Attachment 1

Response to Drury East Modelling Report - Clause 23

Attachment 1: Response to Drury East Modelling Report – Clause 23 Information Requests

RFI Number	Request	Response
TM1	Please update Tables 2-6 and Table 5-1 to include whether projects are "funded" (and if so, what is the funding level and scope), "committed" (in the RLTP but without funding), or "uncommitted". Please identify who is the party responsible for delivering each of these projects. If there is no mechanism to deliver infrastructure that requires third party land, third party agreement or third-party funding, then the reasonableness of including the upgrade should be discussed within the report.	Discussions on the scope, funding, and timeframe of all transport infrastructure considered in the transport assessment have been included in Attachment 4 (Revised Modelling) as well as the revised threshold tables for clarity (Attachment 2 and 3). In addition, the Plan Change has also been amended to require the early delivery of cycle and pedestrian connections to the Drury Central train Station. These upgrades will be required prior to or concurrently with the development. The funding and delivery of these required local upgrades will be addressed through a Developer Funding Agreement which is currently being negotiated. It is expected that this will be finalised prior to a hearing on the Plan Change. It is expected that bus services in areas outside the walking catchment of the Drury Central train station will be provided by AT as demand arises.
TM2	Please comment on the "what", "how", "when" and "by whom" for developer delivered infrastructure required to support the PPC. This should include discussion about the staging of infrastructure such as fit for purpose rail station facilitates, connections to the rail station (including walk, cycle and bus connections to internal development), safety and walking and cycling connections between each PPC area as progressive development occurs.	Refer to Transport Request 1.
TM3	Please confirm whether local upgrades include provision for public transport and active modes infrastructure, and if so "what", "how", "when" and "by whom". Please confirm that the upgrades proposed can be achieved within the existing legal road, or by vesting private property owned by Kiwi Property, FHLD, or Oyster.	Refer to Transport Request 20.

TM4	Please provide further information on transport mitigation measures and triggers with a focus on safety and alternative transport modes. This should draw on the findings of the modelling report, but importantly consider the upgrades and improvements needed to achieve safety outcomes, and active mode and public transport uptake from the outset. At this time the upgrade timing seems to be determined by capacity, rather than safety and the desire to encourage alternative travel modes.	Refer to Transport Request 19.
TM5	Section 2.7.3.1 of the report states that modelling outputs forecast 22,000 – 31,000 vehicles per day on Waihoehoe Road and Great South Road. The author references the Highway Capacity Manual, which indicates a four-lane corridor. While this reference to the Highway Capacity Manual provides an assessment of capacity, it is unclear whether consideration has been given to other outcomes, such as Place. The report should also reference Auckland Transport's Roads and Streets Framework, which includes consideration of place value. Please provide a discussion on how the proposed local road upgrades align with Auckland Transport's Roads and Streets Framework and that being investigated and pursued by the Supporting Growth Alliance, and in particular, how the proposed mitigation for Waihoehoe Road is consistent with that which AT will be seeking designation for.	The revised modelling has shown a significant traffic flow reduction on Waihoehoe Road as a result of revised infrastructure upgrades and their timeframe. Therefore, capacity-wise, this no longer requires widening of the corridor for general traffic and as such, is generally consistent with the proposed mitigation for Waihoehoe Road which AT will be seeking designation for.
TM6	Please confirm what assumptions were included in the model regarding enabling rail as a transport option prior to a fully functional rail station being delivered. Provide commentary on whether these mode share assumptions are likely to align with the user perception of a "temporary" rail station or a development strategy which may start from the south, rather than around the station itself.	Refer to Transport Request 21.
TM7	Please comment on the "what", "how", "when" and "by whom" for the third party delivered infrastructure required to support the PPC. This should include discussion about the staging of infrastructure to provide for a safe network which enables walking, cycling, and public transport trips in line with the mode share assumptions made in the modelling report.	Refer to Transport Request 1.

TM8	While the government has provided support around major infrastructure projects, the applicant will need to confirm the "what", "how", "when" and "by whom" for the infrastructure required to support the PPC. Confirmation should include how funding is assured, rather than suggesting there is a commitment.	Refer to Transport Request 1.
TM9	We recommend that feedback is sought from Auckland Transport and the NZ Transport Agency regarding the access strategy for the Metropolitan Centre. This feedback should be included and discussed within the modelling report.	In the past few years, multiple meetings have been held between the Plan Change team, AT, NZTA and SGA where the initial concept design of the access strategy for the Drury Metropolitan Centre was introduced. Subsequently, the Plan Change team received feedback on the design, which has then been incorporated in the current concept design of the direct access. This conversation will continue, with more detailed discussions with NZTA to take place over the next few months. The Plan Change team anticipates having much more clarity on this matter in time for the Drury East Plan Change hearing.
TM10	Section 3.1.2 states that the Drury Interchange upgrade is planned to be completed in 2024 but the report does identify the source of this information. We understand that the widening of SH1 between Papakura and Drury may be completed by 2024, where this may include some tie in improvements at the Drury Interchange (i.e. northbound ramp configurations). The extent to which the Interchange will be upgraded however needs to be confirmed. We recommend that feedback is sought from the NZ Transport Agency regarding the completion of the Papakura to Drury project, and scope of upgrades to the Drury Interchange. This feedback should be reflected in the Saturn model.	Similar to the above, multiple discussions have been held in the past year regarding the timeframes for the Papakura to Drury project, which has been considered in the transport modelling exercise. The potential upgrades to the Drury Interchange was discussed, however since further information regarding the scope of the upgrade is not available to the Plan Change team, Stantec has made some logical assumptions in regard to how this is coded in the model to progress. It is noted all parties have agreed that continuous liaison will occur between NZTA and the PC team in order to align infrastructure upgrades and timeframe.
TM11	Please comment on the feasibility of the proposed multiple upgrades to the Waihoehoe Road/Great South Road intersection, compared with implementing one or two upgrades to achieve the same result. Consideration should be given to the disruption to the transport network and provision for all modes of transport.	Refer to Transport Request 5.
TM12	Please include a summary of the findings from the Drury East Modelling Report Rev B, dated 18 June 2019, within the modelling report or otherwise provide this report for review.	Please refer to Attachment 6 to the Transport RFI response.

TM13	Please clarify the basis for the assumption that the completion of State Highway 1 works north of Drury Interchange will alleviate pressure on the transport network, including the Great South Road/Waihoehoe Road intersection?	It is our understanding that NZTA is committed to providing an additional general traffic lane, northbound and southbound, which will increase the capacity for general traffic. This was re-confirmed at the meeting with NZTA in December 2019. NZTA has stated that they are still investigating opportunities for a dedicated PT lane and/or HOV lane, however this will be in addition to the third general traffic lane.
TM14	Please comment on the assumed allocation of lanes on State Highway 1 north of Drury Interchange (e.g. general traffic, high occupancy priority, bus lane, etc)?	The SH1 north of Drury has been assumed as 3 lanes of general traffic northbound and southbound, in line with the current NZTA thinking and as confirmed at the meeting between NZTA and the Plan Change team in December 2019.
TM15	Section 3.2 of the report states that the northbound on-ramp capacity at Drury Interchange will be "doubled". Please clarify how this will be achieved, and discuss any downstream effects on State Highway 1? We note that the on ramp in the model already includes a two-lane ramp meter and bypass lane.	Section 3.2 of the report does not state that the northbound on-ramp capacity will be doubled. The on-ramp capacity is constrained by the ramp metering configuration. In order to reduce the delays, the ramp signal phasing was adjusted and this necessitated the need for an additional downstream lane. Note that the model does not already include a two-lane ramp meter and bypass lane (and that the SATURN model does not have separate HOV class to use such a lane anyway). No significant downstream effects on SH1 resulted from the increase in on-ramp throughput. Note that the modelling of the recently released revised infrastructure programme does not require capacity change to northbound on-ramp.
TM16	Please comment on the potential benefit of a high occupancy vehicle/transit lane/truck bypass lane that the northbound on-ramp capacity at Drury Interchange?	Inclusion of a truck/HOV bypass lane will increase the 'ramp signal' capacity but may overload the single lane on-ramp downstream of the ramp signal. Discussion on the benefits of truck/HOV bypass lane operation is beyond the original scope of the ssessment/modelling.
TM17	Section 2.2.1 of the modelling report should clearly state whether the PPC land uses were updated in the macro simulation model (MSM) to obtain updated trip demands. Please confirm whether the MSM outputs include the PPC land-use scenario?	The MSM outputs were based on an earlier iteration of land use assumptions. In order for the modelling to proceed in a workable timeframe the MSM outputs were pivoted around this initial land use, much the same as intermediate staging forecast years.
TM18	Please confirm the land-use assumptions used in the traffic modelling, including outside the PPC area, and whether these assumptions match the current land-use assumptions from B&A? We suggest that these assumptions be tabulated in the modelling report.	Within the PPC area, the decade-by-decade (2028, 2038, 2048) land use match the current land-use assumptions from B&A, dated 1 July 2019. Modelling of the years pre-2028 has taken into account the estimated yearly development staging which was available in a memo by B&A dated 27/06/2019 (can be provided on request).

		The land use assumptions outside of the PPC area is as per the MSM land-use assumptions.
TM19	Please include MSM scenario 11.4 land-use assumptions within Table 2-1?	Noted.
TM20	The report states that "The employment assumptions for Drury East have been adjusted using an estimated target build-out of …. 5,090 jobs", however Table 2-1 states an estimated 15,420 jobs. Please clarify the number of jobs estimated within the PPC area?	5,090 is the within the 'UDF' area (PPC areas) only where 15,420 is combination of zones 550,551,554,555,556 (all of Drury East)
TM21	The report states that the SGA ITA does not clearly outline the land-use assumptions for each year. Instead, the report has used a growth rate per year based on Table 7-3 of the Supporting Growth Alliance ITA. Based on the methodology applied by Stantec, it suggests that an arithmetic growth outcome is assumed, rather than a stepped outcome. We note that Section 7.2.2 of the Supporting Growth Alliance ITA provides a description and analysis of how intermediate years (2028 and 2038) have been provided. Please reconsider whether the SGA ITA provides enough material from which to appreciate the intermediate years (2028 and 2038) from which comparisons can be assessed. Please confirm if information from Section 7.2.2 of the Supporting Growth Alliance Drury ITA has been incorporated within the modelling report.	Yes, the modelling report has incorporated information from Section 7.2.2 of the SGA Drury ITA. As paragraph 7 of Section 2.3 states "*… using the growth from 2016 and 2048+, as outlined in Table 7-3o f the SGA ITA and the growth rate per year in Figure 7-3 (within Section 7.2.2) of the ITA…"*
TM22	For clarity please revise the header of Table 2-2 to "MSM Land-use Assumptions".	Noted.
TM23	Section 2.4 notes that trip generation data from the MSM model was validated in 2016. Section 3.1 uses MSM 2016 outputs to determine whether infrastructure beyond that assumed in the Supporting Growth Alliance ITA is required before 2028. How does the MSM model perform for Drury? Assumed car trip generation rates assumed a level of PT usage. Table 2-4 indicates that MSM assumes 7% of trips by PT for trips originating in Drury during the AM peak. However, the only PT service in Drury is the 376 Service to Papakura, which is a local service at low frequency. We request that the underlying	There is little available data to validate to existing conditions (and MSM itself is not calibrated/validated to existing conditions), and roadworks on SH1 further complicate the issue. Tests carried out in the SATURN model to reflect observed SH1 capacity indicated reasonable response. Census 2013 household travel survey data indicates a PT mode share of around 3~8% for Drury and surrounding Area Units (the AU for Drury is particularly large and not wholly representative of Drury East PPC). MSM 2016 mode share is around 7%. Whilst the MSM model may have high inaccuracy in PT share,

	assumptions in MSM be considered and cross checked, before accepting the MSM prediction and using this as a basis for forecast modelling of Drury East. Please provide evidence that the MSM model reflects existing traffic conditions and mode share splits to an acceptable degree of accuracy for the Drury area?	e.g., 100% if 3% versus 6%, the error in car trips is much lower due to the small percentage of PT trips. Whilst these inaccuracies are considered acceptable for this type of model it is noted that good validation does not guarantee good forecasting. This is especially true if there are major infrastructure and land use changes.
TM24	Section 3.1.2 indicates that, in absence of a direct vehicle connection to the Metropolitan Centre, the public transport mode share needs to be 10% in 2026 and 12% in 2028 for the Great South Road / Waihoehoe Rd roundabout to perform acceptably. The author states that this mode share is very likely to be achieved. Further explanation is required of how the 10% and 12% public transport mode share will be achieved, noting that the modelled baseline requires validation. Please provide further discussion on how the target public transport mode share for 2026 and 2028 is achieved and what the impacts are on the operation of the Great South Road/Waihoehoe Road intersection if not achieved?	The Government has now confirmed funding of the Drury Central train station and electrification of the Papakura to Pukekohe line with delivery prior to 2026. This provides certainty that Drury Centre and the surrounding residential areas will be enjoy high quality public transport facility and services. The Plan Change has also been amended to require the early delivery of cycle and pedestrian connections to the Drury Central train Station. These upgrades will be required prior to or concurrently with the development, and will be assessed as part of subdivision. The funding and delivery strategy for these upgrades will be addressed in the developers' agreement that will be formed this year. It is also noted that there are various active modes and PT-related upgrades (i.e. bus prioritisation and cycle lanes) being earmarked for Waihoehoe Road, SH22, Bremner and Norrie Road that will further support reduction in car trip and mode shift improvement. The PT mode share "target" of 10% (2026) and 12% (2028) was discussed in the modelling report in relation to the possibility to delay the capacity upgrade to the roundabout. The modelling has used a lower (default) mode share of 9% throughout the first decade modelling. It is noted that this default PT mode share appears low in comparison to Drury West and other metropolitan areas in Auckland (refer to section 2.5 of the modelling report). This has resulted in the roundabout operational failure (LOS F) at 2026, which has then been incorporated in the threshold table for the respective year. It is noted that this result is superseded by the revised modelling (refer Transport RFI Response Attachment 4).

TM25	Table 2-3 shows a reduction in the car trip rate from 2016 to 2028, on the assumption that more trips are made by PT. Please confirm if the reduction in the car trip rate assumptions align with the provision of improved PT services. The report should comment on how many trips are expected to use PT, through a mode share assessment. Please provide a public transport mode share assessment that forecasts the number of public transport trips in 2028. Please also comment on any improvements or investment needed to support and enable these trips?	At the RFI meeting between Auckland Transport, Auckland Council, and the Plan Change team, this question was clarified and is now understood to be similar in nature to question above (TM24). This question seeks confirmation that the reduction in car trip rate align with the provision of improved PT services in the first decade. The response to TM24 can be applied to this question.
TM26	Please explain how the difference in public transport usage between Drury West and Drury East, as modelled in MSM, affects the PPC assessment? Please confirm the public transport mode share (2016) for Drury East which has been assumed in the Report, as Section 2.5 in ambiguous. We recommend that this difference is discussed with the Auckland Forecasting Centre to confirm whether adjustments to the MSM model are required.	The public transport mode share for 2016 is as shown in Table 2-4. The difference in public transport usage between Drury West and East results in an increased private vehicle mode split for Drury East. This issue was raised with AFC but given the timetable for this study there was no contingency for re-building the MSM and SATURN models to correct for this. The magnitude of this increase is not considered significant given the primary purpose of the study to broadly assess the infrastructure requirements at 10-year intervals. Furthermore, the assessment of infrastructure requirement is not precise given the overall accuracy of the models used, and the conclusions are based on a range of forecast year results.
TM27	There is potential for additional catchment for the train station from the Auranga development. High quality walking and cycling facilities have been constructed on Bremner Road, these could be extended onto Firth Street and over Great South Road to provide a ready connection to the train station. This may support earlier delivery of the train station and/or train services. Please confirm whether the potential catchment for the train station from the nearby Auranga development been considered, and if so, would provision of a quality walking and cycling connection increase overall public transport mode share and reduce congestion at key constraint points on the network.	Refer to Transport Request 23.

TM28	Please clarify the extent to which the wider network has been considered in the modelling, and what the effects are forecast to be should development occur at a faster rate than anticipated by the FULSS?	The wider network has not been considered beyond the Drury / Paerata / Pukekohe extent. If development occurs at a faster rate than anticipated in other FULSS areas then it is anticipated that these would have a marginal effect on model results and, more importantly, on reported conclusions.
TM29	Section 2.4.1.1 discusses the select link analysis has been undertaken on inbound and outbound trips in peak periods following 2028. Please confirm whether the select link analysis used the Supporting Growth Alliance or PPC Saturn model. Also, confirm what level of development was assumed within the PPC and surrounding areas for each select link analysis assessment. Please confirm whether the select link analysis used the Supporting Growth Alliance or PPC Saturn model, and clarify what level of development was assumed for each analysis?	The SLA used the PPC SATURN model, using the 2028 land use.
TM30	The select link analysis shown in Figures 2-6 and 2-7 of the modelling report shows a much greater use of Great South Road compared to State Highway for northbound trips. This shows a disproportionate level of demand concentrated to Great South Road, rather than using the Drury Interchange. This may be due to delays near Papakura not being represented in the model. The outcome of the select analysis highlights the need to be careful when using the predicted travel patterns when determining infrastructure upgrades. If the directional split at the Great South Road / Waihoehoe Road intersection places too much weight on Great South Road (north), this will cause intersection upgrades to focus on providing too much capacity to the wrong movements or provide more capacity than what is needed. Please provide a wider scope for the select link analysis for northbound trips. This should include consideration of forecast delays at relevant key intersections in Papakura, and a sense check of trip allocation between State Highway 1 and Great South Road (north).	Wider window SLA plots are included as Attachment 7. Predicted travel patterns and infrastructure upgrades are intertwined. The modelling is concerned with whether the proposed infrastructure upgrades are enough to meet the needs of the PPC, not the relative merits and/or exact details of each individual upgrade. The SLA analysis shows a high proportion of Drury trips associated with Papakura, hence the higher use of Great South Road. The only significant delay (5 minutes) in the AM network is on the northbound on-ramp (associated with ramp signal). Removal of this delay only results in a route choice switch of around 100 vehicles, i.e., GSR is still predominate.

TM31	Please provide origin/destination select link analysis for each of the three PPC areas, so traffic volumes, routing, and potential constraint points on the network can be clearly identified.	This request is superseded by the provision of the SATURN model files (revised modelling) to Terry Church on 17/03/2020 as per Terry's request.
TM32	In Section 3.1.1. the author notes that State Highway 1 Papakura to Drury project will have three lanes northbound and southbound, however, the author states that the upgrade is not required to support Drury East development before 2028. However other sections of the modelling report rely on this upgrade to reduce or remove the current level of congestion experienced through Drury (e.g. Section 3.1.2.), yet in this section of the report suggests that the widening is not required. Please confirm the configuration of State Highway 1, between Papakura and Drury, assumed in the PPC Saturn model, and comment on how this effects development within the PPC area?	In the 2019 modelling exercise, general traffic lanes initially assumed in SATURN Modelling, however further testing has been done at a high level to understand if there would be any significant difference in the local network performance should the 3-laning is not implemented until 2028. The tests did not result in any notable differences pre-2028 regardless of whether an additional lane is provided, in terms of interchange performance and GSR/Waihoehoe Rd intersection performance. Therefore, it was concluded that the upgrade is not required from a capacity perspective until 2028.
TM33	Table 3-5 shows a significant increase in vehicles per day on Waihoehoe Road between 2027 and 2028 (17,500 vs 27,700). Please clarify why when other years have much smaller increases. Please explain why the Saturn model shows a significant increase in vehicles per day on Waihoehoe Road between 2027 and 2028?	It is noted that the flow in question is related to the 'no direct access' scenario of the original (now superseded) modelling. Prior to 2028, the network is very constrained and this has significantly limit the capacity of the local network, therefore resulting in lower output flows. In 2028, several SGA assumed infrastructures such as the SH1 3-laning and the new train stations are included in the modelling. This relieved pressure off the network and increase the network capacity, therefore allowing significantly higher flows on the network - in the absence of the direct access, traffic relating to the metropolitan centre will predominately use Great South Road and Waihoehoe Road.

Attachment 2

Revised Threshold - with direct access

Timeframe	Development Threshold			Trip Generation Thresholds				**Revised (2020) Modelling – Infrastructure Upgrades Required**	**Revised Modelling assumptions and other notes (can be provided outside of the table)**
	Residential (Dwellings)	Retail (GFA)	Commercial (GFA)	Inbound Trip (vehicles/hour)	Inbound Public Transport Trip (persons/hour)	Outbound Trip (vehicles/hour)	Outbound Public Transport Trip (persons/hour)		
WITH DIRECT ACCESS									
2026	1,310 units	23,680m^2	13,200m^2	AM: 1,240 PM: 2,080	AM: 50 PM: 330	AM: 1,560 PM: 1,800	AM: 330 PM: 70	**Funded, and assumed to be delivered in NZTA timeframes:** • Drury Central and Drury West train stations – by 2024 • Rail electrification Papakura to Pukekohe – by 2024 • Mill Road (Papakura and Southern) – by 2025/2026 **DTIP Upgrades assumptions:** **Not funded, not required capacity-wise but important for public transport, active modes and safety:** • Waihoehoe Road Upgrade – by 2025 • East West Arterial – Bremner Road realignment and bridge upgrades – by 2026	**DTIP Upgrades Explanation:** <u>Waihoehoe Road Upgrade</u>: Four-laning of Waihoehoe Road between Great South Road / Waihoehoe Road roundabout to Fitzgerald Road. The project SATURN model has not assumed any bus priority lanes, and **has not included any upgrade to the Great South Road / Waihoehoe Road roundabout.** The Waihoehoe Road upgrade is not considered critical from a capacity perspective, due to the output flows on the corridor through to 2048. <u>East West Arterial – Bremner Road realignment</u>: As per the preferred option outlined in the SGA consultation material (Dec 2019), this includes an upgrade (4-laning) to Bremner Road and Norrie Road (east) with a new bridge over Hingaia Stream, new intersections at Creek Street and Firth Street and a closure to Norrie Road (west). **It excludes any upgrade to the Great South Road / Waihoehoe Road roundabout. The Waihoehoe Road upgrade is not considered critical for a capacity perspective, due to the lower flows expected on the corridor through to 2048.** This project is not considered critical from a capacity perspective, due to the output flows on the corridors through to 2048.
2028	2,172 units	39,830m^2	22,200m^2	AM: 1,590 PM: 2,480	AM: 60 PM: 400	AM: 2,040 PM: 2,080	AM: 430 PM: 80	**Funded, and assumed to be delivered in NZTA timeframes:** • Mill Road (Northern) – by 2028 **DTIP Upgrades assumptions:** **Not funded, not required capacity-wise but important for public transport, active modes and safety:** • SH22 Improvements (for future urban extent of SH22) – by 2027 • Jesmond Road Extension – SH22 – NIMT – Burtt Road – by 2027	**DTIP Upgrades Explanation:** <u>SH22 Improvements</u>**:** The model assumes four laning of SH22 between the Drury Interchange and Oira Road (edge of FUZ) and some intersection improvements. **The SATURN model assumes that Great South Road (between the Drury Interchange and GSR/Waihoehoe Rd) will also be four-laned at this point.** The project SATURN model has not assumed any bus priority lanes along the corridor. **However, based on the output flows on Great South Road, four-laning is not actually necessary capacity-wise for general traffic, therefore not restrictive to the implementation of bus priority lane.** Nonetheless, this upgrade is considered important as it will improve public transport and active modes, as well as safety for all users. <u>Jesmond Road Extension – SH22 – NIMT – Burtt Road</u> connection is not considered critical in terms of capacity for general traffic, especially as at this stage it will not have connection to the future Pukekohe Expressway. However this upgrade is important as it provides connection for PT and active modes.
2038	4,640 units	83,960m^2	46,800m^2	AM: 2,670 PM: 3,870	AM: 110 PM: 620	AM: 3,270 PM: 3,410	AM: 690 PM: 140	Upgrade the Great South Road / Waihoehoe Road roundabout to signal. **DTIP Upgrades assumptions:** **Not funded, required capacity-wise:**	This assumes that no capacity upgrade to the Great South Road / Waihoehoe roundabout has taken place until this stage. The upgrade will require 3rd party land take on the Great South Road (north) and Waihoehoe Road (east). Funding and delivery strategy will be discussed between the Plan Change team, SGA and NZTA.

Timeframe	Development Threshold			Trip Generation Thresholds				**Revised (2020) Modelling – Infrastructure Upgrades Required**	**Revised Modelling assumptions and other notes (can be provided outside of the table)**
	Residential (Dwellings)	Retail (GFA)	Commercial (GFA)	Inbound Trip (vehicles/hour)	Inbound Public Transport Trip (persons/hour)	Outbound Trip (vehicles/hour)	Outbound Public Transport Trip (persons/hour)		
								• Pukekohe Expressway Stage 1 – by 2038	Pukekohe Expressway Stage 1: In the absence of information regarding what 'Stage 1' of the expressway includes, the model has assumed a connection between the Drury South interchange to SH22 (Paerata Road) by Glenbrook Road. This upgrade is considered important capacity-wise at this point.
2048	6,428 units	107,650m²	60,000m²	AM: 3,600 PM: 4,990	AM: 150 PM: 800	AM: 4,110 PM: 4,640	AM: 870 PM: 190	Widening of the Great South Road/Waihoehoe Road intersection to provide higher capacity. **DTIP Upgrades assumptions:** **Not funded, required capacity-wise to enable better movement for PT, active modes and general traffic:** • Opaheke North South Arterial – by 2042	The upgrade will require additional land take on all arms of the intersection. Funding and delivery strategy will be discussed between the Plan Change team, SGA and NZTA. Opaheke North South Arterial: New connection to provide for frequent PT, vehicles, and walking and cycling. This is considered important to enable better movement of people within the area, including PT, and walking/cycling. **However, it is considered more appropriate to be a collector road, rather than arterial.**

Other upgrades that are considered in the modelling, however not forming part of the thresholds table above:

Great South Road / Waihoehoe Roundabout interim safety upgrade

Scope: installation of raised table serving as crossing facilities for pedestrians and cyclist at the approaches to the roundabout.

By when: The need for a safety upgrade is not triggered by the Drury East development, rather, it is considered necessary for the overall safety of all road users from the outset. This should be put in place as soon as practicable.

By who: the funding and delivery of this upgrade is to be discussed between the Plan Change team, SGA and Auckland Transport.

SH1 Papakura to Drury South (funded):

Scope: The upgrade has been modelled as 3-lane of general traffic each direction between Papakura and Drury South. The Drury Interchange improvement assumes one additional short-lane on the southbound off-ramp eastbound. The Drury South Interchange assumes a standard interchange configuration. This is considered fairly conservative assumptions given that there is potential for an additional public transport or high-capacity lane on each direction, as well as more advanced upgrades to the interchanges. Regardless, there is very little perceived risk of a significantly late delivery or reduction in scope of the upgrade, and therefore this upgrade has not been included within the thresholds table above.

By when: 2025, as per NZTA timeframe

By who: NZTA

Attachment 3

Revised Threshold - without direct access

Timeframe	Development Threshold			Trip Generation Thresholds				**Revised (2020) Modelling – Infrastructure Upgrades Required**	**Revised Modelling assumptions and other notes (can be provided outside of the table)**
	Residential (Dwellings)	Retail (GFA)	Commercial (GFA)	Inbound Trip (vehicles/hour)	Inbound Public Transport Trip (persons/hour)	Outbound Trip (vehicles/hour)	Outbound Public Transport Trip (persons/hour)		
WITHOUT DIRECT ACCESS									
2026	1,310 units	23,680m^2	13,200m^2	AM: 1,200 PM: 1,880	AM: 50 PM: 300	AM: 1,520 PM: 1,600	AM: 320 PM: 60	**Funded, and assumed to be delivered in NZTA timeframes:** • Drury Central and Drury West train stations – by 2024 • Rail electrification Papakura to Pukekohe – by 2024 • Mill Road (Papakura and Southern) – by 2025/2026 **DTIP Upgrades assumptions:** **Not funded, not required capacity-wise but important for public transport, active modes and safety:** • Waihoehoe Road Upgrade – by 2025 • East West Arterial – Bremner Road realignment and bridge upgrades – by 2026	**DTIP Upgrades Explanation:** Waihoehoe Road Upgrade: Four-laning of Waihoehoe Road between Great South Road / Waihoehoe Road roundabout to Fitzgerald Road. The project SATURN model has not assumed any bus priority lanes, and **has not included any upgrade to the Great South Road / Waihoehoe Road roundabout.** The Waihoehoe Road upgrade is not considered critical from a capacity perspective, due to the output flows on the corridor through to 2048. East West Arterial – Bremner Road realignment: As per the preferred option outlined in the SGA consultation material (Dec 2019), this includes an upgrade (4-laning) to Bremner Road and Norrie Road (east) with a new bridge over Hingaia Stream, new intersections at Creek Street and Firth Street and a closure to Norrie Road (west). **It excludes any upgrade to the Great South Road / Waihoehoe Road roundabout. The Waihoehoe Road upgrade is not considered critical for a capacity perspective, due to the lower flows expected on the corridor through to 2048.** This project is not considered critical from a capacity perspective, due to the output flows on the corridors through to 2048.
2028	2,172 units	39,830m^2	22,200m^2	AM: 1,550 PM: 2,390	AM: 60 PM: 380	AM: 1,990 PM: 1,990	AM: 420 PM: 80	**Funded, and assumed to be delivered in NZTA timeframes:** • Mill Road (Northern) – by 2028 **DTIP Upgrades assumptions:** **Not funded, not required capacity-wise but important for public transport, active modes and safety:** • SH22 Improvements (for future urban extent of SH22) – by 2027 • Jesmond Road Extension – SH22 – NIMT – Burtt Road – by 2027	**DTIP Upgrades Explanation:** SH22 Improvements: The model assumes four laning of SH22 between the Drury Interchange and Oira Road (edge of FUZ) and some intersection improvements. **The SATURN model assumes that Great South Road (between the Drury Interchange and GSR/Waihoehoe Rd) will also be four-laned at this point.** The project SATURN model has not assumed any bus priority lanes along the corridor. **However, based on the output flows on Great South Road, four-laning is not actually necessary capacity-wise for general traffic, therefore not restrictive to the implementation of bus priority lane.** Nonetheless, this upgrade is considered important as it will improve public transport and active modes, as well as safety for all users. Jesmond Road Extension – SH22 – NIMT – Burtt Road connection is not considered critical in terms of capacity for general traffic, especially as at this stage it will not have connection to the future Pukekohe Expressway. However this upgrade is important as it provides connection for PT and active modes.
2033	3,406 units	62,430m^2	34,800m^2	AM: 1,890 PM: 2,860	AM: 80 PM: 460	AM: 2,340 PM: 2,470	AM: 500 PM: 100	Upgrade the Great South Road / Waihoehoe Road roundabout to signal.	This assumes that no capacity upgrade to the Great South Road / Waihoehoe roundabout has taken place until this stage. The upgrade will require 3rd party land take on the Great South Road (north and south) and Waihoehoe Road (east). Funding and delivery strategy will be discussed between the Plan Change team, SGA and NZTA.

Timeframe	Development Threshold			Trip Generation Thresholds				**Revised (2020) Modelling – Infrastructure Upgrades Required**	**Revised Modelling assumptions and other notes (can be provided outside of the table)**
	Residential (Dwellings)	Retail (GFA)	Commercial (GFA)	Inbound Trip (vehicles/hour)	Inbound Public Transport Trip (persons/hour)	Outbound Trip (vehicles/hour)	Outbound Public Transport Trip (persons/hour)		
2038	4,640 units	83,960m^2	46,800m^2	AM: 2,620 PM: 3,730	AM: 110 PM: 600	AM: 3,220 PM: 3,270	AM: 680 PM: 130	Widening of the Great South Road/Waihoehoe Road intersection (on western arm only) to provide higher capacity. **DTIP Upgrades assumptions:** **Not funded, required capacity-wise:** • Pukekohe Expressway Stage 1 – by 2038	The intersection will need to be upgraded on the western arm to provide higher exit capacity. **Note this capacity upgrade could be provided in 2033 instead to minimise upgrade occurrences.** Pukekohe Expressway Stage 1: In the absence of information regarding what 'Stage 1' of the expressway includes, the model has assumed a connection between the Drury South interchange to SH22 (Paerata Road) by Glenbrook Road. This upgrade is considered important capacity-wise at this point.
2048	6,428 units	107,650m^2	60,000m^2	AM: 3,510 PM: 4,910	AM: 140 PM: 790	AM: 4,020 PM: 4,560	AM: 850 PM: 180	Widening of the Great South Road/Waihoehoe Road intersection to provide higher capacity. **DTIP Upgrades assumptions:** **Not funded, required capacity-wise to enable better movement for PT, active modes and general traffic:** • Opaheke North South Arterial – by 2042	The upgrade will require additional land take on all arms of the intersection. Funding and delivery strategy will be discussed between the Plan Change team, SGA and NZTA. Opaheke North South Arterial: New connection to provide for frequent PT, vehicles, and walking and cycling. This is considered important to enable better movement of people within the area, including PT, and walking/cycling. **However, it is considered more appropriate to be a collector road, rather than arterial.**

Other upgrades that are considered in the modelling, however not forming part of the thresholds table above:

Great South Road / Waihoehoe Roundabout interim safety upgrade

Scope: installation of raised table serving as crossing facilities for pedestrians and cyclist at the approaches to the roundabout.

By when: The need for a safety upgrade is not triggered by the Drury East development, rather, it is considered necessary for the overall safety of all road users from the outset. This should be put in place as soon as practicable.

By who: the funding and delivery of this upgrade is to be discussed between the Plan Change team, SGA and Auckland Transport.

SH1 Papakura to Drury South (funded):

Scope: The upgrade has been modelled as 3-laning each direction between Papakura and Drury South. The Drury Interchange improvement assumes one additional short-lane on the southbound off-ramp eastbound. The Drury South Interchange assumes a standard interchange configuration. There is very little perceived risk of a significantly late delivery or change in scope of the upgrade, and therefore this has not been included within the thresholds table above.

By when: 2025, as per NZTA timeframe

By who: NZTA

Attachment 4

Revised Transport Modelling

Revised Transport Modelling – Drury East

Assumptions

Modelling scenarios below, all with and without the direct interchange connection to the metro centre:

- **Year 2026** – with upgrades #1a, 2, 3, 4, 5, 7. Also including sensitivity test (explained below) with higher lower PT mode share representing a scenario without Drury Central train station.
- **Year 2028** – with the upgrades above, plus upgrades #1b, 6, and 8
- **Year 2033** – with all the above upgrades.
- **Year 2038** – with all the above upgrades, plus upgrades #9, 10, 12.
- **Year 2048** – with all the above upgrades, plus upgrade #11.

Table 1: Modelling Assumptions and Infrastructure Upgrades

#	Upgrade Package	Completion	Funding and Delivery
Funded with Committed Delivery Timeframes			
1a	Mill Road (Southern and Papakura Section)	In stages from 2025/2026 to 2027/2028, with consent application lodged by early 2021 for the Southern and Papakura Section. Therefore assuming completion years: • By 2026 : Papakura to Drury South section completed • By 2028: Manukau to Papakura section completed	NZTA
1b	Mill Road (Northern section, i.e Manukau to Papakura)		
2	Drury Central and Drury West stations (funded)	Late 2024	NZTA
3	Rail electrification Papakura to Pukekohe (funded)	Mid – late 2024	NZTA
4	SH1 Papakura to Drury South Widening, interchange improvements and new Drury South interchange, walking and cycling path (funded)	Late 2025	NZTA
Non-funded, target delivery timeframes as per the DTIP staging (Dec 2019), funding and delivery strategy are being explored by Auckland Council, and will be further discussed between relevant parties this year.			
5	Waihoehoe Road Upgrade (Note the model has not included any upgrade to the Waihoehoe Rd/Great South Rd roundabout with this package)	2025	To be confirmed
6	Jesmond Road Extension - SH22 - NIMT - Burtt Road	2027	To be confirmed

7	East West Arterial - Bremner Road realignment and bridge upgrades	2026	To be confirmed
8	SH22 Improvements (for future urban extent of SH22)	2027	To be confirmed
9	Great South Road FTN Upgrade to Papakura	2037	To be confirmed
10	Pukekohe Expressway Stage 1	2038	To be confirmed
11	Opaheke North South Arterial	2042	To be confirmed

We anticipate an early provision of interim safety upgrade to the Great South Road / Waihoehoe Road roundabout, such as raised table for pedestrian and cyclist crossing on all arms. the funding and delivery of this upgrade is to be discussed between the Plan Change team, SGA and Auckland Transport.

Sensitivity Test: Considering the uncertainty around the timeframe for completion of the Drury Central station, and the frequency of services around the time of opening, we will undertake sensitivity tests by adjusting trip rates for prior to 2028 to reflect the no train station situation.

SATURN Network Flows and Delay Output

Refer to Table 3 and 4 for the flows and delays for each modelled year, with and without the direct access.

The results show that the network has acceptable capacity performance throughout the decades, with the longest delay (100 seconds) experienced in 2028 on the northbound on-ramp in AM peak. This is considered minor and considered acceptable. Sensitivity test using an increased trip rate (no Drury Central train station) in 2026 results in practically the same flows and delays than the normal 2026 scenario, indicating that the network has sufficient capacity at that point of time.

SIDRA Intersection Modelling – Great South Road / Waihoehoe Road intersection

Existing Roundabout Performance

Table 2: SIDRA Results - Roundabout vs Signal - WIth Direct Access

With direct access	**Existing Roundabout**		**Signalised Intersection with Full Crossings**	
Year	**DoS**	**Worst LOS**	**DoS**	**Worst LOS**
2026 AM	**0.35**	**B**	**-**	**-**
2026 PM	**0.32**	**B**	**-**	**-**
2028 AM	**0.62**	**C**	**-**	**-**
2028 PM	**0.59**	**B**	**-**	**-**
2033 AM	**0.59**	**C**	**-**	**-**
2033 PM	**0.66**	**C**	**-**	**-**

2038 AM	**0.74**	**B**	**0.85**	**E**
2038 PM	**0.98**	**F**	**0.87**	**E**
2048 AM	**0.64**	**B**	**0.79**	**D**
2048 PM	**2.31**	**F**	**0.90**	**E**

Without direct access

Table 3: SIDRA Results - Roundabout vs Signal - Without Direct Access

Without direct access	**Existing Roundabout**		**Signalised Intersection with Full Crossings**	
Year	**DoS**	**Worst LoS (general)**	**DoS**	**LoS (general)**
2026 AM	**0.59**	**B**	**-**	**-**
2026 PM	**0.49**	**B**	**-**	**-**
2028 AM	**0.74**	**C**	**-**	**-**
2028 PM	**0.97**	**E**	**-**	**-**
2033 AM	**0.86**	**C**	**0.89**	**E**
2033 PM	**1.34**	**F**	**0.94**	**E**
2038 AM	**1.14**	**F**	**0.90**	**E**
2038 PM	**1.49**	**F**	**0.90**	**E**
2048 AM	**1.14**	**F**	**0.79**	**D**
2048 PM	**3.02**	**F**	**0.96**	**E**

Table 2 and Table 3 above show that the existing roundabout has sufficient capacity in the first decade, however needs capacity upgrade by 2038 (with direct access) and by 2033 (without direct access). The SIDRA modelling has assumed and tested some indicative intersection layout, however, **detail design of the intersection, and its funding and implementation strategy will be determined through continuous liaison between SGA, Auckland Transport and the Plan Change team which will occur later this year.**

The modelling has considered active modes and PT, at a high level, through provision of full crossings on all arms of the signalised intersection, and reduction to the lengths of approach and exit short lanes to minimise potential conflict with the potential bus priority corridor (the design is currently being developed by SGA, however is not accessible to Stantec).

Revised Thresholds and Infrastructure Upgrades – refer to Attachment 1 and 2

SATURN Results

Table 4: SATURN results - With Direct Interchange

		Drury Interchange							
		Northbound On-ramp		Southbound Off-ramp		Great South Road Through Eastbound		Great South Road Through Westbound	
WITH DIRECT INTERCHANGE									
Land Use	**Peak**	**Flow (veh)**	**Delay (sec)**	**Flow (veh)**	**Delay (sec)**	**Flow (veh)**	**Delay (sec)**	**Flow (veh)**	**Delay (sec)**
2026	AM	1559	51	986	24	567	22	1311	19
	PM	1098	0	1420	48	229	44	1680	16
2026 – no train station (sensitivity test)	AM	1551	49	987	24	561	22	1313	19
	PM	1121	0	1460	50	232	44	1717	16
2028	AM	1405	111	1100	29	998	25	1303	20
	PM	1217	0	1801	73	275	48	2394	26
2033	AM	1407	102	1250	34	1262	31	1435	22
	PM	1324	0	1778	66	339	49	2419	25
2038	AM	1323	2	1043	25	366	22	1016	38
	PM	1151	0	1440	36	125	52	1349	21
2048	AM	1312	2	1299	32	399	21	1162	37
	PM	1223	0	1797	31	164	51	1467	21

Table 5: SATURN Results - Without Direct Interchange

		Drury Interchange							
		Northbound On-ramp		Southbound Off-ramp		Great South Road Through Eastbound		Great South Road Through Westbound	
WITHOUT DIRECT INTERCHANGE									
Land Use	**Peak**	**Flow (veh)**	**Delay (sec)**	**Flow (veh)**	**Delay (sec)**	**Flow (veh)**	**Delay (sec)**	**Flow (veh)**	**Delay (sec)**
2026	AM	1566	41	984	20	577	13	1326	19
	PM	1085	0	1410	30	288	13	1698	16
2026 – no train station (sensitivity test)	AM	1562	44	986	20	590	13	1337	20
	PM	1094	0	1406	30	289	12	1710	16
2028	AM	1391	89	1098	24	966	14	1212	21
	PM	1224	0	1785	57	340	11	2462	27
2033	AM	1416	83	1228	30	1198	16	1356	21
	PM	1305	0	1771	49	426	11	2587	28
2038	AM	1325	2	1054	19	356	11	1065	35
	PM	1129	0	1531	26	162	11	1402	20
2048	AM	1341	2	1327	26	382	13	1171	35
	PM	1168	0	1987	26	195	11	1609	20

Attachment 5

Response to Request 22 in Oyster Capital PPC - Clause 23

Response to Oyster RFI T22

Please comment on how the ITA responds to the recommended "next steps" identified in

Table 8-1 of the SGA ITA. The report should consider the following

o Land-use changes

o Further consideration of local employment to manage travel demand

o Future Plan Change guidance

o Collection road funding and implementation risks

o Further assessment and design development of network "hot spots"

o Integration with operative Precincts

o Further development of staging strategies

o General design detail

o Further development of the secondary active mode network and greenways

o Further development of rail station access and park and ride strategy

For Oyster ITA

- **Land Use Change**
  The SGA ITA specified that future assessments need to substantiate any changes to land use, and account for the effects of any changes. Specifically relating to the following:
  - Refinements to the location and configuration of the Drury Central and West Centre (and potentially rail station location)
  - The potential to provide further intensification and/or employment around identified rapid and frequent PT corridors to maximise land use-transport integration, and the opportunities to induce modal shift and manage travel demand.

  Stantec Response: The Oyster ITA discusses the proposed land use and development plan, in Section 6 (Proposed Plan Change), and the associated transportation network in Section 8 (Proposed Transportation Network). In conjunction with the adjacent developments by Fulton Hogan and Kiwi, the development traffic effects are assessed extensively through traffic modelling as reported in Section 9 (Traffic Modelling) and Appendix A Traffic Modelling Report. The ITA also features the outcomes of a high-level study on the preferred Drury Central train station location in Section 7.1.1.

  The proposed residential land use within the Oyster Plan Change area is highly complementary to the Metropolitan Centre and the new Drury Central train station. Together with the other proposed land uses (commercial and retail), it supports the desired intensification around the public transport network. The combination of land uses and public transport services will be conducive to mode shift and reduced car trip generation. This is discussed in the Oyster ITA Section 7 Future Accessibility.

- **Further consideration of local employment to manage travel demand**
  The SGA ITA states that provision for further local employment should be considered as part of a travel demand management strategy.

  Stantec Response: As per the response to the integrated land use-transport topic above, the type of land use proposed by Oyster is highly complementary to the adjacent new employment centre. The residential development proposed by Oyster will enable accommodation of more local workforce, which will enjoy high level of accessibility to employment opportunities via active modes or public transport. This has been discussed in the ITA Section 7 (Future Accessibility).

- **Future Plan Change guidance**
  The SGA ITA has developed a draft proposed network required to support the Structure Plan. The SGA ITA states that "further refinement to the network (see below) through future ITAs will be necessary to support Plan Changes. The future ITAs should also provide an evidence base to support the future Precinct provisions, which should seek to adopt and 'follow through' on the network design principles and access strategies identified in this ITA and through the IBC. Provisions may include:
    - Indicative road alignment and road width
    - Transport infrastructure thresholds/triggers, including funding and delivery mechanisms
    - Potential transport and urban form controls".

  Response: The Oyster ITA has addressed the requirements specified above, to the level appropriate for a Plan Change. Indicative road network and cross sections has been discussed in Section 8. The transport infrastructure thresholds are discussed in Section 9 and Appendix A of the Modelling Memo. The aforementioned sections and memo also cover the potential transport and urban form controls that are considered relevant to the Plan Change.

- **Collection road funding and implementation risks**

  The SGA ITA states that there are significant risks associated with sections of collector roads that fall beyond the responsibility of a single developer where roads need to cross significant infrastructure corridors, streams/floodplains, 'hold out' sites, and other third-party land.

  Future ITAs will need to give direction to the Council's Finance and Plans and Places teams to enable the development of an appropriate funding and delivery model to ensure that these connections can be equitably funded and delivered. The information required will include:
  - Identification of the specific sections of collector road which need to cross significant infrastructure corridors, streams/floodplains, and known 'hold out' sites; and
  - Costing and benefit area analysis for each section of the collector road network to assist Council in the design of a funding mechanism.

  Response: The ITA has not addressed the funding and delivery model of the transport upgrades, as these were intended to be part of the land developers agreement (between Kiwi, FH and Oyster), which will be progressed in parallel with the Plan Change lodgement process. Clarification on funded and un-funded upgrades, and progress on the developers funding agreement are included as part of the transportation and planning RFI responses. Further

analysis, such as cost and benefit analysis for sections of roads, is not considered appropriate given the level of planning and design associated with the Plan Change as it stands.

- **Further assessment and design development network 'hot spots'**

  The SGA ITA states that several high-level approaches to site-specific issues have been identified through this ITA where to date the IBC has not provided guidance. Through subsequent ITAs and/or the DBC process, further/more refined assessment and design development of these 'hot spots' will be required to confirm the approaches identified in this ITA are feasible. These items include:
    - Finalisation of the alignment of Mill Road South and configuration of the Drury South Interchange;
    - Drury Centre road access strategy, including the configuration and operational efficiency of the Drury Interchange;
    - Drury West road access strategy and integration with the rail station;
    - Additional crossings of SH1 and the NIMT identified in the collector road network; and
    - Access to the existing strategic network more generally.

Stantec Response: The Plan Change ITA has considered the latest (at the time of writing in November 2019) information regarding the upgrades of SH1 and interchanges, Mill Road, and various other surrounding planned upgrades **within the geographical scope of the study**.

Appendix A of the Oyster ITA, i.e. the Modelling report Section 2.7.1, has reported on the various potential Drury Metropolitan Centre road access strategy. The comprehensive modelling has considered the provision or non-provision of the direct access off the Drury Interchange, which is considered the most desirable from an accessibility perspective. The results of the modelling include the operational efficiency of the Drury Interchange and the Great South Road / Waihoehoe Road intersection.

The revised modelling undertaken in March 2020, following the Plan Change submission and in parallel with the RFI issue, has considered the latest information with regards to the funding, timing and high level scope of various transport upgrades, including Mill Road, SH1 widening and interchange upgrades, new train stations, and various other upgrades to the local network. The outcomes of the modelling are as reported elsewhere in the RFI response.

- **Integration with operative Precinct**

The SGA ITA states that there is ongoing need for integration between SGA's ongoing transport planning and currently operative/live zoned Precincts that are/will shortly be under development. Most obviously, further work through the DBC and future land use planning processes are required to ensure consistency with:

- The Drury 1 (Auranga) Precinct, particularly in respect of the location of the east-west strategic connection;
- The Drury South Precinct, particularly in respect of the location of Mill Road;
- The Franklin 2 (Wesley) Precinct, particularly in respect of how the indicative road network interacts with SGA's preferred location for Paerata Station.

Response: The Plan Change is generally consistent with Council's the Drury Opaheke Structure Plan. Therefore this will ensure that development of the Plan Change area integrates well with the surrounding development.

- **Further development of staging strategies**

The SGA ITA states that the staging strategies outlined in Chapter 9 of this ITA will need to be further developed. This will be enabled by further work on route protection and staging strategy to come through the DBC, as well as the results of the Mill Road Corridor Prioritisation Assessment.

Future staging scenarios will need to demonstrate the effect of project sequencing decisions on network performance, and specifically mode shift and TDM.

Stantec Response: The revised transport modelling has taken into account the latest major project sequencing decisions (funded and un-funded), and the target land use development and staging, and reported on the network performance. This includes consideration for PT and active modes, in terms of identifying which upgrades are required to support mode shift and TDM.

- **General Design Detail**

The SGA ITA states that additional design detail is required across the board, particularly at key intersections. For the transport infrastructure to be route protected by SGA, this will need to occur through the DBC and subsequent NoR process.

Stantec Response: The Plan Change team acknowledges this process and requirement. At the transport RFI meeting on 17/03 with Auckland Council and Auckland Transport, it was discussed and agreed that the design of key intersections and routes will need to be progressed in liaison with SGA throughout the plan change process, with the aim to achieve mutually agreed layout prior to the hearing.

- **Further development of the secondary active mode network and greenways**

The SGA ITA recommends that the secondary active mode network be accommodated primarily on the collector road network, and identifies further opportunities for greenways planning. There will be opportunities through the Plan Change process and future Local Board greenways planning to further refine these networks.

Stantec Response: This recommendation has been considered and incorporated in the general arrangement of the roading network within the Plan Change. The ITA discusses this in Section 8.3 Cross Sections and 8.4. Walking and Cycling.

- **Further development of Station Access and Park-and-Ride strategy**

The SGA ITA outlines a high-level Station Access and Park-and-Ride strategy at section 6.8.3 in lieu of IBC guidance on the matter. Subsequent ITAs and/or the DBC process will need to provide additional detail on the size, access, configuration, demand profile, and pricing of facilities.

Stantec Response: A very high level concept of the roading network around the new Drury Central train station and public transport hub has been included in the ITA, Section 8.1.1. Further study to progress the design of the facilities will occur subsequently, in liaison with relevant parties including Auckland Transport, Watercare, KiwiRail, and developers.

Attachment 6

Drury East 2028 Modelling Report 180619

Drury East - Modelling

This report has been prepared for the benefit of Kiwi Property, Fulton Hogan and Oyster Capital. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to and other persons for an application for permission or approval or to fulfil a legal requirement.

Rev. No.	Date	Description	Prepared By	Checked By	Reviewed By	Approved By
A	11.6.19	Draft	T. Atkinson	D. Hughes	D. Hughes	D. Hughes
B	18.6.19	Draft	T. Atkinson	D. Hughes	D. Hughes	D. Hughes

1 Introduction

To accommodate further growth and to facilitate urbanisation in Drury South, Council is undertaking Structure plans for Drury-Opaheke and Pukekohe-Paerata. The Drury-Opaheke area is divided into Drury East / Central / South (Drury East) and Drury West, as shown in **Figure 1** below. State Highway 1(SH1) separates Drury East and Drury West and provides a direct connection northbound and southbound.

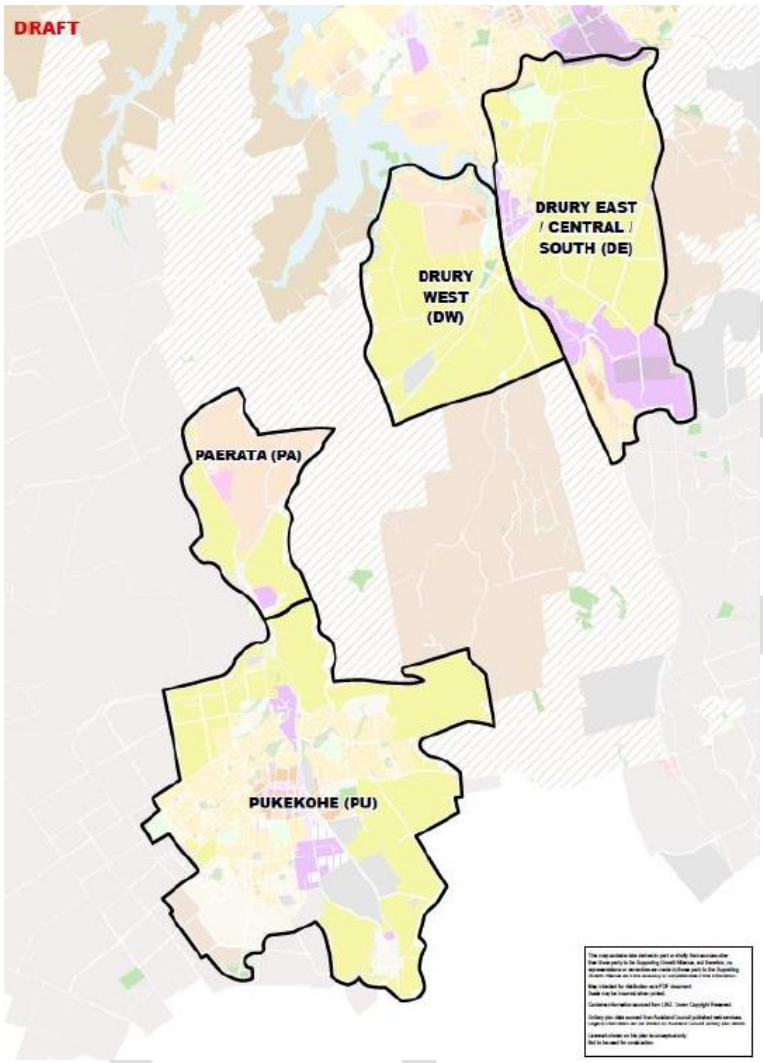


Figure 1: Geographic subdivisions of Structure Plan Areas (draft)

On 2 April 2019, a Draft Integrated Transport Assessment by Supporting Growth Alliance (ITA) was released. This outlined the transportation effects of the proposed Structure Plan areas for Drury-Opaheke and Pukekohe-Paerata, as part of the Council's Future Urban Land Supply Strategy (FULSS). The draft Drury-Opaheke Structure Plan is shown in **Figure 2** below.

Whilst the ITA provides further clarity to the proposed Structure Plan, there are limitations to the level of detail provided. The majority of the modelling methodology and results focussed on the full 2048+ development, rather than the interim years (i.e. 2028 and 2038) and various inputs and assumptions are not clearly defined.

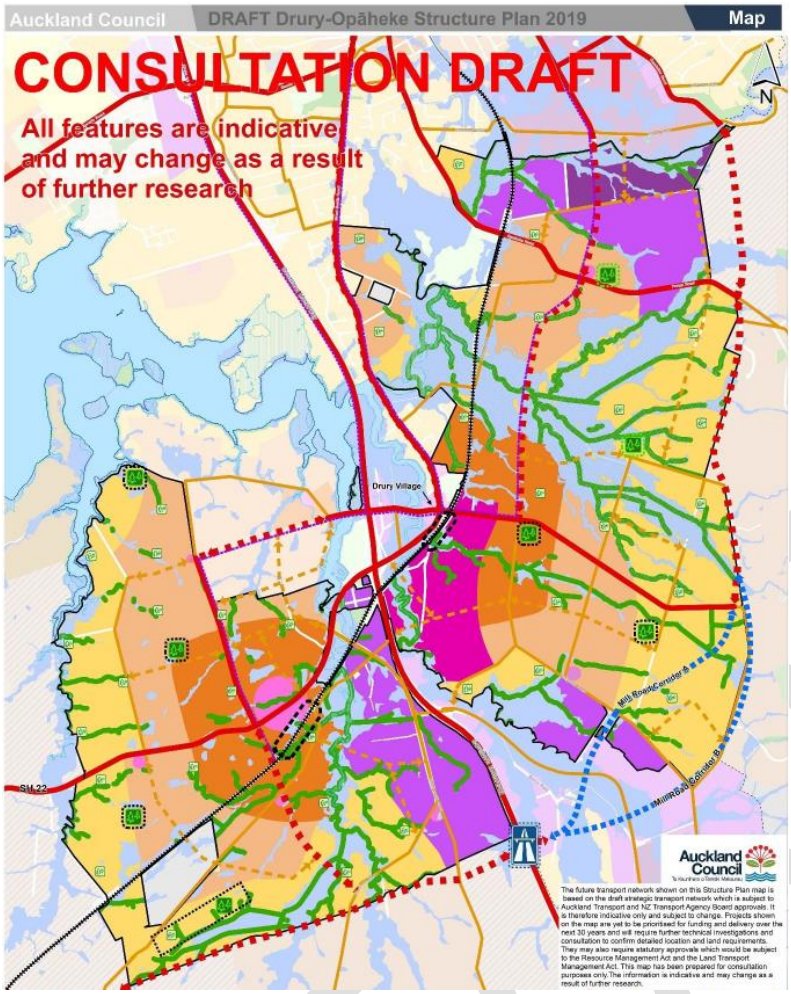


Figure 2: Draft Drury-Opaheke Structure Plan 2019 (from SGA ITA)

Kiwi Property, Fulton Hogan and Oyster Capital have substantial landholdings within Drury East and are interested in undergoing development. Kiwi Property is proposing a Drury Metropolitan Centre (i.e. mixed use) whilst Fulton Hogan and Oyster Capital are both proposing primarily residential development. The areas for each property owner are outlined in **Figure 3** below.

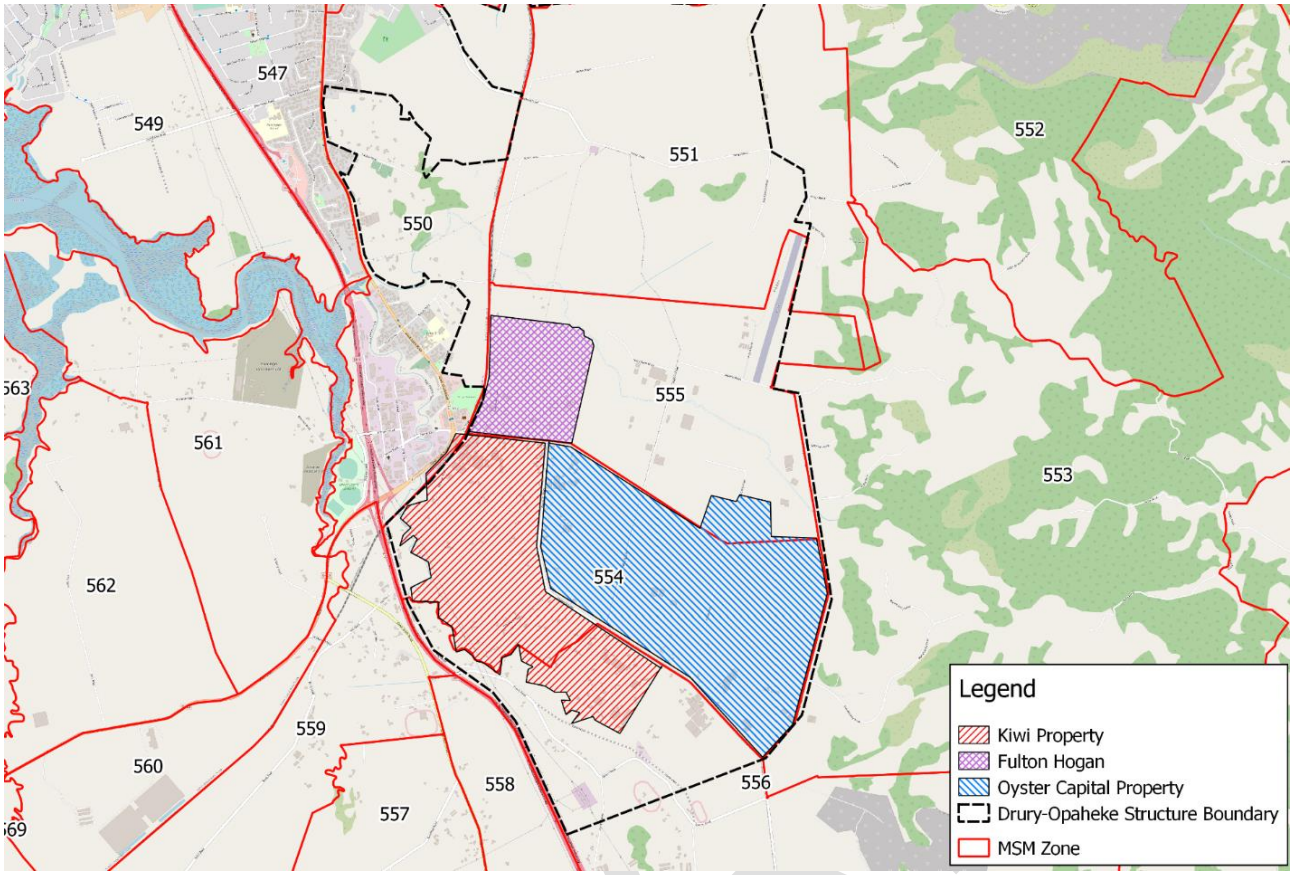


Figure 3: Kiwi, Fulton Hogan and Oyster Capital landholdings in the context of the Draft Structure Plan boundary

The traffic effects due to the proposed developments are required to be assessed on the surrounding network and the access routes to each site also need to be considered. It is considered that Drury East can have multiple connections to the site including the existing Great South Road/Waihoehoe Road route and direct access from the Drury interchange. Connections via Pitt Road, Brookfield / Quarry Road, Pitt Road and Fitzgerald Road can also be provided if desired. Fulton Hogan and Oyster Capital property can be primarily accessed via Waihoehoe Road and Fitzgerald Road. Therefore, the Great South Road / Waihoehoe intersection is critical. The future Mill Road and a connection via Quarry Road have also been considered.

Various modelling scenarios have been undertaken to investigate the potential accesses to the Drury East and the effects of the combined developments on the key access points. The effects on the transport network of bringing forward development in Drury East to Decade 1 have also been considered.

This memo describes the latest modelling methodology (including the land use assumptions for Drury East), outlines the various modelling scenarios investigated and summarises the modelling effects on the relevant surrounding road network. The aim of this memo is to collate the modelling undertaken so far and present the results in one document for ease of reference. The intention is that this memo, alongside the modelling files, become the basis for the individual ITAs for developer plan changes to be written.

2 Modelling Background

The original modelling used Transport for Future Urban Growth (TFUG), now referred to as the Supporting Growth Alliance (SGA), SATURN models based on Auckland Forecasting Centre's (AFC) ART3 models for years 2026, 2036 and 2046.

The ART3 model has since been restructured and rebased to 2016 conditions (previously 2011 based) and is now called the Macro Strategic Model (MSM). There are some notable differences between the previous ART3 model and the new MSM model, as follows:

- The passenger transport model (MPT) has been improved and better integrated with the MSM;
- The MSM model has a revised zone system (more zones) to better represent greenfield areas;
- The land use assumptions between the ART3 model and MSM model were different. MSM results, in terms of demand, were provided by AFC for 2028, 2038 and 2048, and these used land use inputs with Drury variations according to staging provided by B&A in February 2019. Previously obtained ART3 demands were based on standard land use assumptions and the Drury demands were then scaled to match specific Drury land use schedules;
- Some coding differences at the key intersections, in terms of capacity allowance, have been observed between the two models;
- The results/outputs between the current MSM and previous ART3 models are not dissimilar. The earlier modelling also indicated that in 2026 the network would be under considerably more pressure than in 2036 due to the absence of Mill Road and Pukekohe expressway. In particular, the earlier modelling showed high delays at the Drury interchange, although somewhat increased to that reported here now.

An evaluation was then undertaken of the land use assumptions to provide values more reflective of the anticipated development within Drury West and Drury East. These latest assumptions were provided by Barker and Associates, dated Friday 31 May 2019, and included the proposed dwellings for each decade (2028,2038 and 2048) for the Drury-Opaheke area and Pukekohe-Paerata area. The land uses within Drury West included the Auranga development and the land uses in Drury East incorporated the proposed development for Kiwi Property, Fulton Hogan and Oyster Capital. These updated land uses will be discussed in further detail in this report.

2.1 Modelling Methodology

Traffic modelling for Drury has been undertaken using a three-tiered approach, consisting of a macro strategic model, a mesoscopic project model, and a localised microsimulation operational model. The strategic model is the Auckland Forecasting Centre's Macro Strategic Model (MSM). The MSM is an Equilibre Multimodal, Multimodal Equilibrium (EMME) based conventional four stage model[1] covering the wider Auckland area.

The mesoscopic model is a Simulation and Assignment of Traffic to Urban Road Networks (SATURN) based multi-user class (light vehicle and heavy vehicle) user equilibrium assignment model detailing the road network and intersections in the area shown in Figure 6. The mesoscopic model takes the private vehicle and heavy vehicle demands from MSM and further disaggregates the zoning to give a greater level of detail.

The localised microsimulation model is built in Advanced Interactive Microscopic Simulator for Urban and Non-Urban Networks (Aimsun) and covers the Great South Road / SH1 interchange to Great South Road / Waihoehoe Road corridor. Its purpose is to assess the operational performance of these intersections along with any connection to Drury Town Centre. It does this by simulating individual vehicles in sub one second intervals using sophisticated car following and lane changing algorithms. The modelling of signal-controlled intersections is also more complex, with ring-based vehicle actuated phasing providing for phase extension/early cut-off from simulated vehicle detectors.

The zoning areas for the MSM model is shown in **Figure 4** below. Potential staging for the Drury-Opaheke area has also been provided on **Figure 5,** overlaid by the MSM model zoning, to show the comparison in the areas. From this comparison, it can be seen that the MSM zoning areas do not directly align with the proposed staging areas. However, the staging diagram (Figure 5) is indicative only and the household breakdown per stage and decade is discussed further below.

[1] The four stages consist of trip generation, distribution, mode split, and assignment.

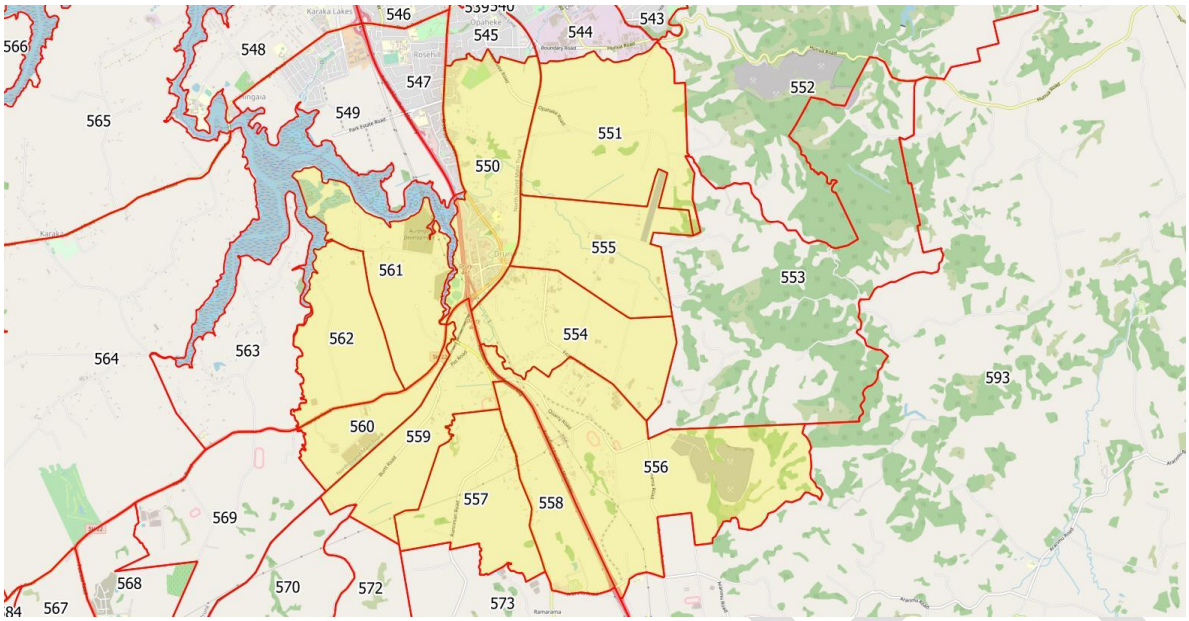


Figure 4: Latest MSM Model Zoning Map

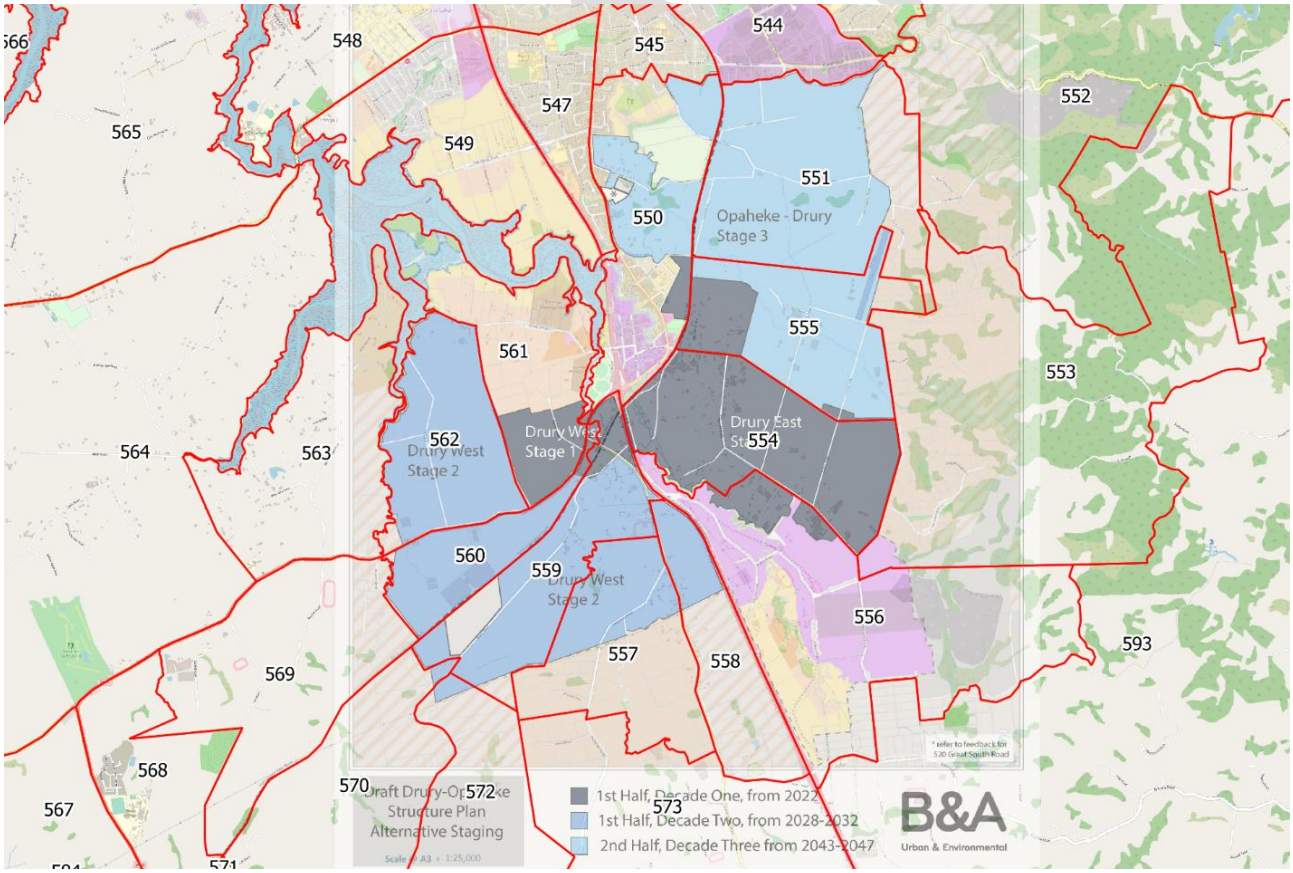


Figure 5: MSM Model areas overlaid on BA Staging Plan

The MSM model was used as a base in the SATURN modelling, to allow more representative and accurate results to be determined. The extent of the Aimsun and SATURN model is shown in **Figure 6** and **Figure 7** below.

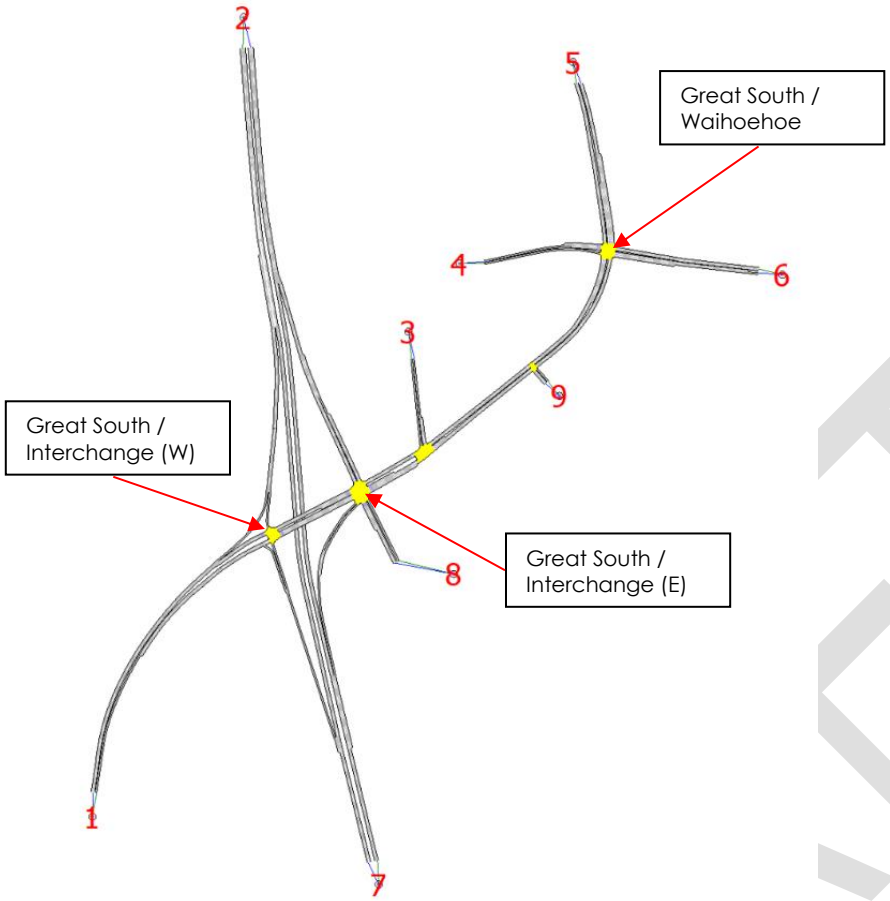


Figure 6: Aimsun Model Extent

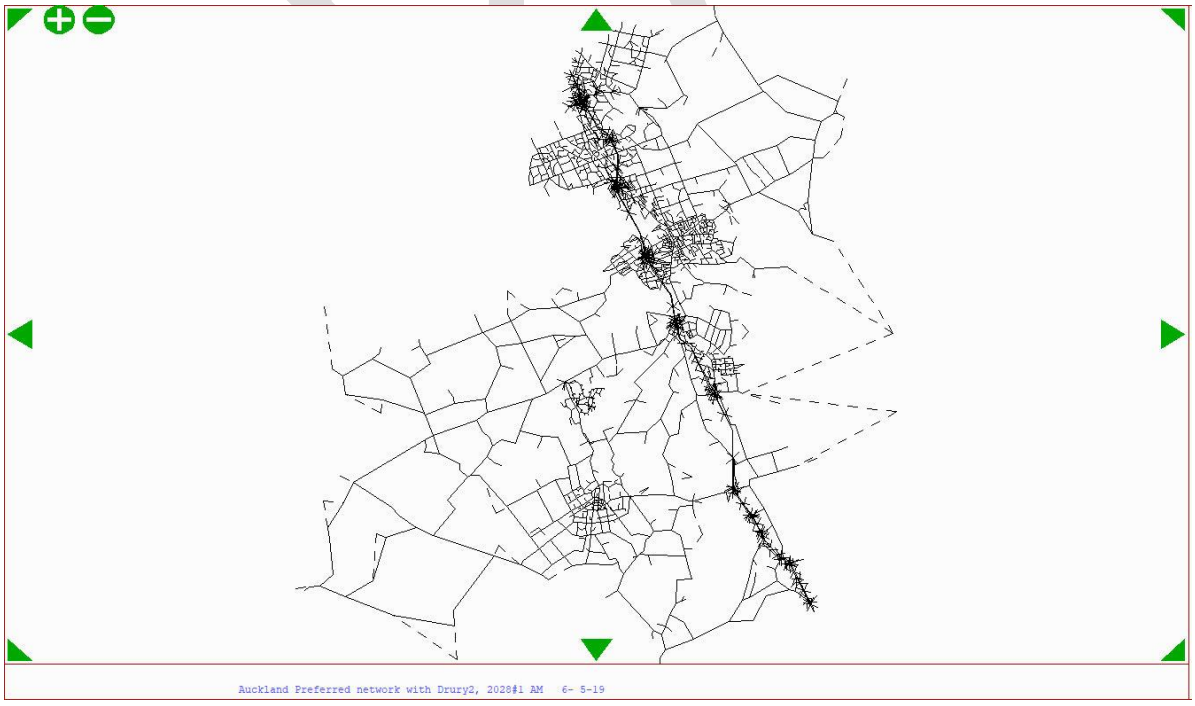


Figure 7: SATURN Model Extent

2.2 Land Use Assumptions

The MSM model was used as a base model for both the Stantec modelling and the SGA model, in order to create a standard baseline. However, the land use assumptions were re-evaluated to reflect the figures provided by Barker and Associates (B&A) dated Friday 31 May 2019, as these were considered to be more realistic yields given constraints and build times. The live-zoned Auranga land (2,650 dwellings), and residential land in Drury South (1,000 dwellings) have been included within the land use assumptions outlined in Table 1 below. Once these areas are incorporated into the SGA model, both sets of assumptions total 26,440 dwellings at 2048+.

B&A has reconfigured the land use assumptions to align with the proposed staging plan for the Drury Structure Plan area (Figure 5) and refined the yield predictions for areas already under development at Auranga and Drury South. It is noted that the assumptions are still considered conservative, as considerable development has been predicted for areas that face unresolved environmental issues (such as the Opaheke flood plain).

The difference in the new land use assumptions and the previous model land use assumption from February 2019 is a significant reduction (approximately 40% for 2028 and 2038). However, in relation to the wider context of the area, it is considered that the previous MSM results can be refactored, thus bypassing the need for a new run (and associated delays). This is a valid approach and is unlikely to have a significant impact on the accuracy of the modelling results.

The SGA ITA does not clearly outline the land use assumptions for each year and therefore it cannot be stated with certainty (as the modified version of the model could not be obtained). However, using the growth from 2016 and 2048+, as outlined in Table 7-3 of the SGA ITA, and the growth rate per year in Figure 7-3 of the ITA, a comparison between the number of households could be estimated for Drury West and Drury East. Our latest land use assumptions and the SGA land use assumptions can be observed in **Table 1**.

Table 1: Land Use Assumptions for the latest B&A and SGA Land Use Assumptions for Drury- Opaheke Area

	Drury West				Drury East			
Latest MSM Model Land Use Inputs (Reduced Land Use dated 31.5.19)								
	2016	**2028**	**2038**	**2048+**	**2016**	**2028**	**2038**	**2048+**
Population[2]	943	3887	15234	37413	2710	9311	18016	29425
Households / Dwellings	357	1482	5928	14946	962	3407	6892	11494
Employment / Jobs[3]	565	1540	3247	4163	1543	5787	12086	15420
Council Land use scenario and yields (provided within the SGA ITA)[4]								
	2016	**2028**	**2038**	**2048+**	**2016**	**2028**	**2038**	**2048+**
Households/Dwellings	357	2221	7701	12014	962	2307	7488	10776

Due to the staging changes, some differences can be observed between the B&A land use assumptions and the SGA households estimated from the ITA. Overall, the latest model assumes a slightly higher land use for the 2028 and 2048 years (361 and 2,369 more respectively) and assumes 2,369 less for the 2038 year. This difference in 2048 is assumed to be due to the live-zoned areas as discussed above.

[2] The population land use assumptions were not provided by B&A. These have been estimated using a ratio of the old households / new households

[3] The employment land use assumptions were not provided by B&A. These have been estimated from the Stantec Drury Modified MSM run.

[4] The SGA households have been assumed from the information provided with Table 7-3 and Figure 7-3 within the ITA. These cannot be confirmed with certainty as the land use assumptions per decade are not outlined within the ITA.

Table 2: Land Use Assumptions for the latest B&A and SGA Land Use Assumptions for Pukekohe - Paerata Area

	Pukekohe - Paerata			
Latest MSM Model Land Use Inputs (Reduced Land Use dated 31.5.19)				
	2016	**2028**	**2038**	**2048+**
Population[5]	23141	30885	46131	49251
Households / Dwellings	8185	11220	17230	18975
Employment / Jobs[6]	8903	11702	14659	16235

Table 2 does not include the Council land use assumptions, as the yearly breakdown could not be determined from the SGA ITA information provided. Therefore, these could not be accurately assumed.

The land use assumptions, per MSM zone, have also been provided for households and employment in **Figure 8** and **Figure 9** below for the Drury-Opaheke area only. The full household, employment and population land use assumptions are broken down per MSM zone and decade (2028, 2038 and 2048+) in **Appendix A** of this report.

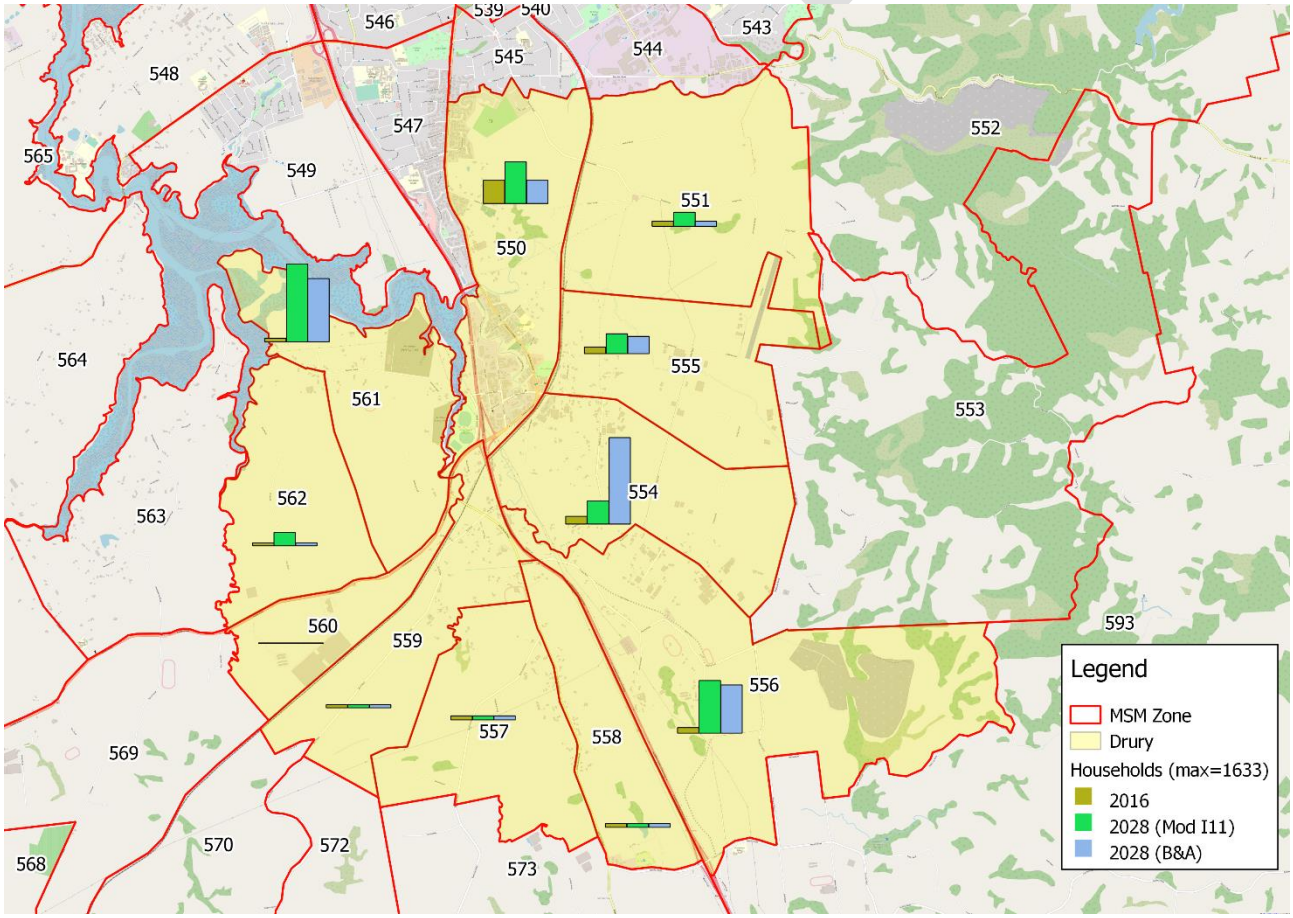


Figure 8: Households for 2016, 2028 (MSM standard land use assumptions) and 2028 (B&A Land use assumptions) per MSM Zone for Drury-Opaheke Area

[5] The population land use assumptions were not provided by B&A. These have been estimated using a ratio of the old households / new households

[6] The employment land use assumptions were not provided by B&A. These have been estimated from the Stantec Drury Modified MSM run.

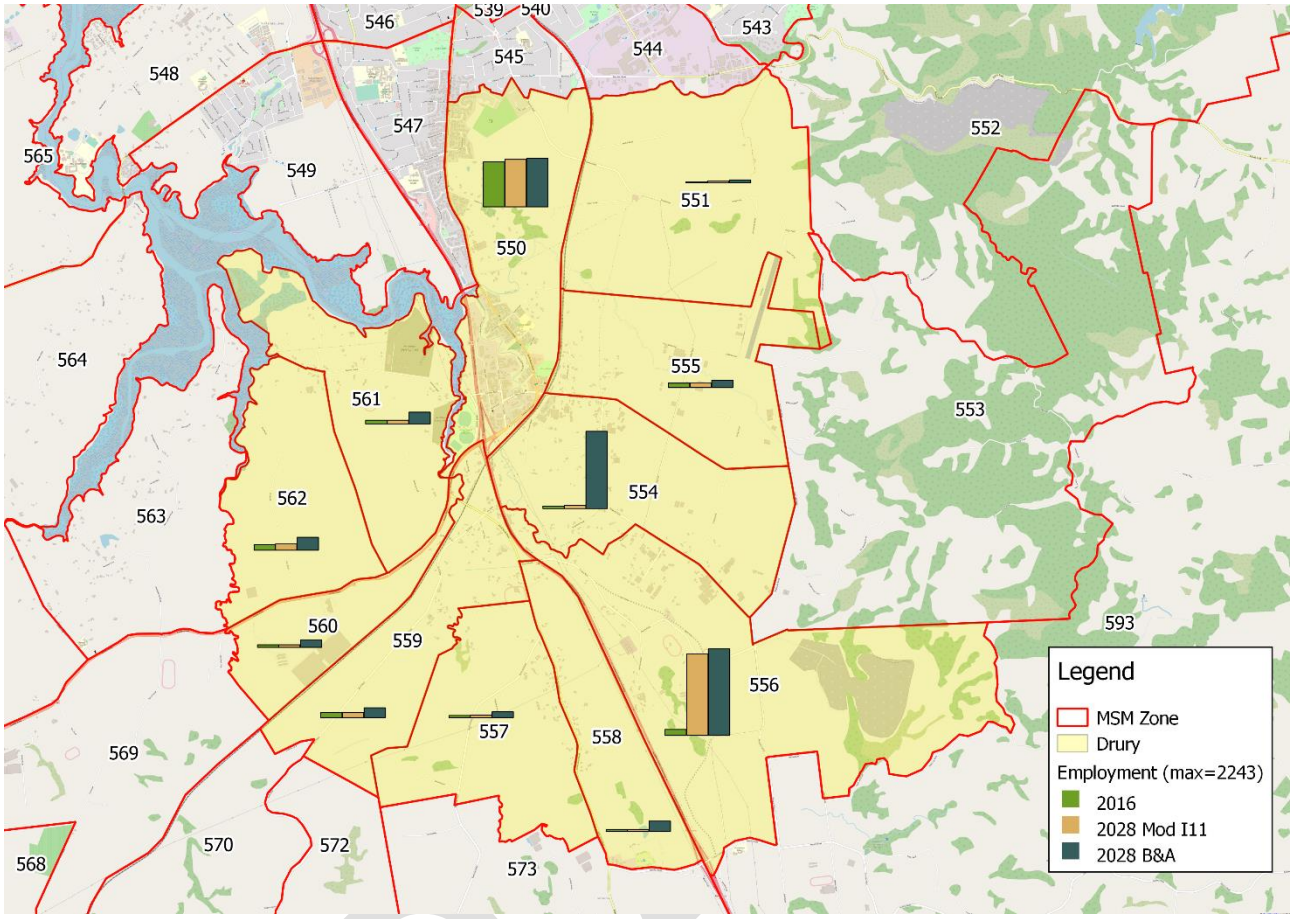


Figure 9: Employment for 2016, 2028 (MSM standard land use assumptions) and 2028 (B&A Land use assumptions) per MSM Zone for Drury-Opaheke area

The above two figures demonstrate that the B&A land uses assume a significant increase in households and employment within the Drury East zone (554) between 2016 to 2028.

The peak hour trip rates have been assessed for each MSM zone in the relevant Drury-Opaheke area, as shown in Appendix B. The Drury West and Drury East total estimated car trip rates per household are summarised in **Table 3** below, for the peak hour periods. The residential trip rates have been undertaken on a per-household basis, as this is the common measure for such rates.

It is noted that the source of the trip generation was determined from the MSM model, as the model was validated to 2016 observed traffic and Public Transport (PT) data, indicating that it generates appropriate levels of travel at an aggregate level.

Table 3: Estimated Hourly Household Car Trip Rate[7]

	2016		**2028**		**2038**		**2048**	
	AM	PM	AM	PM	AM	PM	AM	PM
East	0.96	0.83	0.72	0.64	0.69	0.63	0.64	0.59
West	0.82	0.71	0.49	0.43	0.46	0.40	0.41	0.36
Total	0.92	0.80	0.62	0.55	0.58	0.52	0.53	0.48

[7] The household car trip rate is estimated from MSM home based car person trips (2hr). Divide this by HH, then convert to car trips by dividing by 1.3 (assumed car occupancy rate), and then multiplying by 0.59 (assumed 2hr to 1hr peak factor).

From Table 2, the total peak hour car trip rate per household is approximately 0.92 for the AM peak and 0.80 for the PM peak in 2016. In 2028, the car trip rate per household decreases to approximately 0.62 in the AM peak and 0.55 in the PM peak. Therefore, a larger decrease is observed in the AM peak (32% reduction) compared to the PM peak (25% reduction).

These car trip rates are affected by PT usage. For example, as the PT uptake increases from 2016 to 2028, the car trip rate is anticipated to decrease as less people are making trips via cars. The PT mode share is discussed in further detail below

This difference between the two peak periods is likely due to the AM period encompassing a larger demographic (e.g. school children and working parents) than the PM period (which is likely to only capture the working parents and not school children). It is also more likely that school children use PT rather than driving.

2.3 Public Transport Assumptions

The PT mode share is summarised for Drury West and Drury East in **Table 4** below. The breakdown of PT mode share per MSM model and decade is outlined in Appendix B of this report. The resulting mode split will vary based on the trip purpose and origin / destination of the movement.

Table 4: Summary of PT mode share for Drury East and Drury West for 2016 and 2028

	2016				2028			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
East	7%	2%	1%	6%	14%	3%	3%	11%
West	7%	1%	1%	6%	19%	5%	6%	18%
Total	7%	2%	1%	6%	16%	3%	4%	14%

Table 2 shows that the total percentage of PT mode share increases by 9% between 2016 and 2028 for the AM peak period. It is anticipated that this increase in PT is due to the construction of the Drury West and Drury Central train stations (which were included within the AFC base model). From Appendix B it is observed that the PT increase for zone 560 is approximately 17%, due to the implementation of the Drury West train station. However, in zone 554 (where the Drury Central train station is located) the PT increase is only 5%. As both of these zones are proposed to have new train stations, it is suspected that this difference in PT percentage is due to the difference in catchment areas within the two zones.

3 Modelling Scenarios

The combined traffic effects of the developer's sites was investigated for the 2028, 2038 and 2048 year within the SATURN model, based on the above-mentioned land use assumptions and assuming that the proposed infrastructure outlined within the ITA (i.e the full section of Mill Road, Pukekohe Expressway etc) will be constructed at the relevant stages. The 2038- and 2048-years modelling results showed that the access routes to the site are acceptable, given the required infrastructure upgrades are completed (including signalisation of the Great South Road / Waihoehoe intersection and implementation of the Mill Road interchange).

Further infrastructure upgrades are proposed along SH1 (between Papakura and Bombay) by the New Zealand Transport Agency[8]. These upgrades include additional vehicle lanes, wider shoulders, consideration for PT, improvements to interchanges and enabling rail line electrification. Construction of the southbound section is expected to begin in 2020, with the first stage of the project to occur between Papakura and Drury. These upgrades are likely to have a positive effect on the traffic modelling performance of the below options if they occur before 2028. However, to avoid reliance on these upgrades the modelling assumes that these improvements do not occur until after the first decade (as in alignment within Table 7-4 of the SGA ITA – 2028 constrained scenario).

Earlier staging poses issues due to the additional traffic volumes and lack of funding for required infrastructure in that first decade. The most critical stage was determined for year 2028. In order to understand the effects of the traffic generated from the proposed development sites on the surrounding network, a baseline consented option was investigated in which the proposed development was removed (Option 0). Therefore, Option 0 includes the surveyed existing traffic volumes and allows for anticipated future network traffic growth (and consented development) by assessing the 2028 traffic demands of the adjacent areas (i.e. Pukekohe-Paerata and Drury West). However, provide a 'without proposed development' scenario, the land use assumptions (and thus traffic demands) for MSM zones 555 and 554 (which largely represent the proposed development areas) was reduced to the surveyed 2016 values. Any infrastructure required due to the proposed development has been excluded from the Saturn model (i.e. upgrade to Great South Road East and signalisation of the Great South Road / Waihoehoe intersection).

The effect of the development on the traffic network (in particular the Drury interchange and Great south Road / Waihoehoe intersection) was then assessed in further detail. Various access options have been investigated to determine the traffic effects of Stage 1 for the above-mentioned site areas in the first decade (i.e. 2028) on the network and thus determine which infrastructure is required to provide access to the sites. Each option and the subsequent SATURN modelling results will be discussed in further detail in this report. All of the options, except for Option 1b, are constrained as they do not include the full construction of Mill Road and Pukekohe Expressway. This is clearly stated for each option. The access options are as follows:

0) This is the baseline consented model which represents the 2028 scenario without the proposed Drury East development. No upgrades have been made to Great South Road (East) or Great South Road / Waihoehoe intersection and single lane ramps only;

1a) Inbound and outbound access to Drury East via Drury Interchange (2028 Constrained[9]), + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. Model reference Drury2;

1b) Inbound and outbound access via Drury Interchange (2028 Expanded[10]), + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. Model reference Drury7;

1c) Inbound and outbound via Drury Interchange (2028 Constrained with Mill Road to Fitzgerald Road Only), + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. Model reference Drury8;

[8] https://www.nzta.govt.nz/media-releases/launch-of-sh1-papakura-to-bombay-projects-design-and-consenting-phase/

[9] Constrained includes the components of the road network with current funding commitments (i.e. northern section of Mill Road only).

[10] Expanded includes only the components of the road network assumed to be necessary to provide for 2028 land use.

2a) Inbound via Drury Interchange Only (Brookfield / Quarry Road Connection), 2028 Constrained + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. Model reference Drury9;

2b) Quarry Road Off-Ramp (Brookfield / Quarry Road Connection), 2028 Constrained + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. Model reference Drury10;

2c) Inbound via Drury and Outbound via Firth Street (2028 Constrained). Model reference Drury11;

3) Inbound and outbound via Firth Street, upgraded GSR / Waihoehoe intersection, 2028 Constrained + road upgrades to Waihoehoe Road and Fitzgerald Road. Model reference Drury13; and

A 'ramp meter' is currently located on the northbound on-ramp which has a significant effect on delays in the AM peak period. An updated SATURN model was run to provide double lanes and increase the ramp meter green times and thus investigate the effect on the AM northbound delays. The number of lanes on the southbound off-ramp was also doubled to investigate the delays. It is noted that the ramp meter can be adjusted if required, but an acceptable range is dependent on agreement with NZTA. The comparison between the previous SATURN model and updated SATURN model are shown in **Table 4** below for each option.

In order to investigate the effects of the proposed Drury East development on the traffic network, the 2028 traffic demands and 2016 infrastructure was investigated (i.e. without Drury East development and no upgrade to GSR/Waihoehoe intersection) and compared with the 2028 anticipated traffic demands and infrastructure (i.e. with Drury East development). To provide a more accurate, complex analysis the 'without Drury East development' and 'with Drury East development' scenarios (discussed above) were investigated using the Aimsun model (using data from the SATURN model).

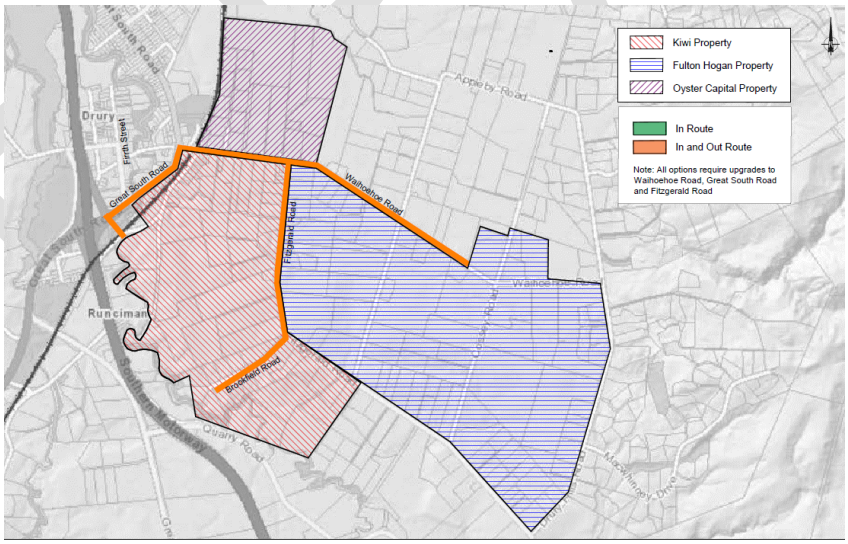
Aimsun is able to provide a greater level of precision than the SATURN model, which is particularly useful when investigating the queuing effect on the Drury Interchange towards SH1 and Great South Road / Waihoehoe intersection performance. However, Aimsun does have a modelling limitation. It is a constrained model in that it does not account for traffic queuing beyond the Aimsun extent. This is a particular issue for the Drury Interchange southbound off-ramp, as it assumes that there is no additional demand than what is being shown in Aimsun. To account for this limitation, a sensitivity analysis was determined to increase the off-ramp capacity (by artificially increasing the off-ramp to two lanes from one lane). This allowed for an increase in traffic demand (from approx. 1,800 to 2,200 vph) to occur on the off-ramp and therefore be included within the Aimsun modelling.

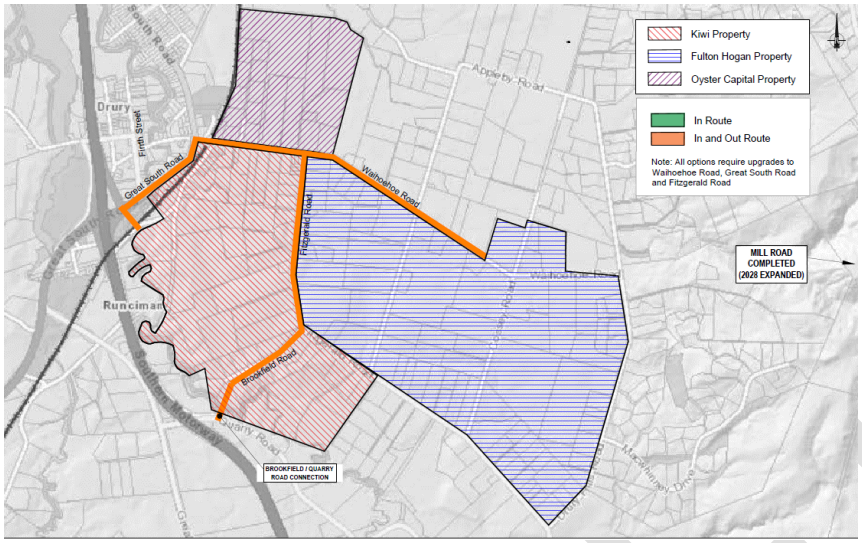
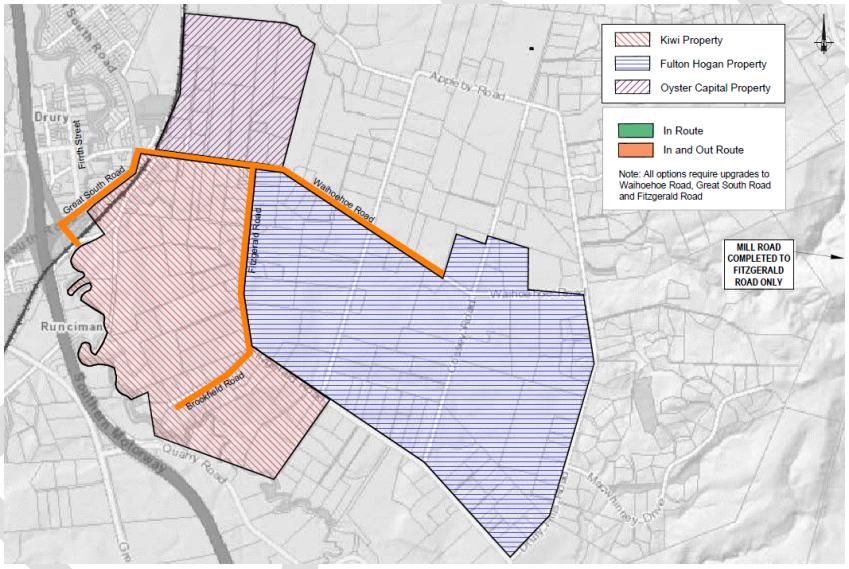
It is noted that of the above-mentioned options, it is likely that either Option 1A or Option 3 will be implemented as the primary access to the Drury East and its town centre. Each Option will have a different effect on the Drury Interchange and subsequently the GSR/Waihoehoe intersection. Due to time restrictions, only those two options have been tested further in Aimsun.

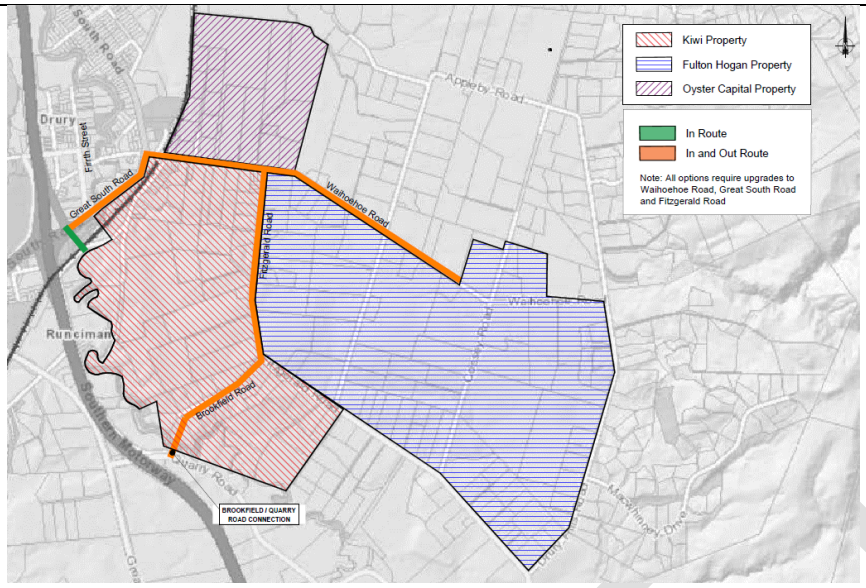
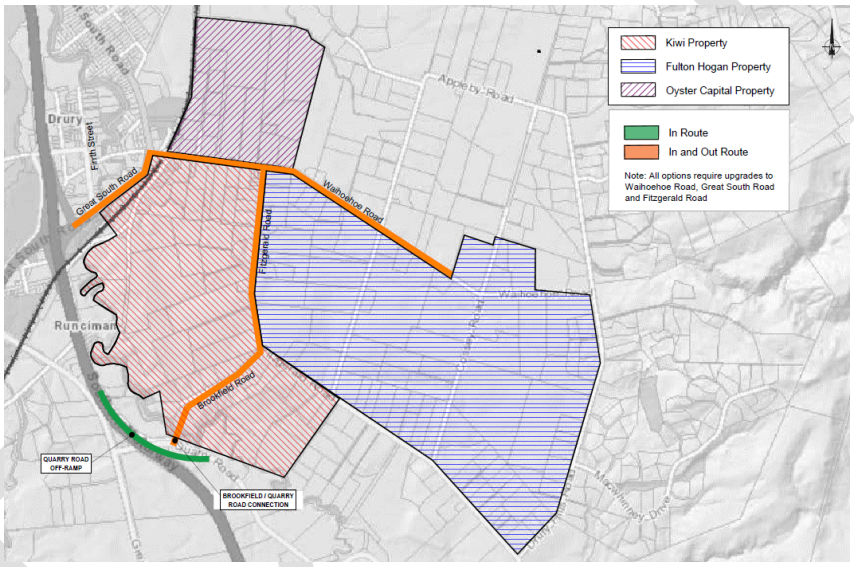
4 Option Modelling Results

The SATURN plots for each Option are outlined in the figures below, for the critical movements; northbound on ramp in the AM peak and southbound off ramp in the PM peak. The results below are determined using the land use assumptions outlined in Table 1 of this report.

Table 5: Option Modelling Comparison for the Drury – Opaheke Area in Delay (seconds)

Option	Description / Diagram	Reduced Land Use SATURN Model (single lane ramps / current meter timing)		Reduced Land Use SATURN Model (double lane ramps / enhanced meter timing)	
		NB On Ramp AM	SB Off Ramp PM	NB On Ramp AM	SB Off Ramp PM
0	Baseline Consented Scenario: no upgrade to Great South Road or Great South Road / Waihoehoe intersection and single lane ramps only. There are no changes as a result of our development, therefore no diagram has been included.	80	207	N/A	N/A
1A	Inbound and outbound access to Drury East via Drury Interchange (2028 Constrained), + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road 	191	140	17	99
1B	Inbound and outbound access via Drury Interchange (2028 Expanded), + upgraded GSR / Waihoehoe intersection, road upgrades to	84	77	2	54

	Waihoehoe Road and Fitzgerald Road, and the full construction of Mill Road (SH1 to Papakura). 				
1C	Inbound and outbound via Drury Interchange (2028 Constrained with Mill Road to Fitzgerald Road Only), + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. 	98	125	2	115
2A	Inbound via Drury Interchange Only (Brookfield / Quarry Road Connection), 2028 Constrained + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road.	205	128	2	25

					
2B	Quarry Road Off-Ramp (Brookfield / Quarry Road Connection), 2028 Constrained + upgraded GSR / Waihoehoe intersection, road upgrades to Waihoehoe Road and Fitzgerald Road. 	195	65	2	21
2C	Inbound via Drury Interchange and Outbound via Firth Street (2028 Constrained).	186	124	22	38

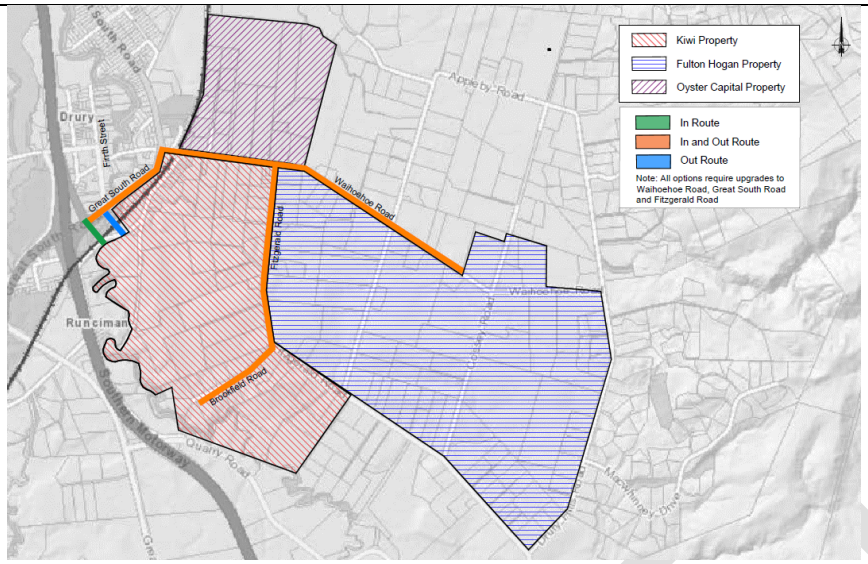
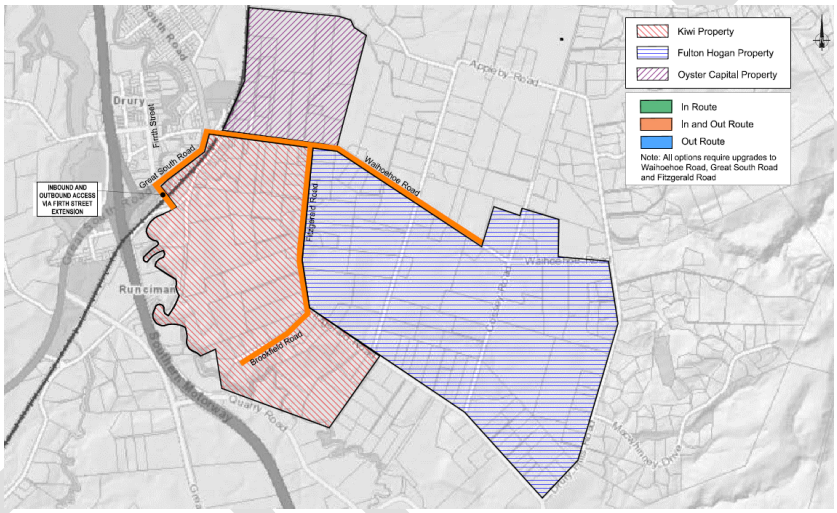
					
3	Inbound and outbound via Firth Street, upgraded GSR / Waihoehoe intersection, 2028 Constrained + road upgrades to Waihoehoe Road and Fitzgerald Road. 	174	134	20	29

Table 4 shows that by adding an additional lane on both the northbound on-ramp and southbound off-ramp and improving the on-ramp ramp meter, the delay is reduced significantly. Option 0 has a delay of 80s for the AM northbound on-ramp and 207s for the PM southbound off-ramp. The northbound delay is lower than the other options, as there is no Drury East development. It is noted that the northbound delay for Option 0 and Option 1b are similar (around 80s) as Option 1b has additional infrastructure (i.e. full Mill Road and Pukekohe Expressway) and thus the delay is reduced in comparison to the other constrained 2028 options.

However, the southbound off-ramp delay for Option 0 is higher than all of the other options with Drury East development. This can be attributed to the signal phasing within Option 0 being set to standard NZTA phasing. Thus, it is highly likely that the Drury Interchange intersections for Option 0 are not optimised and thus less efficient than the optimised intersections with Drury East development.

Several options for access are available to support this live zoning at 2028, all of which are able to accommodate the required land use projections. Although all of the design options are considered supportable, some have a greater potential risk of consenting difficulties than others. These can be summarised as follows:

- All options that gain direct access to or from the Drury interchange carry a potential consenting risk, although this has been lessened by the latest round of testing;
- Using a Brookfield Rd / Quarry Rd SH1 southbound off-ramp instead of a Drury interchange connection reduces the potential consenting risk;
- Fully reverting to the Firth St access location reduces this risk further, although design challenges remain;

The delays for both Option 1A (99s) and Option 3 (29s) are considered acceptable from an operational perspective. The results for Option 1A and Option 3 were investigated in more detail using the Aimsun model. These results are outlined below.

4.1 Aimsun Results

Aimsun models were run for the following three scenarios, using the land use assumptions discussed in Section 2.2:

- **2028 Option 0:** This option includes the anticipated 2028 traffic demands without the Drury East development and no proposed additional connection for access to Drury East Town Centre and no infrastructure upgrades along Great South Road and Waihoehoe (i.e. no widening to the east of GSR and no signalisation of GSR/Waiehoehoe Intersection).
- **2028 Option 1A:** This option includes the anticipated (B&A) 2028 traffic demands with the Drury East development and proposed direct connection (inbound and outbound) to the Drury East Town Centre via the Drury Interchange; and
- **2028 Option 3:** This option includes the anticipated 2028 traffic demands with the Drury East development and proposed connection (inbound and outbound) to Drury East Town Centre via Firth Street;

Option 1A and Option 3 assume two lanes for both the northbound and southbound ramps in order to address the SATURN / Aimsun model limitation previously discussed. This is a theoretical analysis to determine the practical capacity of the ramps. It is not proposed to install the double ramps in 2028 as the performance of the intersection is still considered acceptable. This is discussed in further detail below and the Aimsun results, for the AM and PM peak periods, are summarised in Appendix C of this report.

4.1.1 Option 0 Results

Table 6: Aimusn Results Summary - OPtion 0

Intersection	AM		PM	
	Delay (s)	LOS	Delay (s)	LOS
Great South/Interchange (W)	26	C	9	A
Great South/Interchange (E)	22	C	39	D
Great South/Waihoehoe	10	A	9	A

The Great South/ Interchange (W) and Great South / Waihoehoe Intersection both operate well with a LOS C and A in the AM peak period, respectively. The Great South / Interchange (E) operates a slightly worse but still acceptable LOS D in the PM peak period.

4.1.2 Option 1A Results

Table 7: Aimsun Results Summary - Option 1A

Intersection	AM		PM	
	Delay (s)	LOS	Delay (s)	LOS
Great South/Interchange (W)	23	C	11	B
Great South/Interchange (E)	37	D	42	D
Great South/Waihoehoe	35	D	38	D

From the tables it can be seen that Option 1A has an acceptable traffic performance for both the Great South/Interchange (E)and Great South/Waihoehoe Intersection. A LOS D is noted for the Great South/Interchange (E) and Great South / Waihoehoe intersection during the AM peak period and PM peak period. There is a maximum delay of 42s for the Great South/Interchange (E)during the PM peak period. Great South/Interchange (W) operates slightly better at LOS C and B during the AM and PM peak periods.

The maximum flow of 1,891vph is observed on the East through lane at the Great South/Interchange (W), however this results in a negligible delay of 2s and therefore is not considered an issue.

Flows on the northern leg of the Drury Interchange East can reach 1241vph for right turns. This is within the typical lane capacity of 1,800vph and therefore, it is not anticipated to cause queuing to SH1.

4.1.3 Option 3 Results

Table 8: Aimsun Results Summary - Option 3

Intersection	AM		PM	
	Delay (s)	LOS	Delay (s)	LOS
Great South/Interchange (W)	15	B	8	A
Great South/Interchange (E)	23	C	38	D
Great South/Waihoehoe	39	D	27	C

Option 3 has an acceptable traffic performance for both the Great South/Interchange (E)and Great South/Waihoehoe Intersection. A LOS D and C is noted for the Great South/Interchange (E) and Great South / Waihoehoe intersection during the AM peak period and PM peak period. There is a maximum delay of 51s for the Great South/Interchange (W) during the AM peak period.

The maximum flow of ,2141vph is observed on the East through lane at the Great South/Interchange (W), however this results in a negligible delay of 6s and therefore is not considered an issue.

Flows on the northern leg of the Drury Interchange East can reach 1711vph for right turns during the PM peak period. This is within the typical lane capacity of 1800vph and therefore, it is not anticipated to cause queuing to the SH1.

4.1.4 Aimsun Summary

In summary, the Drury East development results in a reduced intersection performance for Great South/Interchange (E) and Great South/Waihoehoe and a slight increased intersection performance for Great South/Interchange (W). However, the decrease in performance is relatively minor and thus the development is not considered to have a significant adverse effect on the network, given the recommended infrastructure is implemented as discussed in Section 3.

It is highlighted that Option 0 is assumed to be conservative as the AM peak period results do not appear to be reflective of the existing queuing observed at the Great South/Waihoehoe intersection.

Both Option 1A and 3 are viable access options into the Drury East Town Centre, from a traffic modelling perspective. As both options have a traffic demand below 1800vph on the southbound off-ramp for Great South/Interchange € north approach, it is anticipated that queuing will not extend to SH1. This accounts for the maximum allowable capacity, assuming a theoretical two-lane off-ramp. Therefore, it is concluded that neither of the proposed options (Option 1A or Option 3) require two lanes for the off-ramp in 2028.

5 Conclusions

From the abovementioned assessments, the following can be concluded:

- The 2038 and 2048+ traffic modelling is acceptable as the infrastructure required to support the growth is anticipated to be implemented within those decades. Further detail on this will be supplied in the ITAs for the individual plan changes;

- The 2028 staging is critical as the traffic demands have increased as a result of the proposed development, but the infrastructure required to support the development is not yet implemented (due to lack of funding). Therefore, the traffic modelling in this memo primarily focuses on the 2028 decade;

- The Drury East plan changes for first decade live zoning can be supported from a traffic perspective and is unlikely to have a significant adverse effect on the traffic network, given that the infrastructure required to support the preferred option is implemented. Regardless of the option chosen to allow access to the Drury East Town Centre, an upgrade to Great South Road (i.e. widening and additional lanes) and signalisation of the Great South Road / Waihoehoe Road intersection is required;

- Several options for access are available to support this live zoning at 2028, all of which are able to accommodate the required land use projections. The selection and timing of these access options will be determined during the Resource Consent process for each development stage. It is not recommended to propose only one access option as part of the Plan Change, but instead to propose a variety of potential options.

- The northbound on-ramp during the AM peak period is dependent on the ramp meter timing, which can be adjusted if required. However, the recommended range of timing in which the meter is dependent on agreement with NZTA and is therefore a consenting risk;

- Although all of the design options are considered supportable, some have a greater potential risk of consenting difficulties than others. These can be summarised as follows:

    - All options that gain direct access to or from the Drury interchange carry a potential consenting risk, although this has been lessened by the latest round of testing;

    - Using a Brookfield Rd / Quarry Rd SH1 southbound off-ramp instead of a Drury interchange connection reduces the potential consenting risk;

    - Fully reverting to the Firth St access location reduces this risk further, although design challenges remain;

- The latest testing, which works better than the previous, has deemphasised the importance of adding the Mill Road interchange in Decade 1 (2028) including its links to the east and west. This is due to the lessened severity of delays at the Drury interchange, thus preventing a significant migration to the new interchange. Nevertheless, the addition of a full or partial Mill Road connection enhances capacity of the Drury Interchange; and

- Only a single lane off-ramp ramp is required to support the traffic modelling for Option 1A and Option 3.

Appendix A – Land Use Assumptions (dated 31.5.19[11]) per MSM Zone for each decade

Table 9: Drury - Opaheke Area

		2016			2028			2038			2048		
MSM Zone	**Location**	**Pop**	**HH**	**Emp**	**Pop**	**HH**	**Emp**	**Pop**	**HH**	**Emp**	**Pop**	**HH**	**Emp**
550	East	1250	438	1169	1181	438	1258	1130	438	1300	3411	1369	1407
551	East	340	99	32	298	99	81	279	99	1538	6681	2472	1739
554	East	421	148	69	4382	1633	2006	12774	4918	4213	10841	4318	5349
555	East	369	128	117	887	328	199	1379	528	306	6119	2426	863
556	East	330	109	156	2563	909	2243	2453	909	4729	2372	909	6063
557	West	221	79	65	206	79	157	795	322	331	2271	952	425
558	West	132	76	51	124	76	273	152	97	576	230	152	739
559	West	186	59	134	173	59	262	2579	972	553	8578	3342	709
560	West	34	13	70	32	13	196	1947	718	413	6568	2498	530
561	West	195	70	100	3193	1195	311	6894	2696	656	10169	4117	840
562	West	175	60	144	158	60	340	2868	1123	717	9596	3885	920
	East	2710	921	1543	9311	3407	5787	18016	6892	12086	29425	11494	15420
	West	943	356	565	3887	1482	1540	15234	5928	3247	37413	14946	4163
	Total	3653	1277	2108	13198	4889	7327	33251	12820	15333	66838	26440	19582

[11] The Land use assumptions for households were provided by Barkers and Associates dated 31.5.19 and did not include population or employment assumptions. The population land use was interpolated by Stantec using a linear relationship with the households.

Table 10: Pukekohe - Paerata Area

	2016			2028			2038			2048		
MSM Zone	**Pop**	**HH**	**Emp**	**Pop**	**HH**	**Emp**	**Pop**	**HH**	**Emp**	**Pop**	**HH**	**Emp**
569		75			329			657			657	
574		972			972			1300			1939	
575		1354			1354			1711			1752	
576		1298			1298			1420			1536	
577		332			553			722			846	
578		974			974			1375			1775	
580		63			63			1077			1158	
581		2640			2640			2809			2829	
582		48			48			47			48	
583		56			56			591			653	
567		58			463			779			878	
568		48			1410			2632			2632	
571		45			839			1707			1720	
579		221			221			403			552	
Total		**8184**			**11220**			**17230**			**18975**	

Appendix B – PT Mode Share and Household Car Trip Rates

Table 11: Public Transport Mode Share per MSM zone

	2016				2028				2038				2048			
	AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak		AM Peak		PM Peak	
MSM Zone	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination	Origin	Destination
550	6%	2%	1%	5%	12%	4%	3%	10%	15%	8%	7%	14%	18%	9%	8%	16%
551	10%	0%	1%	9%	16%	2%	3%	14%	14%	6%	6%	12%	17%	7%	7%	15%
554	9%	1%	1%	8%	14%	3%	4%	12%	15%	6%	6%	13%	15%	8%	7%	13%
555	9%	0%	1%	7%	16%	3%	3%	14%	17%	5%	6%	15%	18%	6%	7%	16%
556	8%	0%	0%	7%	11%	1%	2%	8%	11%	5%	4%	9%	11%	6%	5%	9%
557	6%	0%	0%	6%	12%	4%	5%	13%	12%	6%	7%	14%	13%	6%	8%	15%
558	6%	0%	0%	6%	7%	5%	5%	8%	7%	8%	8%	9%	7%	10%	9%	10%
559	8%	1%	1%	6%	23%	6%	8%	21%	24%	7%	10%	22%	27%	8%	11%	25%
560	6%	1%	2%	4%	23%	5%	7%	20%	26%	7%	11%	24%	28%	8%	12%	26%
561	7%	0%	1%	6%	20%	6%	7%	19%	18%	5%	7%	17%	21%	6%	8%	19%

562	7%	1%	1%	6%	16%	4%	4%	14%	18%	6%	7%	17%	20%	6%	8%	19%
East	7%	2%	1%	6%	14%	3%	3%	11%	14%	6%	6%	13%	15%	7%	7%	13%
West	7%	1%	1%	6%	19%	5%	6%	18%	20%	6%	8%	19%	23%	7%	9%	21%
Total	7%	2%	1%	6%	16%	3%	4%	14%	17%	6%	6%	15%	19%	7%	7%	17%

Table 12: Household Car Trip Rate per MSM Zone

	2016		2028		2038		2048	
MSM Zone	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**	**AM Peak**	**PM Peak**
550	1.25	1.08	0.94	0.82	0.71	0.62	0.55	0.48
551	0.67	0.56	0.56	0.48	0.77	0.70	0.55	0.49
554	0.62	0.53	0.66	0.59	0.64	0.57	0.65	0.61
555	0.72	0.63	0.52	0.44	0.47	0.40	0.45	0.39
556	0.82	0.71	1.11	1.05	1.11	1.07	1.23	1.21
557	0.68	0.57	0.49	0.45	0.48	0.45	0.45	0.42
558	0.48	0.41	0.92	0.89	1.38	1.33	1.43	1.39
559	0.99	0.85	0.49	0.42	0.43	0.38	0.39	0.34
560	1.56	1.35	0.43	0.37	0.43	0.37	0.39	0.33
561	0.84	0.74	0.49	0.42	0.46	0.40	0.40	0.36
562	1.07	0.97	0.51	0.44	0.46	0.40	0.41	0.36
East	0.96	0.83	0.72	0.64	0.69	0.63	0.64	0.59
West	0.82	0.71	0.49	0.43	0.46	0.40	0.41	0.36
Total	0.92	0.80	0.62	0.55	0.58	0.52	0.53	0.48

Appendix C – Aimsun Results

Table 13: 2028 AM Option 0 - Aimsun Results

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
Great South/Interchange (W)	E_R	144	5	7	A	26	C
	E_T	815	8				
	S_L2	0	0	58	E		
	S_R	137	58				
	W_T	623	49	49	D		
Great South/Interchange (E)	E_L	0	0	34	C	22	C
	E_L2	0	0				
	E_T	351	34				
	N_L	245	11	22	C		
	N_R	608	27				
	N_T	0	0				
	S_L1	0	0				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_L2	0	0	0	A		
	S_R	0	0				
	W_R1	0	0	17	B		
	W_R2	0	0				
	W_T	758	17				
Great South/Waihoehoe	E_L	155	7	8	A	10	A
	E_R	419	9				
	E_T	25	8				
	N_L	185	3	3	A		
	N_R	113	4				
	N_T	348	3				
	S_L	0	0	19	B		
	S_R	128	23				
	S_T	436	18				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	W_L	87	8	8	A		
	W_R	0	0				
	W_T	12	12				

Table 14: 2028 PM Option 0 - Aimsun Results

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
Great South/Interchange (W)	E_R	39	58	4	A	9	A
	E_T	1781	2				
	S_L2	0	0	59	E		
	S_R	110	59				
	W_T	117	49	49	D		
Great South/Interchange (E)	E_L	0	0	64	E	39	D
	E_L2	0	0				
	E_T	739	64				
	N_L	320	7	28	C		
	N_R	1080	34				
	N_T	0	0				
	S_L1	0	0				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_L2	0	0	0	A		
	S_R	0	0				
	W_R1	0	0	31	C		
	W_R2	0	0				
	W_T	226	31				
Great South/Waihoehoe	E_L	5	7	9	A	9	A
	E_R	334	9				
	E_T	19	9				
	N_L	392	5	6	A		
	N_R	92	7				
	N_T	542	7				
	S_L	0	0	16	B		
	S_R	226	18				
	S_T	203	14				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	W_L	248	5	6	A		
	W_R	0	0				
	W_T	29	11				

Table 15: 2028 AM Option 1A - Aimsun Results

Intersection	Approach_ Movement[12]	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
Great South/Interchange (W)[13]	E_R	421	36	12	B	23	C
	E_T	1145	3				
	S_L2	0	0	54	D		
	S_R	224	54				
	W_T	575	40	40	D		
Great South/Interchange (E)	E_L	10	36	55	E	37	D
	E_L2	122	35				
	E_T	515	60				
	N_L	341	31	28	C		
	N_R	854	27				
	N_T	90	21				

[12] The annotations for the approach and movement are as follows: Eastern (E), Western (W), Northern (N) and Southern (S). Right (R), Through (T), Left (L) and the number indicates the lane number if there are multiple lanes with the same movement

[13] Refer to Figure 6 for Intersection Locations

Intersection	Approach_ Movement[12]	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_L1	0	59	49	D		
	S_L2	197	45				
	S_R	188	54				
	W_R1	63	43	30	C		
	W_R2	1	37				
	W_T	738	29				
Great South/Waihoehoe	E_L	245	24	31	C	35	D
	E_R	576	33				
	E_T	42	34				
	N_L	379	3	21	C		
	N_R	119	63				
	N_T	345	27				
	S_L	0	27	56	E		
	S_R	216	54				

Intersection	Approach_ Movement[12]	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_T	557	57				
	W_L	88	31	33	C		
	W_R	0	0				
	W_T	18	44				

Table 16: 2028 PM Option 1A - Aimsun Results

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
Great South/Interchange (W)	E_R	248	33	6	A	11	B
	E_T	1891	2				
	S_L2	0	0	71	E		
	S_R	93	71				
	W_T	182	40	40	D		
Great South/Interchange (E)	E_L	0	0	48	D	42	D
	E_L2	107	42				
	E_T	665	49				
	N_L	425	49	43	D		
	N_R	1241	41				
	N_T	191	41				
	S_L1	0	0	51	D		
	S_L2	232	50				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_R	9	69				
	W_R1	60	16	10	B		
	W_R2	0	0				
	W_T	216	9				
Great South/Waihoehoe	E_L	39	23	23	C	38	D
	E_R	500	23				
	E_T	23	21				
	N_L	642	9	36	D		
	N_R	103	31				
	N_T	444	75				
	S_L	0	1	65	E		
	S_R	340	37				
	S_T	188	115				
	W_L	190	27				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	W_R	0	0	26	C		
	W_T	49	24				

Table 17: 2028 AM Option 3 - Aimsun Results

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
Great South/Interchange (W)	E_R	234	23	8	A	15	B
	E_T	1160	5				
	S_L2	0	0	51	D		
	S_R	182	51				
	W_T	515	21	21	C		
Great South/Interchange (E)	E_L	0	0	36	D	23	C
	E_L2	0	0				
	E_T	467	36				
	N_L	373	19	18	B		
	N_R	927	18				
	N_T	2	18				
	S_L1	0	0	0	A		
	S_L2	0	0				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_R	0	0				
	W_R1	0	0	24	C		
	W_R2	0	0				
	W_T	688	24				
Great South/Waihoehoe	E_L	205	26	24	C	39	D
	E_R	649	24				
	E_T	46	25				
	N_L	314	56	48	D		
	N_R	119	68				
	N_T	431	38				
	S_L	0	53	54	D		
	S_R	171	62				
	S_T	277	50				
	W_L	85	30	32	C		

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	W_R	0	24				
	W_T	19	39				

Table 18: 2028 PM Option 3 - Aimsun Results

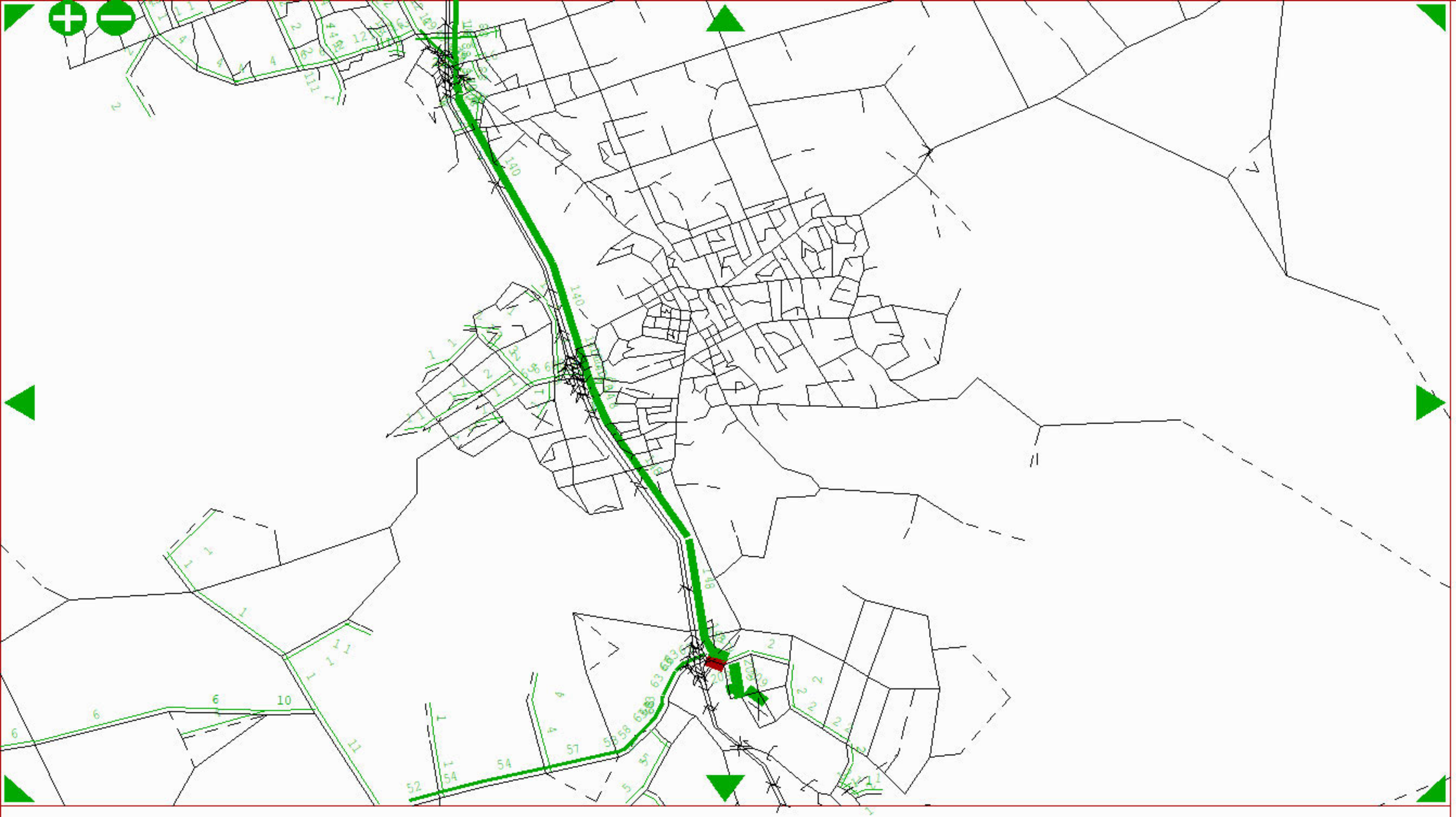
Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
Great South/Interchange (W)	E_R	159	11	6	A	8	A
	E_T	2141	5				
	S_L2	0	0	49	D		
	S_R	91	49				
	W_T	191	20	20	C		
Great South/Interchange (E)	E_L	0	0	30	C	38	D
	E_L2	0	0				
	E_T	588	30				
	N_L	482	22	42	D		
	N_R	1711	48				
	N_T	1	33				
	S_L1	0	0	0	A		

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	S_L2	0	0				
	S_R	0	0				
	W_R1	0	0				
	W_R2	0	0	26	C		
	W_T	271	26				
Great South/Waihoehoe	E_L	95	39				
	E_R	353	27	31	C		
	E_T	22	53				
	N_L	442	15				
	N_R	93	31	24	C	27	C
	N_T	708	29				
	S_L	0	21				
	S_R	262	41	35	C		
	S_T	181	26				

Intersection	Approach_ Movement	Flow (vehicles)	Movement Delay (seconds)	Approach Delay (seconds)	Approach Level of Service (LOS)	Intersection Delay (seconds)	Intersection Level of Service (LOS)
	W_L	185	17	20	B		
	W_R	0	0				
	W_T	34	33				

Attachment 7

SLA Plots



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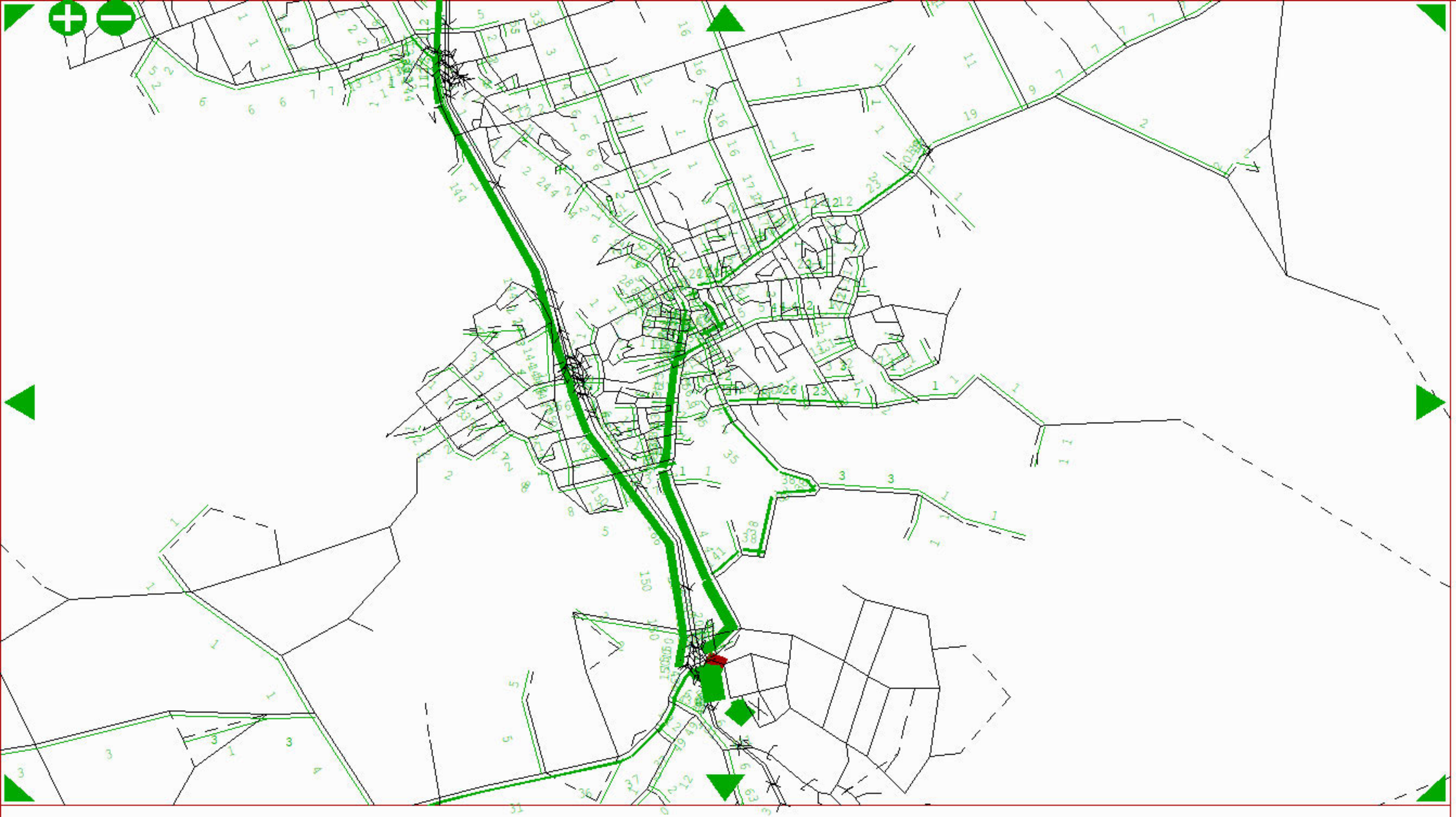

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Link
Assignment
Thru links:
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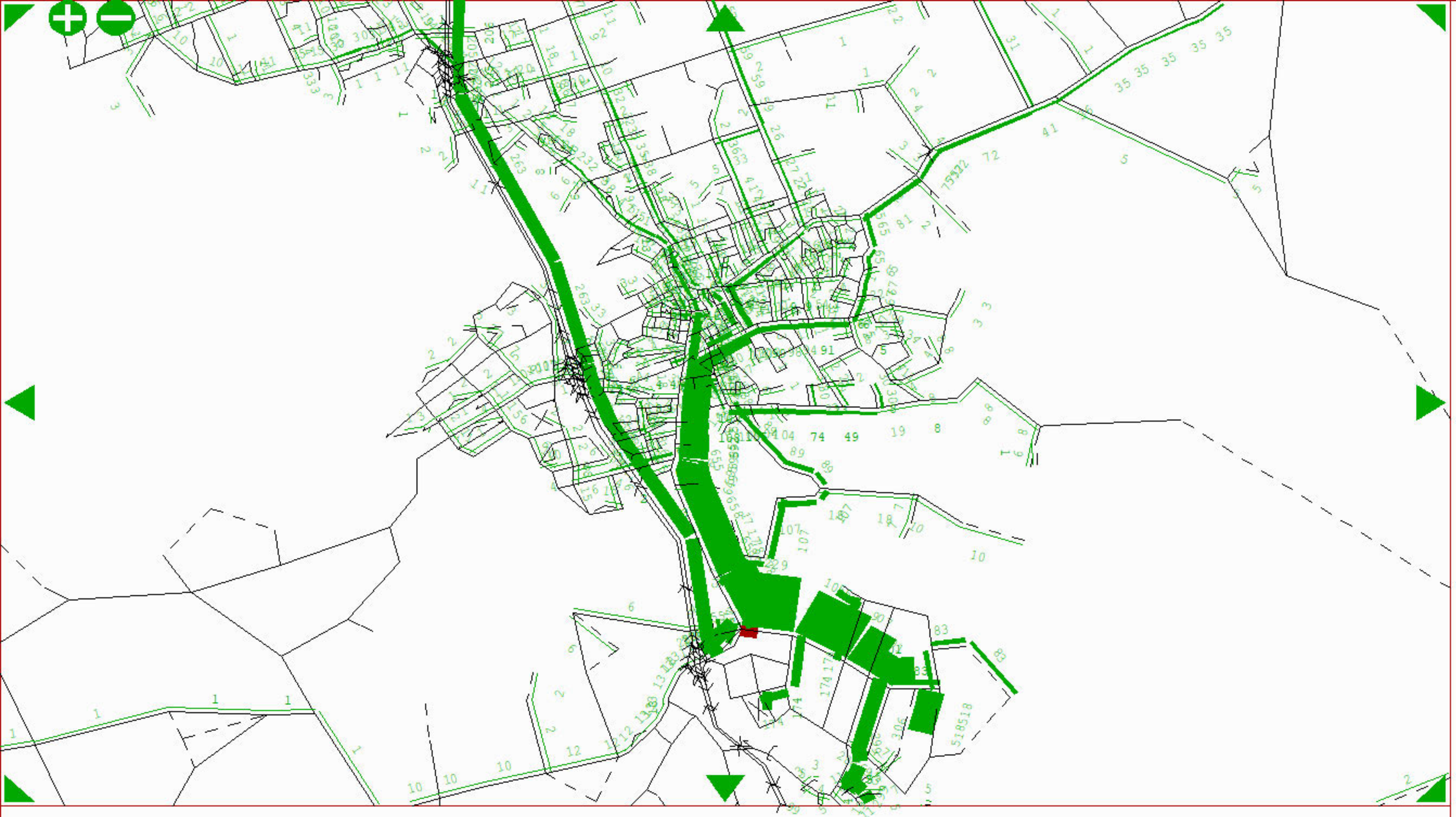
Auckland Preferred network with Drury2, 2028#10 AM 12- 3-20



Selected
Link
Assignment
Thru links:
3061 3075

Total Demand
Flow = 1229

Network fixd
Flow = 20

All User Cls

saVe in D.B. x

Full stats x

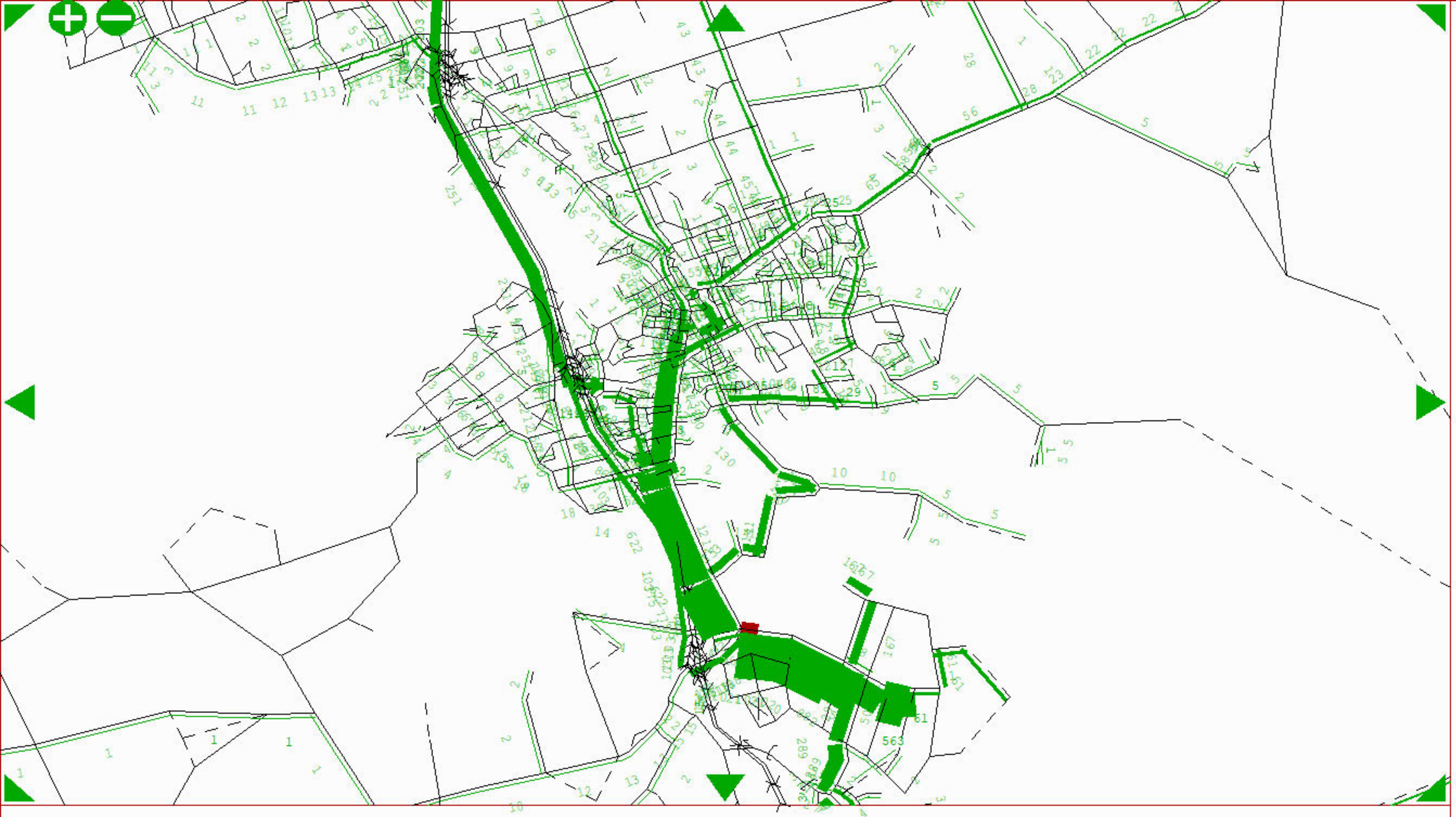
Information x

diSplay of link annotat >

Q - Return

+ Menu bar!

Auckland Preferred network with Drury2, 2028#10 PM 12- 3-20



Selected
Link
Assignment
Thru links:
3075 3061

Total Demand
Flow = 1021

Network fixd
Flow = 0

All User Cls

saVe in D.B. x

Full stats x

Information x

diSplay of link annotat >

Q - Return

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Auckland Preferred network with Drury2, 2028#10 AM 12- 3-20