%	10%
Tuakau Town Centre	40%	50%	-	10%
Residential Area near the Site	40%	40%	20%	-

7.10 Assuming commuter traffic generated by the proposed Site would follow similar trip patterns, the estimated peak hour and daily traffic volumes generated by the Site on the adjoining road network is shown in Table 3.

Table No. 3

Estimated Additional Traffic Distribution			
Road	% Trips	Peak Hour (vph)	Daily (vpd)
Geraghtys Road	100	470	3,610
St Johns Avenue	60	282	2,166
Buckland Road (west of Geraghtys Rd intersection)	40	188	1,444

7.11 Based on the traffic distribution assumptions noted above, the forecast increase in traffic volumes on the main roads within the vicinity of the Site are shown in Table 4. Existing two-way peak hour traffic volumes on all roads have been estimated based on a conservative assumption that peak period traffic equates to 11% of the AADT.

Table No. 4

Estimated Changes in Traffic Volumes				
Road	**Period**	**Estimated Existing Trips**	**With Proposed Rezoning**	**Change**
Geraghtys Road	Peak	14	484	+3,357%
	Daily	125	3,735	+2,888%
St Johns Avenue	Peak	41	323	+688%
	Daily	370	2,536	+585%
Buckland Road (west of Geraghtys Rd intersection)	Peak	871	1,059	+22%
	Daily	7,917	9,361	+18%

7.12 The assessment indicates that trips generated by the proposed Site will result in a significant increase in traffic volumes on Geraghtys Road and St Johns Avenue, based on their current low volumes. These increases only form a small proportion of the increases associated with other rezoning in the PWDP. Given the current historic road environment, some intersections will have to be upgraded to safely accommodate the additional volume of traffic generated by the Site and other rezoning. The specific intersections and likely upgrades are discussed further in Section 8.

7.13 The increase in traffic volumes on Buckland Road is not particularly significant compared to Geraghtys Road and St Johns Avenue, and I consider that the existing road configuration and infrastructure has sufficient capacity to accommodate traffic generated by the proposed Site.

7.14 However, other residential zones as part of the PWDP that have yet to be developed, will have an impact on Buckland Road (i.e. also increase traffic volumes). Therefore, I agree with the recommendation stated in the AECOM ITA that Buckland Road should be upgraded with wider shoulders and pedestrian and cyclist facilities be extended as development proceeds on the western side of Tuakau. I have assumed this 'widened' state exists as the baseline environment for rezoning assessment purposes in the next section.

8. ASSESSMENT OF TRANSPORTATION EFFECTS

8.1 This section of my evidence provides a high-level assessment of the transportation impacts of the additional traffic generated on the surrounding road network if the site is rezoned. I also provide a brief opinion on the suitability of proposed access locations and internal roading provisions outlined within the proposed Geraghtys Road Structure Plan.

Separation distances

8.2 The PWDP Rule 14.12.1.1(1)(b) requires a minimum separation distance of 30 m between an intersection and a vehicle crossing on a 50 km/h transport corridor. This requirement is fulfilled by the separation distance between Access 3 and the access to Envirofert Limited to the south which is approximately 30 m.

8.3 However, the separation distance between Access 2 and the existing vehicle crossing north of the proposed access on the opposite side of Geraghtys Road is approximately 7.5 m. Access 3 is also proposed to be located directly opposite the existing vehicle crossing to 57 Geraghtys Road.

8.4 The PWDP states that Rule 14.12.1.1(1)(b) does not apply where the separation distance requirements of Table 14.12.5.1 and Figure 14.12.5.2 cannot be achieved on a site's road frontage due to existing vehicle accesses on adjacent sites. Therefore, the shortfall in separation distances from the proposed accesses to existing vehicle crossings is not considered critical.

8.5 The PWDP Rule 14.12.1.1(1)(b) also specifies a minimum separation distance of 100 m between intersections. The separation distance between Access 2 and Access 3 is approximately 190 m.

8.6 The minimum separation distance requirement between intersections is also readily achieved by the separation distances of approximately 265 m from Access 2 to the Geraghtys Road / St Johns Avenue intersection and approximately 285 m from Access 3 to the Geraghtys Road / Dromgools Road intersection.

8.7 Therefore, the Site accesses are expected to comply with PWDP's minimum requirements with respect to separation distances.

Sight distances

8.8 The PWDP Rule 14.12.1.1(1)(b) specifies a minimum sight distance of 90 m from vehicle crossings on a 50 km/h transport corridor. This is easily achievable for both access points as demonstrated below in Table 5.

Table No. 5

Sight Distance Assessment			
Location	**Direction**	**Sight Distance** (measured on-site)	**Minimum Requirement**
Access 2	To the north	240 m	90 m
	To the south	215 m	
Opposite of Access 2	To the north	225 m	
	To the south	215 m	
Access 3	To the north	>400 m	
	To the south	115 m	
Opposite of Access 3	To the north	>400 m	
	To the south	118 m	

Access intersection design

8.9 Concept intersection designs for the proposed accesses have not been developed as part of the proposed Structure Plan, and would be confirmed at a subdivision resource consent stage.

8.10 I have assessed both proposed intersections against Austroads Guide to Road Design Part 4: *Intersections and Crossings – General* Figure A 10(b) to determine if right turn bays are warranted for the Site. Assuming the design peak hour volume on Geraghtys Road is approximately 11% (i.e. in accordance with Austroads) of the AADT, the existing major road traffic volume is about 14 vehicles per hour (vph) which is a low volume and currently does not require a right turn bay.

8.11 However, acknowledging that the lands to the north of the Site and east of Geraghtys Road are currently undeveloped but zoned Residential in the PWDP, the through traffic volume on Geraghtys Road is expected to increase in the long term more than 14 vph. Based on Austroads Figure A 10(b), a right turn bay will be warranted for the Site (for at least one access) when the total through traffic volume (both directions) on Geraghtys Road exceeds 160 vph.

8.12 During the interim stage (i.e. before Geraghtys Road traffic volume exceeds 160 vph), both access intersections to the site would be 'Tee' intersections and as identified earlier. I expect both will operate safely and efficiently with a form of priority control, most likely 'Give Way' since the sight distances are excellent in both directions.

New spine road

8.13 The new spine road is to comply with the design requirements of Table 14.12.5.14 of the PWDP, based on their function within the Road Hierarchy as set out in Table 14.12.5.5 as per the PWDP Rule 14.12.1.6(1)(c).

8.14 Table 14.12.5.5 of the PWDP defines the roading hierarchy for the city. As a low trafficked roading connection that primarily provides an access function between the Site and the local road network, the internal roading network would best align with PWDP definition of a "local road".

8.15 Based on the estimated peak hour and all-day trip generation potential of the Site, the internal road network is expected to have sufficient capacity to easily accommodate the expected levels of traffic generated by the site.

8.16 Table 14.12.5.14 of the PWDP outlines the minimum road reserve, carriageway and berm widths for roads. The standards outline the minimum requirement of 20 m wide road reserve for local roads. This includes the provision of 6 m wide trafficable carriageway, footpaths on both sides of the road (minimum 1.8 m wide) and a metre shoulder on each side of the road.

Wider network considerations (Intersection capacity assessment)

8.17 Existing intersection capacities were assessed using the industry recognised SIDRA Intersection 9. The existing traffic volumes that were incorporated in the models were based on the following assumptions:

(a) Existing two-way peak hour traffic volumes on all roads have been estimated to 11% of the AADT.

(b) Trip distribution to be based on traffic patterns identified in Table 2.

(c) No additional traffic related to undeveloped residential zones has been added to the road network.

8.18 Geraghtys Road currently carries around 45 vph at its intersection with St Johns Avenue during peak periods. The modelling results indicate that all movements currently perform at Level of Service (LOS) A due to the low volumes recorded at the intersection. The Geraghtys Road / St Johns Avenue intersection will potentially become significantly busier with the site developed for residential activity. This could easily rise to 515 vph in the future with the Site fully developed. Modelling shows that all movements will continue to perform at LOS A even with the Site fully developed.

8.19 Approximately 950 vph are currently accommodated at the Buckland Road / Geraghtys Road intersection. The modelling results indicate that the intersection currently performs satisfactorily with the Church Street approach being the worst performing at LOS B during peak periods. This is still a good Level of Service with small delays. The modelling results remain similar (LOS B on Church Street approach) when the trips generated by the Site are added to the existing traffic (i.e. a total of approximately 1,140 vph). Sensitivity testing of the existing estimated traffic volumes indicate that the intersection could accommodate an additional 60% of traffic (approximately 600 vph) before turning movements (i.e right turn from Geraghtys Road and Church Street) deteriorate to LOS E.

8.20 The Buckland Road / George Street intersection currently accommodates approximately 1,100 vph during peak periods. The modelling results indicate that the intersection currently performs satisfactorily with the worst approach being George Street northeast, performing at LOS B. Sensitivity testing of the existing estimated traffic volumes indicate that the intersection could accommodate an additional 35% of traffic (approximately 400 vph) before the right turning movement from George Street (northeast) deteriorates to LOS E. When trips generated by the Site are added to the existing traffic, the intersection continues to perform satisfactorily as this is less than 400 vph noted above. However, the George Street (northeast) approach deteriorates to LOS C during peak hours. Again, this LOS is quite acceptable and would not usually trigger a capacity upgrade.

8.21 However as noted above, the site forms a small proportion of the traffic generated by other large rezoning proposed in the location. The cumulative effect of all the rezoning is likely to require intersection upgrades and I would expect all the subject properties to contribute a fair share of the costs of upgrades through future development contributions.

Wider network considerations (Safe system intersection)

8.22 The Austroads Research Report (AP-R556-17) – "Understanding and Improving Safe System Intersection Performance" prepared by the Australian Road Research Board summarises that:

(a) Intersection types with the greatest contribution to fatal and serious injury (FSI) problems were:

(i) Urban priority-controlled intersections;

(ii) Urban signalised intersections; and

(iii) Rural priority-controlled intersections.

(b) The intersection type closest to the Safe System vision was the urban roundabout, followed by the rural roundabout due to reduced vehicles speeds and low collision angles (compared with right angle intersection approaches).

(c) The main traffic movements of concern, according to the leading FSI crash types, were:

(i) Adjacent direction movements;

(ii) Opposing – turning;

(iii) Pedestrians crossing or stepping out; and

(iv) Off-path movements (i.e. loss of control).

(d) Among the vulnerable road users, the following urban scenarios presented the greatest concern for Safe System intersection design:

(i) Pedestrians at priority-controlled and signalised intersections; and

(ii) Cyclists and motorcyclists at priority-controlled intersections and at roundabouts (a high proportion but not a high number).

8.23 A high-level assessment was undertaken on the existing intersections based on the Safe System risk assessment framework which includes assessing the exposure, likelihood and severity of major crash types occurring.

8.24 At the existing Buckland Road / Geraghtys Road give way-controlled crossroad intersection, the relatively high AADT on Buckland Road (approximately 7,900 vpd) and high volume of pedestrians due to the adjacent schools raises the road users' exposure to crashes to moderately high. The number of crashes as identified in Paragraph 4.12 is relatively low however a serious injury has occurred in the five years which increases the severity factor to moderately high. With the intersection likely to accommodate additional traffic due to the KTL rezoning as well as other residential zones as per the PWDP within the vicinity of the Site, the risk factors are only likely to get worse. Therefore, I recommend that the existing Buckland Road / Geraghtys Road intersection be upgraded to an urban compact roundabout such that the intersection aligns closely with Safe

System principles. This upgrade is needed to safely support the wider anticipated growth in Tuakau due to the structure plan and PWDP rezoning, irrespective of whether the proposed KTL rezoning is approved.

8.25 At the existing Geraghtys Road / St Johns Avenue give way-controlled 'Tee' intersection, the AADT on Geraghtys Road as well as St Johns Avenue is relatively low (<500 vpd) with very few pedestrian and cyclist movements. This reduces road users' exposure to crashes and with the lack of crash record, the likelihood of crashes is also low. As such, I conclude that the existing Geraghtys Road / St Johns Avenue intersection need not be upgraded.

8.26 However, the proposed rezoning to the west of Geraghtys Road and the undeveloped residential zone to the east of Geraghtys Road are anticipated to increase the traffic volume on Geraghtys Road to approximately 4,000 vpd and on St Johns Avenue to approximately 3,000 vpd. Moreover, the Tuakau Structure Plan proposes to extend St Johns Avenue to the west of the intersection with a link connecting to Buckland Road (Figure 5). These factors contribute to increasing the crash risk at this intersection. Therefore, it is my opinion that the Geraghtys Road / St Johns Avenue should be upgraded to an urban compact roundabout when the proposed fourth leg to the intersection is to be constructed, which is assumed to be when land to the north of the KTL site is developed.

8.27 I have not assessed the existing George Street / Buckland Road intersection from a road safety perspective as it was covered in the ITA prepared by AECOM in support of the Tuakau Structure Plan. The crash history at Buckland Road / George Street at that time (2014) recorded a cluster of six crashes suggesting there may be cause for making the intersection safer and the report recommended that this intersection may require a change from a priority-controlled intersection to a roundabout or signalised intersection. A quick desktop study has identified that 14 crashes were reported in the last 5 years at this intersection with three of those crashes identified as minor injury crashes. Recognizing that this is the busiest intersection and that the remaining undeveloped but zoned residential areas within Tuakau are likely to add traffic to this intersection, I recommend that the existing George Street / Buckland Road intersection be upgraded to an urban compact roundabout in accordance with Safe System principles, including safe pedestrian and cycling facilities.

Urban Compact Roundabout with Safety Platforms

8.28 Due to the land constraints that exist within the road reserves, I have recommended existing intersections be upgraded to an urban compact roundabout form with safety platforms at approaches. These safety platforms act to reduce vehicle approach and entry speeds to the roundabout in a similar way that approach curves and a large central island do at a conventional roundabout. Figure 6 shows a concept design of the recommended roundabout form obtained from (AP-R556-17).

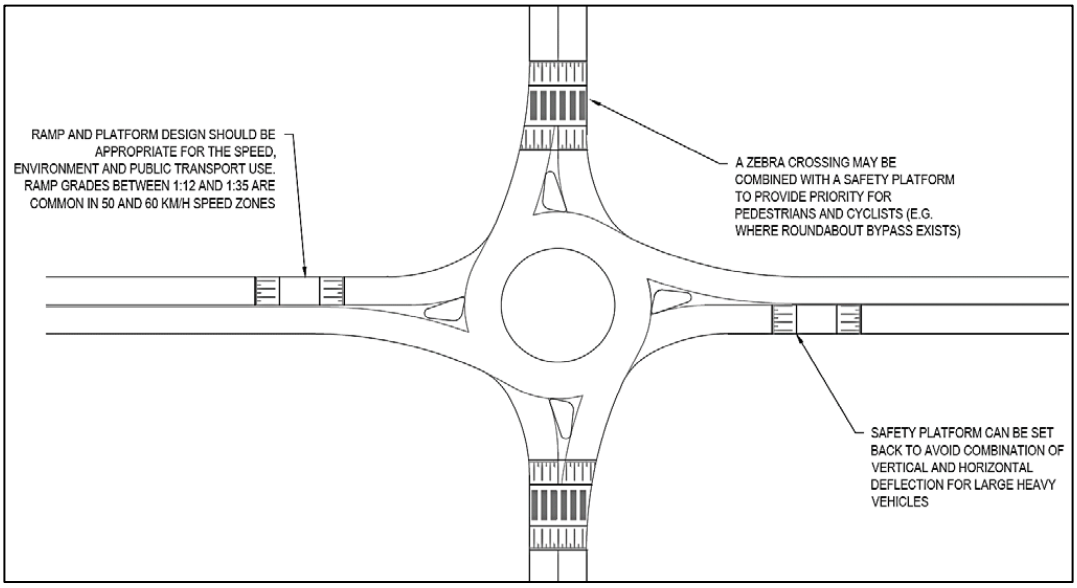

Figure 6: Urban Compact Roundabout Concept Design

8.29 The recommended roundabout form is well suited to low-speed urban environment (≤ 60 km/h), where current knowledge on safety platforms in traffic calming context may be applied directly as per the Austroads (2016d) guide.

8.30 The raised safety platforms may also be combined with zebra crossings where there is a strong pedestrian / cyclist demand (i.e. Buckland Road). This removes potential confusion as to the intent of the raised pavement area and would also provide a shift in traffic priority towards active transport.

8.31 On local roads such as Geraghtys Road and St Johns Avenue, or where operating speeds are expected to be low, raised safety platforms can take more varied forms, e.g. speed humps or speed cushions. This treatment would provide improved safety to vehicles, pedestrians and cyclists through reduced impact speeds. Cost reductions can also be expected as the design would rely less on creation of tight horizontal deflections.

8.32 Roundabouts are highly aligned with the Safe System with regards to vehicle-vehicle conflicts, but poorly aligned for vehicle-pedestrian conflicts. However, despite the high risk to cyclists, motorcyclists and pedestrians, roundabouts are found to be more aligned with Safe System objectives than signalised intersections. The average casualty crash reduction for urban roundabouts is reported to be approximately 80% based on many reviewed studies.

Intersection Upgrades

8.33 The intersection upgrades recommended in paragraphs 8.24 to 8.27 are based on assumptions mentioned in this evidence. Due to the lack of information on all other zoned developments within Tuakau, all intersection upgrades identified in this assessment will have to be studied in greater detail at the time of resource consent, taking into consideration:

(a) Any other consented developments that have or are expected to contribute travel demand in the short to medium term at these intersections;

(b) The point (i.e. time period) at which an upgrade is necessary and what form of improvement is needed for Safe System outcomes to serve the travel mode types; and

(c) How and by whom the effects should be monitored to trigger the upgrade, and appropriate funding mechanisms for such upgrades.

8.34 Therefore, I recommend that suitable planning rules are included in the PWDP to assess the cumulative effects of traffic generated from the various areas that are rezoned, and provision is made for the interaction upgrades to be funded and built, potentially through a combination of District Plan provisions and development contributions. John Olliver provides more detail of this in his evidence.

Transport Modes

8.34 I consider it unlikely that local bus services will travel through the new internal road network following completion of residential development in the Site. It is likely that services will continue to operate on the arterial road network (Buckland Road and George Street).

8.35 The proposed Geraghtys Road Structure Plan provides for network permeability and connectivity for active modes (pedestrians and cycling) that will support uptake of non-car based travel.

8.36 The uptake of walking and cycling as a viable alternative to private car use for short trips is reliant on the development of safe and convenient urban connections within the existing and proposed adjoining urban areas.

8.37 The internal road network is expected to be developed in accordance with the PWDP which will support safe and attractive environment for pedestrians and cyclists.

9. PROPOSAL ALIGNMENT WITH TRANSPORT STRATEGIES AND POLICIES

9.1 The following documents were referred to in order to determine the proposed rezoning compliance with national and regional transport strategies and policies:

(a) Government Policy Statement (GPS) and Land Transport 2018 / 19 – 2027 / 28; and

(b) 2018 Update to the Waikato Regional Land Transport Plan 2015 – 2045

9.2 This assessment finds that the proposed Geraghtys Road Structure Plan is consistent with the new GPS and directions set out in the Waikato Regional Land Transport Plan because:

(a) The proposed access and internal road network arrangement signals a focus on improving / maintaining the safety of Geraghtys Road.

(b) The proposed Structure Plan provides for network permeability and connectivity for active modes that will support uptake of non-car based travel.

(c) The proposed rezoning will establish residential dwellings in close proximity to places of employment (i.e. Tuakau Town Centre and Pukekohe) and education (Tuakau College and Tuakau Primary School), reducing the need for future residents to rely on private motor vehicles and consequently reducing emissions.

10. CONCLUSIONS

10.1 On the basis of the assessments carried out, and my recommendations relating to road infrastructure upgrades, I consider that the transportation effects from rezoning the site for residential purposes will be sufficiently

mitigated to an acceptable and appropriate level, which is generally no more than minor.

Siva Balachandran
15 February 2021