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Hingaia Special Housing Area

Staging Analysis of Transport Infrastructure Improvements

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Executive Summary

This report summarises the staging analysis of transport infrastructure improvements within the Hingaia Special Housing Area (SHA). The staging results establish the level of new traffic and development that triggers the need for each identified infrastructure improvement.

The trigger points are approximate only and have been determined using existing traffic volumes from AT traffic count data, SATURN models that have been produced for the Hingaia SHA, and Sidra Intersection software to assess intersection performance. The table below summarises the trigger points for each upgrade.

Location	Upgrade	Household (hh) Trigger Points
Hingaia Road / Harbourside Drive Intersection	Dual right turn from south	318hh increase to the south or 715hh increase in Hingaia
	Full upgrade	1,072hh increase in Hingaia (or 1,609hh increase in Hingaia if LOS E accepted on Hingaia Rd Right)
Hingaia Road /Kuhanui Drive Intersection	Signalisation	49 hh increase from south and 140 hh increase from north
Hingaia Road / Oakland Road Intersection	Signalisation (T-intersection)	718 hh on Oakland Road
	Signalisation (4-arm intersection)	576 hh on Oakland Road (with very low hh on southern approach) or 668 hh in Hingia SHA split between south and north of the intersection
Park Estate Road / Kuhanui Drive Intersection	Signalisation	Not required with expected traffic volumes
Park Estate Road / Hinau Road Intersection	Signalisation	1,380 hh to the north west of intersection if Hugh Green is fully developed
Park Estate Road / Great South Road Intersection	Flush median on Great South Rd	709 hh increase along Park Estate Road
	Signalisation	1,366 hh increase along Park Estate Road
Hinau Road extension	New route	2, 127 hh in Hingaia SHA (54% of development that use Kuhanui Drive as an alternative route)
Hingaia Road Widening at Kuhanui Drive[1]	4 laning	1,295 hh increase in Hingaia SHA
Hingaia Road Widening at Oakland Road[1]	4 laning	1,532 hh within Hingaia SHA (1483 to south and north of Hingaia and 5% growth of Hingaia Rd traffic) or 890 hh on south and north with 100% increase of Hingaia Rd traffic
Park Estate Road Widening	Widening to local road standard	Any increase of hh (the road is already below standard for a local road)
	Widening to collector road standard	450 households or as function changes

[1] Four lane trigger points for Hingaia Road have been determined separately for the Kuhanui Drive and Oakland Drive intersections. However, it will be more cost effective to four lane all of Hingaia Road (at Kuhanui Drive and Oakland Road) in one stage

Contents

1 Introduction

1.1 Report Purpose

This purpose of this report is to summarise the methodology and results of a staging analysis of transport infrastructure improvements within the Hingaia Special Housing Area (SHA). The staging results establish the level of new traffic and development that triggers the need for each identified infrastructure improvement.

1.2 Scope of Analysis

The staging analysis includes consideration of intersection upgrades, new road links, and widening of existing roads.

The intersections that have been examined are:

- Hingaia Road / Harbourside Drive
- Hingaia Road / Kuhanui Drive
- Hingaia Road / Oakland Road
- Park Estate Road / Kuhanui Drive
- Park Estate Road / Hinau Road
- Park Estate Road / Great South Road

The need for the following new route has been examined:

- Hinau Road extension

The need to widen the following existing roads has been examined:

- Hingaia Road
- Park Estate Road

2 Methodology

2.1 Existing Traffic Volumes

Existing traffic volumes have been determined using AT traffic count data and SATURN models that have been produced for the Hingaia SHA.

2.2 Intersection Performance Requirements

Intersection performance criteria have been adopted from the transport assessment report prepared by Flow Transportation Specialists (Flow) in November 2014. The intersection performance criteria stated in Section 5 of the Flow Report are:

- *Individual movements at the intersections are to have Level of Service (LOS) E or better, unless on the main arterial (Hingaia Road) where this is to have LOS D or better.*
- *Overall intersection LOS to be D or better.*
- *Vehicle queues are not to extend beyond upstream intersections.*

2.3 Intersection Trigger Point Assessment

Sidra Intersection software has been used to assess each of the intersections. Signal timing was set to Practical Cycle Time with a maximum cycle time of 120 seconds.

The trigger points for each intersection upgrade were determined by:

- Increasing the Sidra Flow Constant on a single approach until the intersection performance criteria described in Section 2.2 were exceeded; and/or
- Increasing the Sidra Flow Constant for all movements and approaches until the intersection performance criteria described in Section 2.2 were exceeded.

The traffic volume triggers have been converted into household numbers using a trip rate of 0.85 trips per household during peak hours and trip distributions from the Hingaia SHA SATURN model. The 0.85 trip rate is an average, in reality trips rates will vary throughout the development sites depending on dwelling types.

3 Results

3.1 Hingaia Road / Harbourside Drive Intersection

The existing layout of the Hingaia Road/ Harbourside Drive intersection is shown in Figure 1.

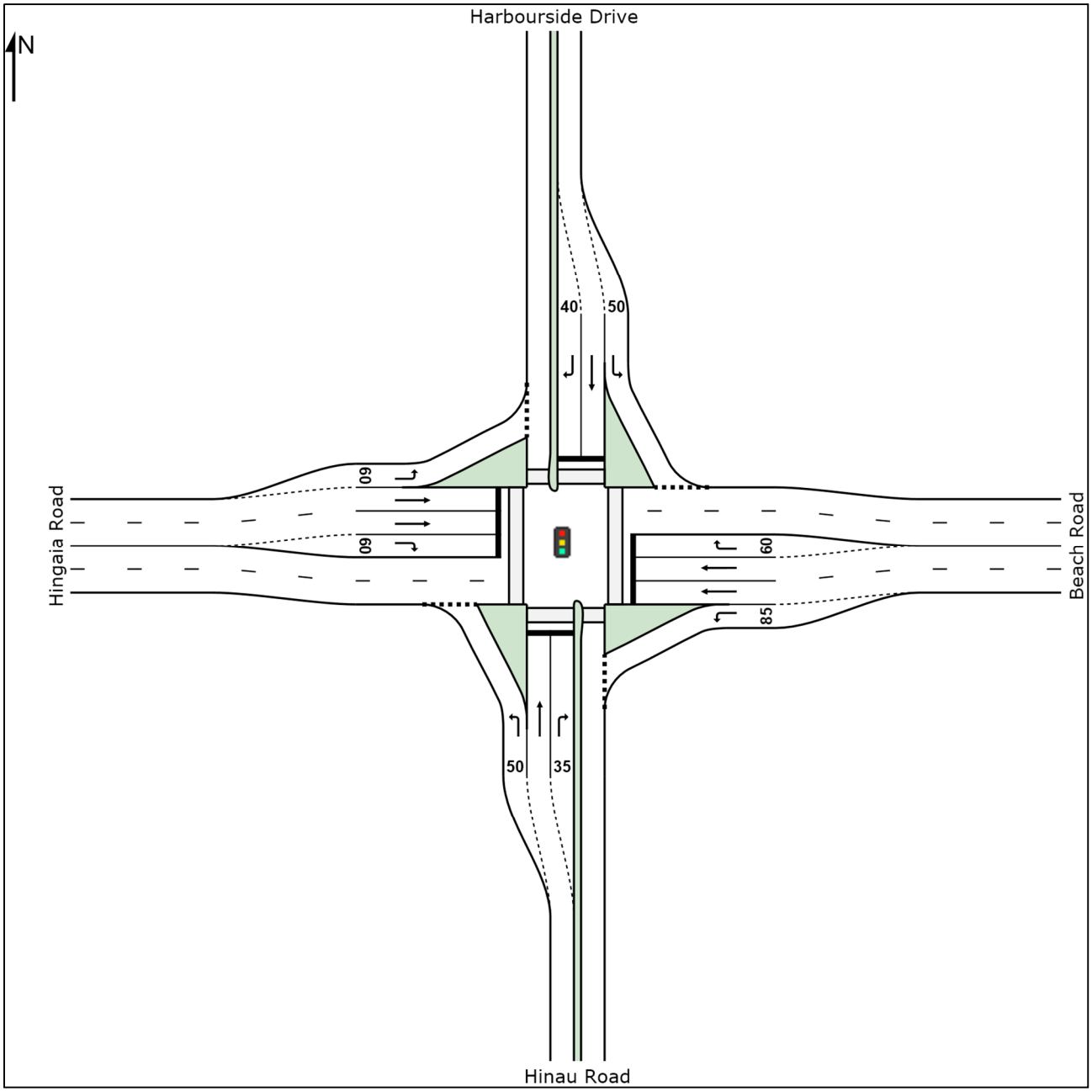

Figure 1 Hingaia Road / Harbourside Drive Existing Layout

The signal timing adopted in the Sidra models has assumed the Beach Road approach has a favourable arrival profile because it is likely to be coordinated with the Papakura Interchange signals.

Upgrade options that have been investigated are:

- Dual right turn on southern approach (Figure 2);and
- Full intersection upgrade (Figure 3).

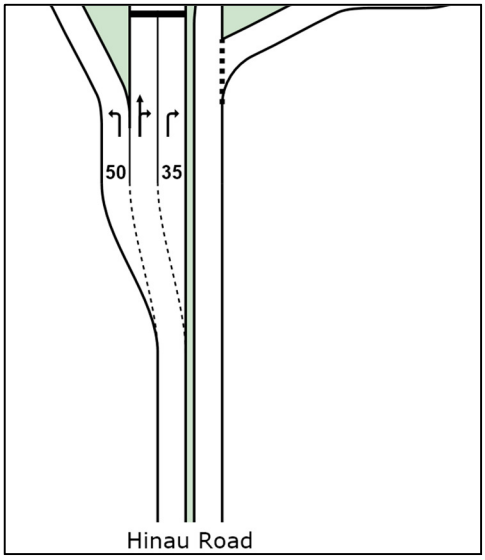

Figure 2 Dual Right turn on Hinau

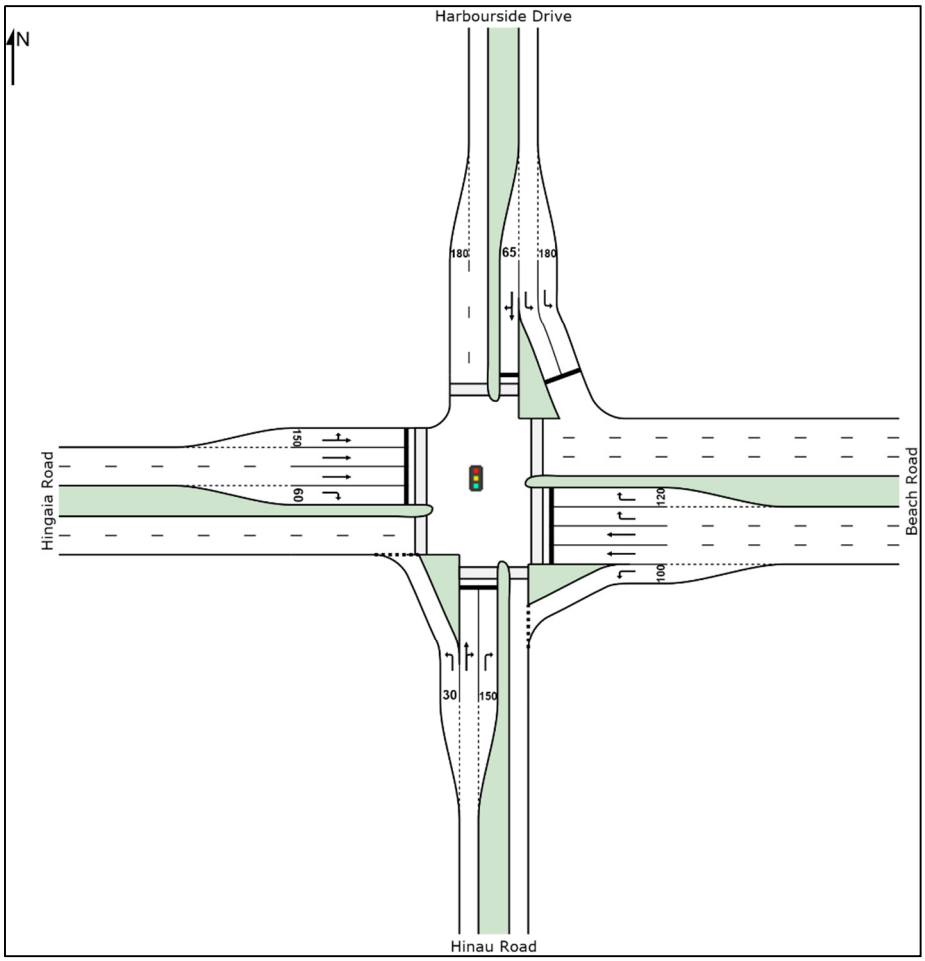

Figure 3 Hingaia / Harbourside full intersection upgrade

3.1.1 Dual Right on South Approach of Harbourside Drive Intersection

As shown in Table 1, the need to provide a dual right turn on the southern approach is triggered by the Level of Service (LOS) of the right turn from Beach Road into Harbourside Drive. The LOS of this movement drops to LOS E with either a 608 vehicle per hour (vph) increase of traffic across the entire intersection or an increase of 270 vph on the southern approach. Although this movement operates at LOS E, the queue lengths remain within available stacking space; therefore, this LOS may be acceptable.

If LOS E is accepted on the right turn from Beach Road, then the upgrade to a dual right turn on the southern approach is triggered by higher traffic volumes (or households), either:

- 894 household increase within Hingaia SHA globally; or
- 342 household increase south of the Hingaia Road / Harbourside Drive intersection.

Table 1 Trigger point for dual right turn at Hingaia Road / Harbourside Drive Intersection

Upgrade	Triggered By	Trigger Point for Improvement			
		Peak Hour Traffic (vph)		Households	
		Entire Intersection	Single Approach	Entire Intersection	Single Approach
Dual right turn on southern approach	LOS E on Beach Right	608 vph	270 vph to the south	715hh	318 hh to the south
	LOS E on Hingaia	760 vph	291 vph	894 hh	342 hh to the south

3.1.2 Full Intersection Upgrade of Harbourside Drive Intersection

Full upgrade of the Hingaia Road / Harbourside Drive intersection is triggered by LOS E of the Hingaia Road right turn into Hinau Road, which occurs at approximately 1,000 household growth in Hingaia SHA. If LOS E is acceptable on the right turn movement, then the next trigger point is LOS E on the Hingaia Road eastbound through movement, which occurs at 1,600 household growth in Hingaia.

Table 2 Trigger point for full intersection upgrade of Hingaia Road / Harbourside Drive Intersection

Upgrade	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Full Intersection Upgrade	LOS E on Hingaia Right	912 vph	1,072 hh
	LOS E on Hingaia Through	1,368 vph	1,609 hh

3.2 Hingaia Road / Kuhanui Drive Intersection

Options investigated:

- Signalisation
- Four laning of Hingaia Road [2]

[2] Four lane trigger points for Hingaia Road have been determined separately for the Kuhanui Drive and Oakland Drive intersections. However, it will be more cost effective to four lane all of Hingaia Road (at Kuhanui Drive and Oakland Road) in one stage.

3.2.1 Signalisation of Kuhanui Drive Intersection

The operation of the Kuhanui Drive intersection with Hingaia Road is significantly impacted by the conflict between opposing traffic movements into and out of Kuhanui Drive and the northern approach. The need for signalisation is primarily driven by the LOS of the right turn out of Kuhanui Drive, which even when at a low volume can operate poorly because of the number of opposing flows. There is also no opportunity for this right turn to be made in two stages using the median because of the conflict with traffic turning right from Hingaia Road into the northern arm of the intersection.

It is likely pedestrian movements will also drive the need for signalisation across Hingaia Road. A stop controlled intersection does not provide pedestrians (particularly vulnerable and mobility impaired pedestrians) safe opportunities to cross Hingaia Road.

Table 3 Trigger point for signalisation of Hingaia Road / Kuhanui Drive Intersection

Improvement	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Signalisation	LOS F on Right from Kuhanui Dr	42 vph from south and 119 vph from north	49 hh from south and 140 hh from north

3.2.2 Four Laning of Hingaia Road at Kuhanui Drive

LOS F on side roads triggers the need to four lane Hingaia Road at the Kuhanui Drive intersection. This occurs when overall intersection volumes are 1,100 vph greater than current volumes, which represents an additional 1,295 households using the intersection from within the Hingaia SHA.

Table 4 Trigger point for 4 laning of Hingaia Road at Hingaia Road / Kuhanui Drive Intersection

Improvement	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Four laning	LOS F on side roads	1,100 vph	1,295 new hh in Hingaia SHA

3.3 Hingaia Road / Oakland Road Intersection

Options investigated include:

- Signalisation
- Four laning of Hingaia Road[3]

3.3.1 Signalisation of Oakland Road Intersection

While the Oakland Road intersection remains as a T-intersection rather than a four-arm intersection, signalisation will be warranted when traffic volumes using Oakland Road reach 611vph (two way), which equates to 718 households on Oakland Road.

[3] Four lane trigger points for Hingaia Road have been determined separately for the Kuhanui Drive and Oakland Drive intersections. However, it will be more cost effective to four lane all of Hingaia Road (at Kuhanui Drive and Oakland Road) in one stage.

As soon as the intersection becomes a 4-arm intersection, the trigger point for signalisation reduces regardless of the volume of traffic approaching from the south. Even with very low traffic volumes on the southern arm, signalisation is triggered by only 490vph on Oakland Road or 576 households (i.e. 80% of the trigger point without the fourth approach to the intersection). This is because traffic exiting Oakland Road now needs to look at an additional approach to determine that a safe gap is available, which reduces the capacity of the Oakland approach movements. Alternatively, 668 households within Hingaia SHA (on either Oakland or the southern approach) trigger signalisation (assuming through traffic volumes on Hingaia Road remain constant).

Table 5 Trigger point for signalisation of Hingaia Road / Oakland Road Intersection

Upgrade	Triggered By	Trigger Point for Improvement			
		Peak Hour Traffic (vph)		Households	
		Entire Intersection	Single Approach	Entire Intersection	Single Approach
Signalisation (as T-Intersection)	LOS F on Oakland Right		611vph (two way on Oakland)		718 hh on Oakland
Signalisation (as 4-arm intersection)	LOS F on Oakland Right and south approach	567 vph on north and south approaches	490vph two way on Oakland, with very low volumes on southern approach	668 hh in Hingia SHA south and north of intersection	576 hh on Oakland, with very low hh on southern approach

3.3.2 Four-laning of Hingaia Road at Oakland Intersection

LOS F on Oakland Road and the southern approach triggers the need to four lane Hingaia Road at the Oakland Road intersection. LOS F on the side roads occur with 1,483 households within Hingaia SHA to the north and south of the intersection combined with a small (5%) increase of traffic volume on Hingaia Road. Alternatively, if Hingaia Road traffic increases significantly (i.e. doubles) then the trigger point for four laning at Oakland Road will be reduced to 890 households within Hingaia SHA to the north and south of the intersection. These trigger points represent approximately 1,830 vph (two-way flow) using Hingaia Road at the Oakland Road intersection.

Table 6 Trigger point for 4 laning of Hingaia Road at Hingaia Road / Oakland Road Intersection

Upgrade	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Four laning of Hingaia Road	LOS F on side roads	41 vph on Hingaia (5% increase) and 1,261 vph on side roads	1,532 hh within Hingaia SHA (1483 to south and north of Hingaia and 5% growth of Hingaia Rd traffic)
		757 vph combined on south and north with 100% increase of Hingaia Road traffic	890hh on south and north with 100% increase of Hingaia Rd traffic
		1830vph on Hingaia Road	

3.4 Park Estate Road / Kuhanui Drive Intersection

The Park Estate Road / Kuhanui Drive intersection has been assessed as a four-arm priority controlled intersection using 2031 traffic flows from the Hingaia SHA SATURN model and the following assumptions:

- Northern approach trips are those expected from the Karaka Lakes South Subdivision (approximately 30% of Karaka Lakes trips are expected to use Park Estate Road).
- Western approach trips are those from the Aote development with 120 households (distributions similar to the Karaka Lake South development have been adopted i.e. 30% along Park Estate Road).
- Southern approach trips are those expected from the Hugh Green group development (approximately 17% of Hugh Green Group trips are expected to use this intersection based on distributions adopted within the Hingaia SHA SATURN models).

The Sidra intersection assessment shows the Park Estate Road / Kuhanui Drive intersection operates within intersection performance criteria with full development of the Hingaia SHA. Therefore, signalisation is not required for vehicular traffic capacity, although it may be required to support pedestrian accessibility.

3.5 Park Estate Road / Hinau Road Extension Intersection

The Park Estate Road / Hinau Road Extension intersection has been assessed as a four-arm priority controlled intersection using 2031 traffic flows from the Hingaia SHA SATURN model.

The need to signalise the Park Estate Road / Hinau Road Extension intersection is triggered by the LOS of the right turn out of the southern approach (i.e. from the Hugh Green Development) because this movement must give way to numerous movements at the intersection. As traffic volumes increase along Park Estate Road traffic wanting to travel east from Hugh Green group will start favouring a signalised intersection over alternative priority controlled intersections. With full development of Hugh Green (1,500 households) a need for a signalised intersection access to Park Estate Road will be triggered by only 354 vehicles per hour on Park Estate Road west of the Hinau Extension (i.e. 1,380 households from development west of Hinau Road).

Table 7 Trigger point for signalisation of Park Estate Road / Hinau Road Intersection

Upgrade	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Signalisation	LOS F on Southern approach right turn	354 vph on Park Estate Rd west of intersection and 600 vph on right turn from south	1,380 hh to the north west of intersection* and 1,500 hh to the south

** Based on 30% of trips from Hingaia SHA developments near Park Estate Road travelling south.*

3.6 Park Estate Road / Great South Road Intersection

The Park Estate Road / Great South Road intersection is currently a stop-controlled intersection, as shown in Figure 4.

The upgrade options are:

- Flush Median on Great South Road (Figure 5) with vehicles turning right out of Park Estate using it as a seagull style intersection (i.e. making the right turn in two movements); and
- Signalisation.

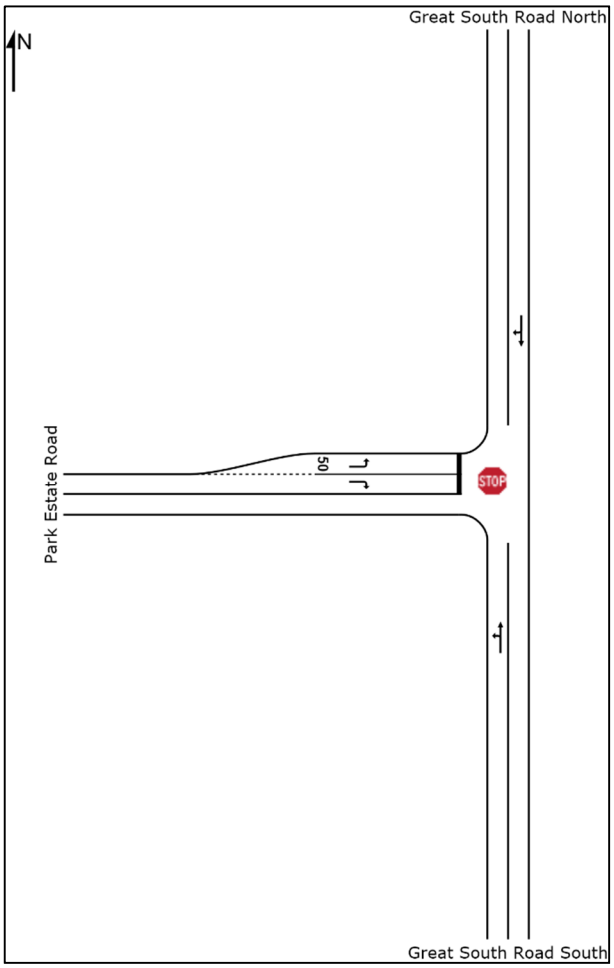

Figure 4 Park Estate Road / Great South Road Existing Layout

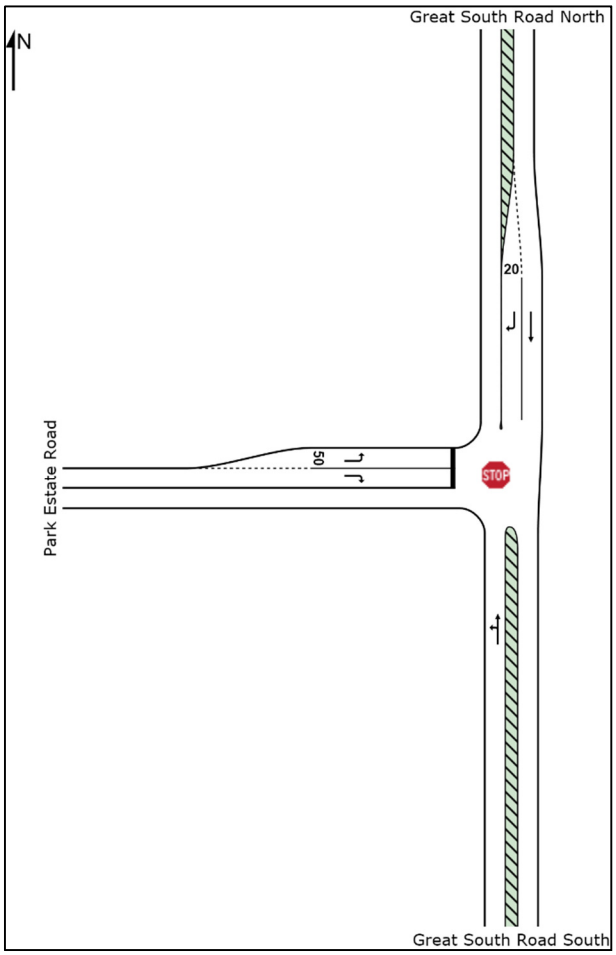

Figure 5 Park Estate Road / Great South Road with Flush Median

It is worth noting that Coultard Terrace is very close to the Park Estate Road intersection and careful consideration of access to/from Coultard Terrace will be required for any design of the Park Estate Road intersection.

Table 8 Trigger points for Park Estate Road / Great South Road Intersection

Upgrade	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Flush Median on GSR	LOS F on right out of Park Estate Road	217 vph additional from Park Estate	709 additional hh in Hingaia SHA*
Signalisation	LOS F on right out of Park Estate Road	418 vph additional from Park Estate	1,366 additional hh in Hingaia SHA*

** Based on 36% of AM peak outbound trips going south (rather than north via Hingaia Road).*

The trigger points identified for the Park Estate Road / Great South Road intersection assume no growth along Great South Road. It is reasonable to assume the number of households that trigger each upgrade will be less if Great South Road traffic volumes increase.

The 1,366 household trigger point for signalisation of the intersection assumes that all traffic turning right out of Park Estate Road will choose to use the flush median to make the right turn in two stages. It is unlikely 100% of right turners will use the flush median; therefore, fewer than 1,366 households is likely to trigger a need for signalisation. A more reasonable trigger point would be 1,000 households (i.e. assuming half the right turners choose to use the flush median).

3.7 Hinau Road Extension

The Hinau Road extension is required for a number of purposes:

- To provide access to properties along its edge;
- To function as a collector route linking southern Hingaia to northern Hingaia and offering an alternative route to Kuhanui Drive (Kuhanui Drive will have a similar function and will act as an alternative to Hinau Road);
- To provide a direct pedestrian and cycling link from the south of Hingaia (the northern portion of the road has already been constructed with a shared path); and
- To provide for bus routeing between south Hingaia and Hingaia Road / Harbourside Drive.

Given the two traffic functions of the Hinau Road Extension above, there are two modelling based trigger points for its construction:

- As development occurs along its frontage; or
- As alternative routes exceed their functional capacity.

According to ATCOP, collector roads can carry up to 10,000 vehicles per day with up to four lanes (i.e. 2,500 vpd per lane) and local roads can carry up to 5,000 vehicles per day with two lanes (i.e. up to 2,500 vpd per lane). These are the upper limits, not target values.

Kuhanui Drive will be the closest alternative north-south route to the Hinau Road extension. It will operate as a collector route with two lanes. When Kuhanui reaches a trigger value of 2,000 vpd per lane (i.e. 80% of maximum value), this could trigger the need for the Hinau Road extension. Peak hour traffic of 200vph would equate to an approximate daily traffic volume of 2,000vpd.

It is important to note that the above figures are based on traffic flows alone and that there are other factors to consider in the timing of this road such as urban design, residential amenity, cyclist safety, legibility, network resilience and balanced traffic flows.

The lack of this road could also have other adverse traffic effects due to re-routing of traffic flows from the Hugh Green site. Such traffic is likely to be concentrated / redirected onto Park Estate Road, which could have adverse traffic effects on the functioning of Great South Road and its intersection with Park Estate Road. Without the Hinau Road extension, approximately 16% of Hugh Green traffic will use Great South Road to travel to/from the Papakura Interchange in the AM peak and 27% of Hugh Green traffic will use Great South Road to travel to/from the Papakura Interchange in the PM peak. These effects have not been accounted for in the modelling.

Table 9 Traffic trigger point for construction of Hinau Road Extension

Upgrade	Triggered By	Trigger Point for Improvement	
		Peak Hour Traffic (vph)	Households
Construction of Hinau Road Extension	Development adjacent to road	n/a	n/a
	Capacity of Kuhanui Drive	200 vph one-direction on Kuhanui Drive	2, 127hh in Hingaia SHA i.e. 54% of development *

** Based on traffic volumes travelling southbound along Kuhanui Drive in the AM peak, which consist of 18% of households within Karaka Lakes, 8% of households within Sam Huo, 3% of households within Hayfield, 3% of households within KARLA, and 17% of households within Hugh Green.*

3.8 Hingaia Road Widening

The need to widen Hingaia Road to four lanes is largely drive by poor levels of service at side roads. The performance of collector routes accessing Hingaia Road decreases as increasing traffic volumes require longer green times to clear the signalised intersections.

The triggers for widening Hingaia Road to four lanes are discussed in sections 3.2.2 (Kuhanui Drive Intersection) and 3.3.2 (Oakland Road intersection).

3.9 Park Estate Road Widening

Park Estate Road is narrow with no shoulder, line marking, or pedestrian facilities. In its current state, it does not meet AT Code of Practise (ATCOP) standards for a local road. A local road cross section should include at least 3m wide traffic lanes, footpaths, and shoulder or parking space. With full build out of Hingaia SHA, Park Estate Road will function as a collector road, which in addition to the local road requirements should also include provision for cyclists and may require wider traffic lanes than a local road.

The need to widen Park Estate Road will largely be driven by safety and the changing function of Park Estate Road rather than traffic capacity.

It is currently a cul-de-sac but with Stage 1b of the Karaka Lakes South subdivision, it will become a through route between Hingaia and Great South Road. It will also start functioning as a pedestrian route for schoolchildren in Hingaia accessing schools on the eastern side of SH1. As the only east west route across SH1 that does not have major intersections along it, it will also likely be an attractive route for cyclists. To ensure all modes are catered for safely, Park Estate Road will need to be upgraded to (as a minimum) include:

- 3m wide traffic lanes (1 in each direction);
- Shoulders to provide a slightly wider cross section, which is particularly important for heavy vehicles such as buses, refuse trucks, and removal trucks. If shoulder space is 1.8m wide it could also be used by on-road cyclists in the absence of other cycle facilities; and
- 2.0m wide footway on at least one side of the road.

The minimum standards described above do not meet ATCOP standards for a local or collector road but will at least address the function and safety issues along Park Estate Road. Other cross-

sections may achieve the same results (e.g. a shared cycle/pedestrian path would reduce the need for wide shoulders to cater for cyclists).

As further development occurs in Hingaia SHA, Park Estate Road can be upgraded to ensure it continues to meet standards for its function. Parking may not be required and will depend on the nature of development adjacent to Park Estate Road.

The local road capacity of 2,500 vehicle per day per lane will be reached on Park Estate Road with approximately 450 households (based on a 65/35 directional split of traffic and 0.85 trips per household in peak periods).

4 Conclusions

The trigger points that have been determined are approximate only. Table 10 summarises the trigger points for each upgrade.

Table 10 Trigger Point Summary

Location	Upgrade	Trigger Point (households)
Hingaia Road / Harbourside Drive Intersection	Dual right turn from south	318hh increase to the south or 715hh increase in Hingaia
	Full upgrade	1,072hh increase in Hingaia (or 1,609hh increase in Hingaia if LOS E accepted on Hingaia Rd Right turn)
Hingaia Road /Kuhanui Drive Intersection	Signalisation	49 hh increase from south and 140 hh increase from north
Hingaia Road / Oakland Road Intersection	Signalisation (as T-intersection)	718 hh on Oakland Road
	Signalisation (as 4-arm intersection)	576 hh on Oakland Road (with very low hh on southern approach) or 668 hh in Hingia SHA split between south and north of the intersection
Park Estate Road / Kuhanui Drive Intersection	Signalisation	Not required with expected traffic volumes
Park Estate Road / Hinau Road Intersection	Signalisation	1,380 hh to the north west of intersection if Hugh Green is fully developed
Park Estate Road / Great South Road Intersection	Flush median on Great South Road	709 hh increase along Park Estate Road
	Signalisation	1,366 hh increase along Park Estate Road
Hinau Road extension	New route	2, 127 hh in Hingaia SHA (54% of development that use Kuhanui Drive as an alternative route)
Hingaia Road Widening at Kuhanui Drive[4]	4 laning	1,295 hh increase in Hingaia SHA
Hingaia Road Widening at Oakland Road[4]	4 laning	1,532 hh within Hingaia SHA (1483 to south and north of Hingaia and 5% growth of Hingaia Rd traffic) or 890 hh on south and north with 100% increase of Hingaia Rd traffic
Park Estate Road Widening	Widening to local road standard	Any increase of hh (the road is already below standard for a local road)
	Widening to collector road standard	450 households or as function changes

[4] Four lane trigger points for Hingaia Road have been determined separately for the Kuhanui Drive and Oakland Drive intersections. However, it will be more cost effective to four lane all of Hingaia Road (at Kuhanui Drive and Oakland Road) in one stage.

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