

Memorandum

To	Hamish Crawford
Copy	Cheryl Cleary
From	Emma Cui, Allan Liu and Robert Swears
Office	Auckland Westhaven
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Subject	Nukuhau Plan Change

1 Introduction

We have carried out additional SIDRA (v9) modelling to understand the performance of the Control Gates Bridge (CGB), Norman Smith Street/Wairakei Drive intersection and Spa Road/Tongariro Street roundabout with permitted land developments north of the Bridge (Figure 1) and with the proposed Nukuhau Plan Change, before there is a second bridge across the Waikato River to provide access to Taupō from the north.

The additional traffic models also compare the traffic operation performance of the Control Gates Bridge, Norman Smith Street/Wairakei Drive intersection and Spa Road/Tongariro Street roundabout with and without Nukuhau Plan Change.

APPENDIX 1: DISTRICT RESIDENTIAL SUPPLY BREAKDOWN

Northern End of the Lake		Southern End of the Lake	
EUL	1,300	Kuratau/Omori	180
WEL	496	Mohi	50
Brentwood	120	Turang	400
Lakeside Brentwood	350	Whareroa	160
Vineyard on Huka falls	36	Undeveloped half charges	275
Acacia Bay	150	Total Southern End	1,065
Kinloch	334	Unzoned	
7 Oaks	162	Five Mile Bay site A and C	440
Undeveloped half charges	742	Nukuhau Private Plan Change	780
Total Northern End	4,290	Total Unzoned	1,220

Figure 1: Permitted Land Development North of Bridge, Taupo Residential Dwelling Demand Addendum Report (July 2021)

2 Trip generation and distribution assessments

Trip generation and distribution assessments were carried out to determine the additional trips generated from the permitted land developments and Nukuhau Plan Change.

2.1 Assessed Household Numbers

We assessed two scenarios:

- 50% of the permitted developments (30% for Undeveloped Half Charges) and 40% of the development from Nukuhau Plan Change.
- 100% of the permitted developments (60% for Undeveloped Half Charges) and 80% of the development from Nukuhau Plan Change.

Development	No. houses	Development percentage at 2021	Development percentage by 2025	Development percentage by 2030
Seven Oaks and Kinloch	496	0%	50%	100%
Acacia Bay	150	0%	50%	100%
Brentwood	120	0%	50%	100%
Lakeside Brentwood	350	0%	50%	100%
Undeveloped half charges	742	0%	30%	60%
PC37 Nukuhau	780	0%	40%	80%

Subsequent to completing our modelling analysis we noted that we had inadvertently omitted the trip generation associated with the 36 dwellings from Vineyard on Huka Falls. While this oversight results in a slight reduction in the overall trip generation from the permitted development, the volume of additional traffic is less than 1% of the total, therefore, we conclude that the effect of the oversight is negligible on the results of our analysis.



Figure 2 Location of Permitted Land Development and Proposed PC 37 Nukuhau

2.2 Trip Generation Rate

We have used the trip generation rates from the Taupō Traffic Model, which is part of the Waikato Regional Transportation Model (WRTM); namely:

- AM Peak 0.72 trips/household/hr
- PM Peak 0.85 trips/household/hr

2.3 Trip Arrival and Departure Rate

We have used the trip arrival and departure rates from the Taupō Traffic Model (part of Waikato Regional Transportation Model).

Period	Movement	% Movements
AM Peak Hour	Arrival Split (Trips In)	0.25
	Departure Split (Trips Out)	0.75
PM Peak Hour	Arrival Split (Trips In)	0.63
	Departure Split (Trips Out)	0.37

2.4 Trip Distribution

Travel Route

We have assumed that different routes will be used for accessing Wairakei Drive, depending on the origin / destination of particular journeys. The table below describes the assumed route assignments for the different origins.

	Pohipi Road and Wairakei Drive to and from Taupo town centre via CGB (Blue Route)	Norman Smith Street from Taupo town centre via CGB (Red Route)
Seven Oaks and Kinloch	100%	0%
Acacia Bay	0%	100%
Brentwood	0%	100%
Lakeside Brentwood	0%	100%
Undeveloped half charges	75%	25%
PC37 Nukuhau	50%	50%

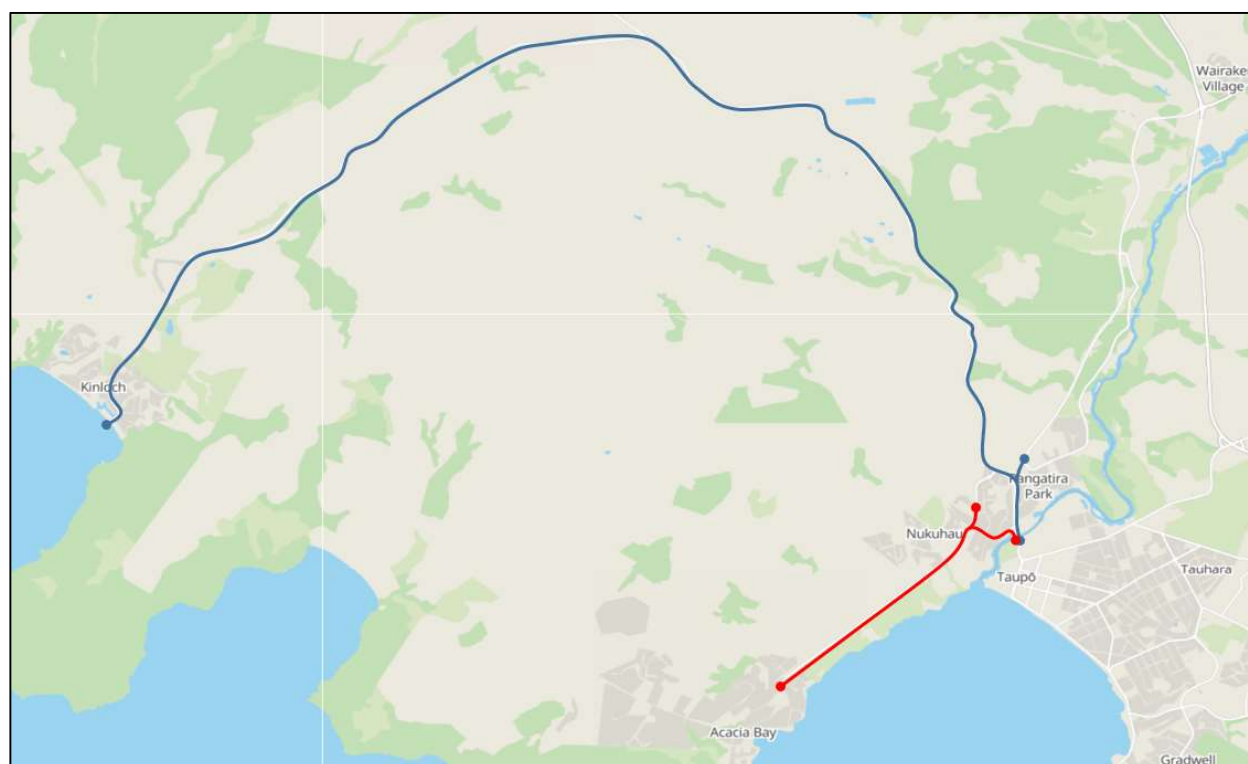


Figure 3 Travel Route and Trip Distribution

2.5 Assumptions made:

- 70% of the trips generated by Kinloch will travel to and from the Taupo Town Centre via Control Gates Bridge in the AM and PM peak. The other trips generated by Kinloch will be not involve journeys to and from the Taupo Town Centre;
- 80% of the trips generated by Acacia Bay, Brentwood and Lakeside Brentwood will travel to and from Taupo Town Centre via Control Gates Bridge in the AM and PM peak;
- 85% of the trip generated from Nukuhau Plan Change development will travel to and from Taupo Town Centre via Control Gates Bridge in the AM and PM peak;
- 1% net annual traffic growth rate, additional traffic growth subject to land developments;
- Any turning volumes for a particular movement at any intersection that were lower than 10 were rounded up to 10 vehicles.

2.6 Additional Trips

Table 1 and Table 2 below summarise the additional trips generated from each of the permitted land developments and Nukuhau Plan Change.

Table 1 Additional Trips 2025

	2025			
	Additional Trips into Town via Wairakei Dr (AM)	Additional Trips into Town via Norman Smith St (AM)	Additional Trips out of Town via Wairakei Dr (PM)	Additional Trips out of Town via Norman Smith St (PM)
Seven Oaks and Kinloch	94	0	93	0
Acacia Bay	0	32	0	32
Brentwood	0	26	0	26
Lakeside Brentwood	0	76	0	75
Undeveloped half charges	72	24	72	24
PC37 Nukuhau	72	72	71	71
Total	237	230	235	228

Table 2 Additional Trips 2030

	2030			
	Additional Trips into Town via Wairakei Dr (AM)	Additional Trips into Town via Norman Smith St (AM)	Additional Trips out of Town via Wairakei Dr (PM)	Additional Trips out of Town via Norman Smith St (PM)
Seven Oaks and Kinloch	187	0	186	0
Acacia Bay	0	65	0	64
Brentwood	0	52	0	51
Lakeside Brentwood	0	151	0	150
Undeveloped half charges	144	48	143	48
PC37 Nukuhau	143	143	142	142
Total	475	459	471	455

3 Traffic Model

The 1% net annual traffic growth rate has been applied to the base traffic volumes (2021 base model from Taupo Traffic Model) to determine the base future traffic volumes in 2025 and 2030. Trips generated from the permitted land developments and Nukuhau Plan Change development have been added to the base volumes to determine future traffic volumes.

Additional modelling in SIDRA (v9) has been completed for the Norman Smith Street / Wairakei Drive intersection, Control Gates Bridge, and the Spa Road/Tongariro Street roundabout for the scenarios listed below:

- 2021 base model (traffic volumes direct output from Taupo Traffic Model).
- 2025 model assuming 50% development of permitted land only.
- 2025 model assuming 50% development of permitted land and 40% development of Nukuhau.
- 2030 model assuming 100% development of permitted land only.

- 2030 model assuming 100% development of permitted land and 80% development of Nukuhau.

3.1 Modelling Output

Table 3 to Table 5 below summarise the outputs from the SIDRA models. Note that the queue lengths reported below are the 95th percentile queue lengths.

Table 3 Modelling Output - 2021 Base Model

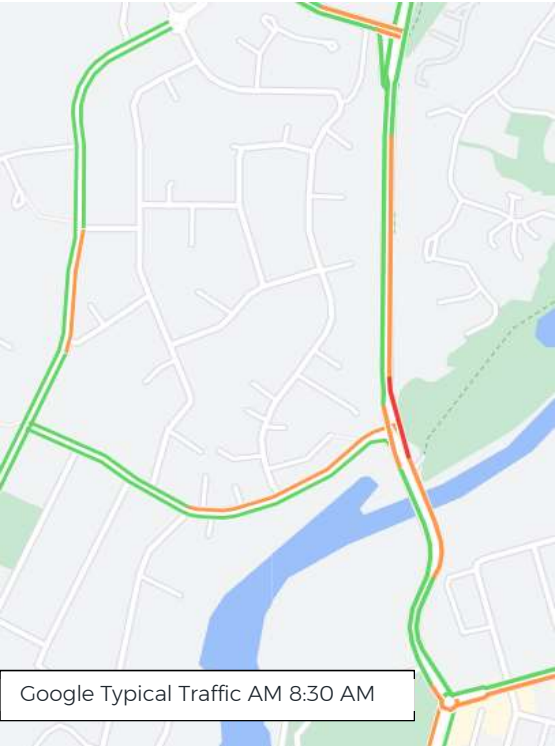
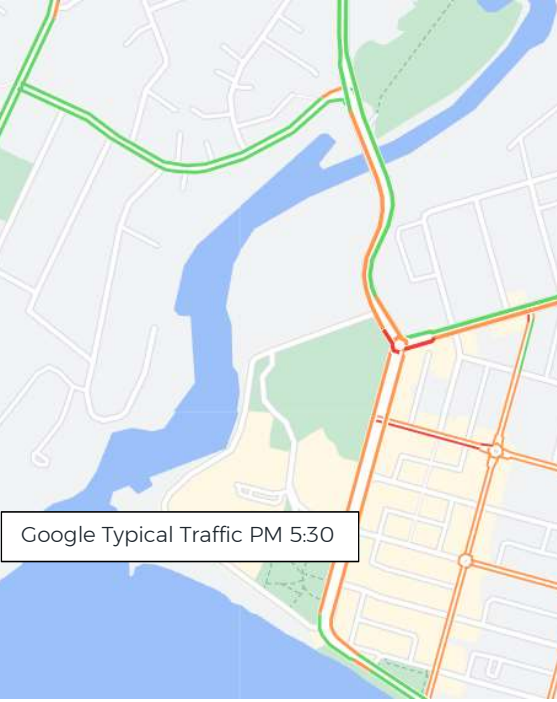
2021 base model – current	
 <p>Google Typical Traffic AM 8:30 AM</p>	<p>AM Peak</p> <ul style="list-style-type: none"> • Google Maps indicates the most significant current delay is at the Norman Smith Street/Wairakei Drive intersection. • The modelling indicates: <ul style="list-style-type: none"> • The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS C with a 20-second overall delay and a 140 metre queue length on Norman Smith Street. • The Bridge is expected to operate at full capacity (100% Degree of Saturation) in the southbound direction, with a through movement delay of 15 seconds. • The Spa Road/ Tongariro Street roundabout is likely to operate at LOS A with an overall delay of 5 seconds and a 35 metre queue length on the Tongariro Street north approach.
 <p>Google Typical Traffic PM 5:30</p>	<p>PM Peak</p> <ul style="list-style-type: none"> • The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS B with a 10 second overall delay and an 85 metre queue length on the Wairakei Drive south approach • The Bridge is expected to operate within capacity, with a through movement delay of 5 seconds in the northbound direction. • The Spa Road/ Tongariro Street roundabout is likely to operate at LOS B with an overall delay of 10 seconds and a queue length of 85 metres on the Tongariro Street southwest approach. • It is noted the model outputs indicate a different pattern of congestion when compared with Google Maps. This is considered to be because of the effect of traffic activities operating at other minor intersections close by.

Table 4 Modelling Output - 2025 Model

2025 model – Future	
2025 model without Nukuhau	2025 model with Nukuhau
<p>AM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS E with a 70 second overall delay and a 530-metre queue length on Norman Smith Street The southbound through movement on Wairakei Drive is likely to operate at LOS F with a delay of 105 seconds. The Bridge is expected to operate overcapacity in the southbound direction, with a through movement delay of 130 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS A with an overall delay of 5 seconds and a queue length of 55 metres on the Tongariro Street north approach. <p>PM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS D with a 45-second overall delay and a 375 metre queue length. <ul style="list-style-type: none"> The northbound through movement is likely to operate at LOS F with a delay of 115 seconds. The Bridge is expected to operate overcapacity in the northbound direction, with a through movement delay of 110 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS F with an overall delay of 105 seconds and a queue length of 1080 metres on the Tongariro Street southwest approach. <ul style="list-style-type: none"> The left turn movement from the Tongariro Street southwest approach is likely to operate with a delay of 335 seconds. 	<p>AM Peak</p> <ul style="list-style-type: none"> The Norman Smith/Wairakei Drive intersection is likely to operate at LOS F with a 105 second overall delay and a 700 metre queue length. <ul style="list-style-type: none"> The southbound through movement on Wairakei Drive is likely to operate at LOS F with a delay of 145 seconds. The Bridge is expected to operate overcapacity in the southbound direction, with a through movement delay of 175 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS A with an overall delay of 10 seconds and a queue length of 65 metres on the Tongariro Street north approach. <p>PM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS E with a 65 second overall delay and a 495 metre queue length on the Wairakei Drive south approach. <ul style="list-style-type: none"> The northbound through movement is likely to operate at LOS F with a delay of 155 seconds. The Bridge is expected to operate overcapacity in the northbound direction, with a through movement delay of 155 seconds. The Spa Road/Tongariro Street roundabout is likely to operate at LOS F with an overall delay of 170 seconds and a queue length of 1535 metres on the Tongariro Street southwest approach <ul style="list-style-type: none"> The left turn movement from the Tongariro Street southwest approach is likely to operate with a delay of 515 seconds.

Table 5 Modelling Output - 2030 Model

2030 Model – Future	
2030 model without Nukuhau	2030 model with Nukuhau
<p>AM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS F with a 180 second overall delay and a 1000 metre queue length on Norman Smith Street. <ul style="list-style-type: none"> The southbound through movement is likely to operate at LOS F with a delay of 255 seconds. The Bridge is expected to operate overcapacity in the southbound direction, with a through movement delay of 255 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS B with an overall delay of 10 seconds and a queue length of 115 metres on Spa Road <p>PM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS F with a 100-second overall delay and a 725-metre queue length on the Wairakei Drive south approach. <ul style="list-style-type: none"> The right turn movement from Norman Smith Street is likely to operate at LOS F with a delay of 180 seconds The Bridge is expected to operate overcapacity in the northbound direction, with a through delay of 235 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS F with an overall delay of 265 seconds and a queue length of 2070 metres on the Tongariro street southwest approach. <ul style="list-style-type: none"> The left turn movement from the Tongariro Street southwest approach is likely to operate with a delay of 710 seconds. 	<p>AM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS F with a 280-second overall delay and a 1700 metre queue length on Norman Smith Street <ul style="list-style-type: none"> The right turn movement from Norman Smith Street is likely to operate at LOS F with a delay of 395 seconds. The Bridge is expected to operate overcapacity in the southbound direction, with a through movement delay of 345 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS D with an overall delay of 45 seconds and a queue length of 540 metres on Spa Road <ul style="list-style-type: none"> The left turn movement from Spa Road is likely to operate at LOS F with a delay of 345 seconds. <p>PM Peak</p> <ul style="list-style-type: none"> The Norman Smith Street/Wairakei Drive intersection is likely to operate at LOS F with a 135-second overall delay and a 1000 metre queue length on the Wairakei Drive south approach. <ul style="list-style-type: none"> The northbound through movement is likely to operate at LOS F with a delay of 300 seconds. The Bridge is expected to operate overcapacity in the northbound direction, with a through delay of 325 seconds. The Spa Road/ Tongariro Street roundabout is likely to operate at LOS F with an overall delay of 390 seconds and a queue length of 2675 metres on the Tongariro street southwest approach. <ul style="list-style-type: none"> The left turn movement from the Tongariro Street southwest approach is likely to operate with a delay of 935 seconds.

3.2 Network En-route travel time

En-route travel time analysis has been set up in SIDRA Route.

We have set up the following routes in the SIDRA network in all modelled scenarios to understand the overall en-route travel between Control Gates Bridge and the intersection of Norman Smith Street /Wairakei Drive which is considered to be the most critical section within the study area.

- in the AM peak:
 - Route 1 - from the Wairakei Drive north approach to the southern end of the Bridge.
 - Route 2 - from Norman Smith Street to the southern end of the Bridge.
- in the PM peak:
 - Route 3 - from the southern end of the Bridge to the Wairakei Drive north approach.
 - Route 4 - from the southern end of the Bridge to Norman Smith Street.

We have provided the route diagrams and summarised the predicted results in the tables below.

Table 6 SIDRA Network En-Route

AM Peak		PM Peak	
Route 1	Route 2	Route 3	Route 4
<p>Diagram for Route 1 (AM Peak): Shows a north-south road layout. A north arrow is in the top left. The road is labeled 'Wairakei Dr N' at the top, 'Norman Smith St W' at the intersection, 'Wairakei Dr S' below the intersection, 'CGB N' further south, and 'CGB S' at the bottom. A green line with arrows indicates the route starting from the north approach, passing the intersection, and continuing south to the southern end of the bridge (CGB S).</p>	<p>Diagram for Route 2 (AM Peak): Shows the same road layout as Route 1. A green line with arrows indicates the route starting from Norman Smith St W, turning south onto Wairakei Dr S, and continuing to the southern end of the bridge (CGB S).</p>	<p>Diagram for Route 3 (PM Peak): Shows the same road layout as Route 1. A green line with arrows indicates the route starting from the southern end of the bridge (CGB S), moving north through CGB N, past the intersection, and continuing north to Wairakei Dr N.</p>	<p>Diagram for Route 4 (PM Peak): Shows the same road layout as Route 1. A green line with arrows indicates the route starting from the southern end of the bridge (CGB S), moving north through CGB N, past the intersection, and turning west onto Norman Smith St W.</p>

Table 7 En-Route Travel Time

Scenarios	En-route Travel Time (seconds)			
	AM Peak		PM Peak	
	Route 1	Route 2	Route 3	Route 4
2021 Base model - current	15	20	25	25
2025 model without Nukuhau	50	50	40	45
2025 model with Nukuhau	60	75	45	45
2030 model without Nukuhau	100	115	50	50
2030 model with Nukuhau	130	200	55	55

The table indicates that, compared with the existing conditions:

- with the traffic volume growth to the year 2025 and the assumed level of permitted development, the en-route travel time will likely increase by:
 - 30-35 seconds in the AM peak.
 - 15-20 seconds in the PM peak.
- based on the predicted traffic volume in the year 2025 and the assumed level of permitted development, and if the Nukuhau area is assumed to be partially developed, the en-route travel time will likely increase by:
 - 45-55 seconds in the AM peak.
 - 20 seconds in the PM peak.
- with the traffic volumes continuing to climb to the year 2030 and the assumed level of permitted development, the en-route travel time will likely increase by:
 - 85-95 seconds in the AM peak.
 - 25 seconds in the PM peak.
- based on the predicted traffic volume in the year 2030 and the assumed level of permitted development, and if the Nukuhau area is assumed to be predominantly developed, the en-route travel time will likely increase by:
 - 115-180 seconds in the AM peak.
 - 30 seconds in the PM peak.