Section 92 Response Attachments

Attachment 6 - Traffic

Traffic Design Group Ltd
Level 1, 103 Carlton Gore Road
Newmarket
PO Box 2592, Shortland Street
Auckland 1140
New Zealand
P +64 9 531 5006
W www.tdg.co.nz

11117-4
12 December 2012

Watercare Services Ltd
c/- Central Interceptor Project Team
Aecom
PO Box 4241
Shortland Street
Auckland 1140

Copy via email: **acederman@tonkin.co.nz**

Dear Alia

Watercare Central Interceptor
Transport Response to Section 92 Request for Further Information

A request for further information has been issued by Auckland Council (Council) under section 92 of the Resource Management Act 1991 (s92 request) relating to the Watercare Central Interceptor Resource Consent application and Notices of Requirement for the Central Interceptor Main Project Works.

The following letter provides further information in relation to transport matters.

Question 3.7 in the s92 request references a letter from Angie Crafer of Flow Transportation Specialists, dated 20 September 2012. The questions below derive from this letter and have been given corresponding numbering. Each of the transport matters discussed in the s92 request, which require a response, is discussed below.

References to the TIA report in this letter are to the Traffic Impact Assessment report prepared by Traffic Design Group (TDG) in support of the AEE and submitted with the Notices of Requirement and resource consent applications (Technical Report E of Part D of the AEE).

1. Central Interceptor Project – Main Project Works

Information is sought by Auckland Transport on:

- *Advise whether permission has been sought/gained from relevant stakeholders to use Morning Star Drive (a private road).*

  Response provided Section 2.7 of the Section 92 Response Report.

- *Are alternatives available to avoid locating permanent structures outside the road carriageway, particularly at sites L2S2 and L3S3*

  Response provided Section 2.7 of the Section 92 Response Report.

- *How will residents and affected parties be informed of the construction activity and how will the area of affected parties be identified.*

  Response provided Section 2.7 of the Section 92 Response Report.

In general, information is sought on:

- *A generic CTMP (to include for example, requirements for notifying residents, property owners, businesses, wheelwash, parking, etc).*

A generic outline for a CTMP has been produced and attached as Appendix B in this s92 Response letter. Communication matters will be dealt with in a separate communications plan, as part of the wider Construction Management Plan (CMP).

Information requests specific to each site are responded in the following sections.

1.1 WS1 (Western Springs)

1.1.1 Information required (Table, Section 1.1.1)

- *The SIDRA files supplied for the intersection of Great North Road and Bullock Track do not correspond to those documented in the report.*

  This intersection has been remodelled in SIDRA in light of the comments received. The updated results are presented and discussed below in relation to other requests received.

- *The secondary site on the eastern side of the Caltex service station on Great North Road is constrained by existing structures/facilities and topography. We would therefore like to see if it is feasible to turn a truck around on site using the existing access gate. A truck backing from or onto Great North Road would create potential significant safety concerns. Could a tracking assessment be supplied?*

  The secondary site area includes the grassed space between the Caltex service station and the SH16 off-ramp. Truck tracking curves shown in Figure 2a of Appendix A demonstrate the turnaround of a truck on-site using a proposed access on the western side of the site off Great North Road. The proposed layout provides greater separation of the SH16 off-ramp than the existing access gate and is considered a better and safer location than current access. Given the confined area of this site, the entire site including the grassed area will be used by trucks for manoeuvring and the manoeuvring path will be adjusted in accordance to the works to ensure no reverse manoeuvring onto the road is required.

- *The traffic modelling has considered the impacts of construction traffic upon existing traffic flows. This area will experience different traffic flows when the Waterview Connection is completed. Therefore we would like to see the predicted effects of construction traffic on the forecast future traffic flows, post Waterview Connection completion, including an assessment of traffic coming from/going to the west (eg: towards the Waterview interchange).*

  It is acknowledged that the Waterview Connection will likely be operational prior to the commencement of works associated with this project. With this in mind, data from the Beca Western Ring Route (WRR) Model has been sourced to obtain information on forecast future flows.

  The Beca Model is a large scale “regional” model developed using the computer simulation programme EMME. As such, some minor side roads and effects are not included. For example Stadium Road has not been modelled at all as part of the Great North Road/SH16 Eastbound interchange intersection. Thus the data supplied from this model should only be seen as indicative when applied to small local scale intersections such as those considered for this report.

  Nonetheless WRR Model data was obtained for the 2011 and 2016 years for the following intersections:

  - Great North Road/SH16 eastbound Interchange
  - Great North Road/St Lukes Road
  - St Lukes Road/SH16 westbound Interchange
  - SH20/Dominion Road Interchange
  - SH20/Maioro Road Interchange.

The data received is summarised in Appendix C.

Based on the WRR model results supplied by Beca, 2016 was selected as a new base year for the "existing traffic" SIDRA models. Traffic volumes for the base models were obtained directly from the WRR model results, except where modified as required based on the limitations of the model and the engineering judgement of TDG engineers. These exceptions are detailed as appropriate through the text of this report. Where 2016 model data was not available for particular movements, surveyed 2012 data was scaled using appropriate growth factors. It is noted that the WRR model results are 2 hour peak period results. These were converted to peak hour results using peak hour factors determined during the TDG traffic surveys.

"Future" or construction traffic models were developed from the base models, based on cumulative peak hour traffic volumes for the operational sites [Note: see following section on cumulative effects of sites modelled]. This traffic was distributed along the main truck routes to the sites based on judgement of likely routes contained in the original TDG TIA report.

The SIDRA models were also reassessed in light of the FLOW observations made about lane utilisation and weaving on St Lukes Road and Great North Road in this area.

A request has been made via the s92 request to consider the option of construction site traffic taking advantage of the completion of the Waterview Connection to access SH20. It was suggested that vehicles which do so would use the Great North Road interchange. It is agreed that the completion of the Waterview Connection will allow efficient access to SH20 and may divert construction vehicles to this route, and considered likely that such traffic will join/exit SH20 via the SH16 to SH20 ramps at the Great North Road interchange and then exit SH16 at the St Lukes interchange.

The SIDRA results for the Great North Road/St Lukes Road intersection during the three peak hours modelled are shown in the following tables 1 to 3. Full SIDRA results are provided in Appendix D.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road	29.7	C	265	21.6	C	215
Great North Road WB	17.4	B	124	18.7	B	107
Great North Road EB	25.9	C	197	8.7	A	58
Intersection	**25.2**	**C**	**265**	**17.0**	**B**	**215**

Table 1: Model Results for Great North Road/St Lukes Road – Existing conditions (no construction vehicles)

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road	35.1	D	311	22.6	C	229
Great North Road WB	17.4	B	125	16.9	B	107
Great North Road EB	25.8	C	197	8.7	A	58
Intersection	**27.3**	**C**	**311**	**16.8**	**B**	**228**

Table 2: Model Results for Great North Road/St Lukes Road – Construction Year 2016 (with construction/previous scenario)

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road	21.8	C	229	24.5	C	225
Great North Road WB	19.9	B	146	14.9	B	94
Great North Road EB	16.7	B	165	8.2	A	55
Intersection	**19.5**	**B**	**229**	**16.7**	**B**	**225**

Table 3: Model Results for Great North Road/St Lukes Road – Construction Year 2016 Scenario v3

The above SIDRA results indicate that the effect of the construction traffic, even when four closely located sites are in operation, is minimal. Overall increases in delay are in the region of a few seconds and increases in 95th percentile queue length are less than 20 metres (equivalent to 3-4 cars). These changes are considered to be well within the capacity of the road network.

It is noted that the WRR 2016 model shows a marked reduction in volume of traffic turning right from St Lukes Road into Great North Road, in both the AM and PM peak periods from the 2011 model volumes. Increases for the left turn volume from St Lukes Road into Great North Road and the through eastbound volume for the morning and afternoon peak period respectively are also noted.

Similar development processes were employed for the development of St Lukes Road Westbound interchange models.

The SIDRA results for the St Lukes Road Westbound on/off ramps intersection during the three peak hours modelled are shown in Tables 4 to 6 below.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road NB	50.6	C	260.0	27.6	C	132.6
Westbound Off-Ramp	46.2	B	498.3	26.3	C	249.8
St Lukes Road SB	59.1	B	400.0	34.6	C	197.1
Intersection	**51.6**	**D**	**498.3**	**29.1**	**C**	**249.8**

Table 4: Model Results for St Lukes Road/Westbound On/Off ramps – Base Year 2016 (no construction)

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road NB	52.9	D	268.7	31.4	C	144.7
Westbound Off-Ramp	51.2	D	542.3	25.6	C	249.4
St Lukes Road SB	65.9	E	420.0	35.4	D	205.3
Intersection	**56.1**	**B**	**542.3**	**30.4**	**C**	**249.4**

Table 5: Model Results for St Lukes Road/Westbound On/Off ramps – Construction 2016 Year (with construction/previous scenario)

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road NB	50.5	D	260.0	53.7	D	144.9
Westbound Off-Ramp	50.6	D	522.5	27.4	C	268.3
St Lukes Road SB	59.2	E	388.1	37.9	D	212.3
Intersection	**53.1**	**D**	**522.5**	**36.8**	**D**	**268.3**

Table 6: Model Results for St Lukes Road/Westbound On/Off ramps – Construction Year 2016 v3

It is noted that the WRR model appears to have diverted considerable traffic off SH16 westbound at the St Lukes interchange to then turn right along St Lukes Road in the AM peak. The two hour AM peak volume increases from 684 vehicles (2011 WRR base model) to 1183 vehicles, a 73% increase. This volume increase is considered to drive the increase in off-ramp queue length noted above existing observations.

Aside from the above observation, it can be concluded that the effect of the construction traffic on the operation of this intersection is minimal, with maximum increase in average delay of 5-6 seconds and increases in 95th percentile queue length of around 50m, equivalent to 8 – 10 cars.

At the Great North Road/SH16 Eastbound Interchange it is noted that the WRR model appears to have diverted considerable traffic off SH16 eastbound at the St Lukes interchange to then turn right along Great North Road. Such diverted traffic would presumably continue towards the CBD via Great North Road. This effect is particularly noticeable in the morning peak period, when the two hour AM peak volume increases from 253 vehicles (2011 WRR base model) to 1867 vehicles. While it is acknowledged that use of this route to access the CBD does currently occur (primarily as a “rat-run” to avoid congestion further east on SH16 in the vicinity of the Central Motorway Junction) and may be a favourable option under certain conditions for SH16/SH20 vehicles post Waterview Connection it is considered that the volume of vehicles which have been diverted to this route is not consistent with the practical capacity limitations of intersections on this route.

Creating a peak hour model for the 2016 AM period (by adjusting the two-hour volumes with respect to peak hour factors observed during the TDG surveys), indicates that the Great North Road/SH16 eastbound interchange intersection will exceed capacity under this demand. This over capacity demand exists primarily due to the major demand flows (the right turn from the eastbound off-ramp, through eastbound on Great North Road and the right turn onto the motorway from Great North Road westbound) all being opposing movements – none can run simultaneously. Hence practical options to manage demand are limited. Given that the diversion of traffic off SH16 and onto Great North Road eastbound (towards the CBD) is something of a “rat run” manoeuvre it is considered unlikely that this route choice will be favoured if the resultant congestion invalidates any time advantage the route may potentially offer.

The notes provided by Beca with the WRR model results note that the increase may be due to instability in route choice.

Similarly in the afternoon peak the right turn volume from the eastbound off-ramp is higher in the 2016 WRR model than in the 2011 WRR although the increase is less significant: an 83% increase rather than a 700+% increase.

Subsidiary versions of the base models were created by TDG for this report where the predicted 2016 traffic volumes have been adjusted to what have been considered more appropriate levels. In practice this means projected RT volume in the AM peak has been

reduced to 60% of projections. The revised models are identified as "v2" in the SIDRA results in Appendix D. These models have then been used as the base models for assessment of the intersection operation, and used to create the future models for construction traffic effects. The construction traffic models accounted for the cumulative effects of having multiple sites in operation.

The results of these models are presented in Tables 7 and 8 below.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH16 Ebd on/off ramp	57.1	E	200	66.3	D	218
Great North Road WB	80.6	F	195	60.2	E	233
Stadium Road	69.0	E	77	65.8	E	23
Great North Road EB	53.8	D	300	72.1	E	338
Intersection	**60.5**	**E**	**300**	**66.7**	**E**	**338**

Table 7: Model Results for Great North Road/Stadium Road/SH16 Ebd On/Off ramps – Base Year 2016

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH16 Ebd on/off ramp		E	195	67.0	E	219
Great North Road WB	80.6	F	195	60.2	E	233
Stadium Road	69.2	E	81	72.1	E	35
Great North Road EB	54.1	D	303	73.6	E	346
Intersection	**60.2**	**E**	**303**	**67.7**	**E**	**346**

Table 8: Model Results for Great North Road/Stadium Road/SH16 Ebd On/Off ramps – Construction 2016 Year (previous scenario)

A further future model was then created where all traffic for the four operational sites was routed through the St Lukes interchange and the Great North Road/St Lukes intersections.

The results of this scenario are detailed in Table 8 below. Further detailed results are presented in Appendix D. This model scenario is identified as v3.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH16 Ebd on/off ramp	56.3	E	203	69.7	E	232
Great North Road WB	80.6	F	195	60.2	E	233
Stadium Road	69.1	E	78	67.9	E	36
Great North Road EB	57.7	E	316	78.7	E	356
Intersection	**62.1**	**E**	**316**	**70.2**	**E**	**356**

Table 9: Model Results for Great North Road/Stadium Road/SH16 Ebd On/Off ramps – Construction 2016 Year (v3)

As with the results presented in Table 7 the above results indicate that the effect of the construction traffic on the operation of the intersection is minimal. Increases in delay are in the region of 5 seconds or less.

The modelling of the Great North Road/Bullock Track/Tuarangi Road intersection has also been revised to make appropriate allowances for both the tendency of drivers on the Bullock Track to accept a reduced critical gap, and (more significantly) to account for the platooning of traffic flows along Great North Road due to the effects of upstream signalised intersections.

Traffic volumes at the intersection were adjusted to reflect the predicted changes in traffic patterns identified by the WRR 2016 model to create a new base year of 2016. A "future" model was then created to add the effects of construction traffic. This model accounted for the cumulative effects of having multiple sites in operation.

The results of these models are presented in Tables 10 and 11 below.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Great North Road WB	0.5	N/A	1	0.3	N/A	3
Great North Road EB	1.7	N/A	2	4.2	N/A	5
Bullock Track	39.9	E	27	349	F	283
Tuarangi Road	17.6	C	26	14.8	B	11
Intersection	**8.1**	**N/A**	**27**	**38.8**	**N/A**	**283**

Table 10: Model Results for Great North Road/Bullock Track/Tuarangi Road – Base 2016 Year

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Great North Road WB	0.5	N/A	1	0.3	N/A	3
Great North Road EB	1.8	N/A	2	4.2	N/A	5
Bullock Track	40.9	F	27	355.7	F	287
Tuarangi Road	17.6	C	26	14.8	B	11
Intersection	**8.2**	**N/A**	**27**	**39.3**	**N/A**	**287**

Table 11: Model Results for Great North Road/Bullock Track/Tuarangi Road – Construction 2016 Year

The modelling indicates that the effect of the additional construction traffic on the intersection operation is minor, with an increase of average delay of only 6 seconds on the worst affected leg. The average delay increase is less than one second. Changes of this magnitude would not be readily detectible to most motorists using this intersection.

We note that the revised SIDRA models contained within this s92 response have been developed with 2016 as the base year. Traffic volumes for 2016 have either been obtained from the Beca 2016 WRR model or by the appropriate factoring of 2012 traffic data. In summary, the effect of the cumulative construction traffic volumes is considered minimal and well within general daily variations in traffic flow.

Results of the remaining intersections from this modelling are discussed in sections specific to the site location.

- *Cumulative effects of construction at sites WS1, AS1, AS2, L1S1, L1S2 and L2S2 have not been considered. These effects need to be assessed, particularly with regard to the St Lukes Interchange operation to determine if restrictions need to be placed on truck movements during peak traffic times. This may need to consider a network model (eg using transit) due to the interaction between the St Lukes Road/westbound ramps, St Lukes Road/Great North Road and Great North Road/eastbound ramps/Stadium Road intersections.*

  It is anticipated that not all of these sites will be under construction at the same time. The timing of construction at each site will vary with different sites at different stages which will tend to spread the traffic loading. Furthermore, the trip generation for each of the construction sites has been conservatively estimated to examine their worst case scenarios. On this basis there is limited opportunity for cumulative effects of multiple sites to present a problem. Notwithstanding this, the additional SIDRA analysis described previously has been undertaken assuming four of the six construction sites identified are in operation and generating traffic. This is considered an appropriate and conservative yet realistic approach to examine any cumulative effects generated by multiple construction sites.

  An assumption was made that simultaneous operations would be occurring at the principal large site (Western Springs WS1) and three small or intermediate sites. This is an appropriate scenario as with estimated relative construction lengths at the various sites, it is likely that the large site will be in continuous or near-continuous operation throughout the project whilst the smaller sites will come on and off-stream as the project progresses.

  The Western Springs WS1 site will generate a peak of 27 vehicle movements during the peak hour and the small/immediate sites will, at worst, produce nine vehicle movements during the peak hour. Thus the four sites will cumulatively generate a peak of 54 vehicle movements during the peak hour. It is noted that even if all six of the sites identified operate simultaneously, the cumulative peak only increases to 72 movements for the peak hour. This is equivalent to approximately 2% of the typical peak hour volumes through the intersections under assessment, and would be similar to the typical day to day variations in traffic flow on the road network.

  SIDRA analysis for the St Lukes Road/westbound ramps, St Lukes Road/Great North Road and Great North Road/eastbound ramps/Stadium Road intersections has been carried out on the basis of the cumulative construction traffic volumes detailed above and with forecast future traffic flows post Waterview Connection completion. This has been included in Appendix D.

<u>General comments that could be addressed:</u>

- *Figure 2 from the Traffic Impact Assessment report shows the tracking curve for a semi-trailer truck extending outside the designated works area at the Bullock Track entrance. Confirm if widening of the existing crossing is required.*

  Widening of the Bullock Track entrance will be required as per the tracking curves shown on Figure 2 of the TIA report. This is shown in a close-up revised version Figure 2b, which shows the tracking curve remaining within the designation but widens the driveway to the north by approximately 2.5m.

- *The Bullock Track/Great North Road intersection has an existing safety problem. The effect of heavy vehicles turning left into Bullock Track could reduce safety for vehicles exiting Bullock Track. A review condition could be considered that limits truck access to the site during peak morning and evening periods should the safety record worsen.*

  Based on the information provided, it is anticipated that no more than five heavy vehicles will access the site via the Bullock Track/Great North Road intersection during the peak hour. However, if the safety record worsens, the site CTMP could be reviewed to possibly

limit truck access during peak periods. Consideration could also be given to adding a temporary slip lane for left turning traffic at that time.

- *The SIDRA models provided show significantly different results to those reported in the TIA.*

  Comment addressed previously. See revised results in Section 1.1.2.

- *Consider providing a pedestrian crossing facility at the northern end of Stadium Road.*

  It is considered that a pedestrian crossing facility is not necessary given that heavy vehicle movements would be restricted during major events occurring at Western Springs Stadium. It is understood that during other times, the majority of pedestrians parking on this road will be travelling to MOTAT and the proposed construction of a 2m footpath and bus stop drop off area on the western side of Stadium Road (MOTAT side) are adequate measures to minimise pedestrian/site vehicle conflicts.

1.2 Mount Albert War Memorial Reserve (AS1)

1.2.1 Information Required (Table, Section 1.2.1)

- *Cumulative effects of construction at multiple sites need consideration. This assessment should consider construction vehicle access to/from the west via SH16, as well as traffic flows post Waterview Connection.*

  See detailed response in Section 1. In summary, cumulative effects of construction at multiple sites are minimal.

- *More detail needs to be provided in terms of how access to the northernmost 36 public parking spaces is to be maintained, while still fencing the proposed construction area.*

  Figure 4a attached in this letter details the temporary arrangement of the public car park to maintain access to the northern parking spaces.

- *Confirm number of existing off street parking spaces that would be removed from public use during construction.*

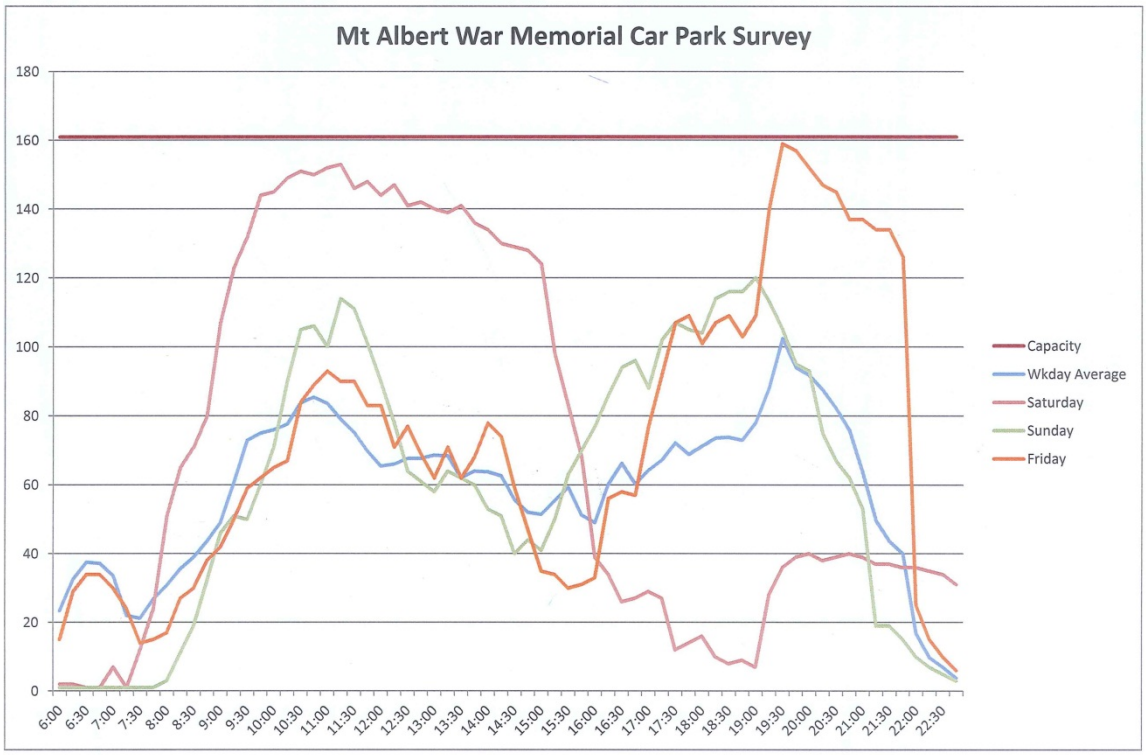
  As shown in Figure 4a total of 23 parking spaces would be removed from public use during construction. This includes 12 spaces in the north-western parking aisle, and 11 spaces in the parking areas immediately to the east of the parking aisle.

  In order to gauge the weekly usage of the car park, a week long (Monday –Sunday) survey was undertaken in the week starting 19 November 2012. Each day the car park was surveyed in 15 minute intervals between 6am and 11pm.

  The survey recorded all parking which occurred within the park boundaries, that is to say all parking areas accessed by the driveway from New North Road (Councillors Drive) and the two driveways from Wairere Avenue, including parking along those driveways.

  Results of the Parking Survey

  The graph below shows the observed numbers of vehicles parking on a typical average weekday, and a Friday (peak weekday), Saturday and Sunday, measured against the available capacity of the car park. The average weekday included data from the Friday survey.



It is apparent from the attached graph that observed number of parked vehicles only approached the capacity of the car park on two occasions, Friday evening between 7pm and 10pm and Saturday between 9am and 2pm.

An event was being hosted at the Mt Albert War Memorial Reserve on Saturday and it is considered that this event contributed a higher than typical demand for parking on this day. Parking occupancy on the Sunday is much lower than on the Saturday, and on Saturday from around 3pm, when the event at the park had concluded, demand for parking dropping significantly.

On the Friday evening it is understood that a combination of the regular Friday evening events at the Park, plus activities associated with setting up for the event on Saturday caused a spike in parking demand.
Outside of these two occasions demand for parking is notably less and in general a surplus of approximately 40 spaces is always available.

Observations made during the parking survey indicate demand for parking within some areas of the car park is significantly higher than in others. For instance the area in front of the YMCA experiences a high occupancy throughout the day, whilst the parking areas accessed from the northern driveway on Wairere Avenue (those affected by the proposed Watercare works) are close to empty throughout most days.

Overall there is generally adequate parking provision for the activities at the Mt Albert War Memorial Reserve, and significant excess of parking available, except on days (or just before days) when significant events are held.

- *Detail is required regarding the location of contractors parking during construction.*

  It is proposed that workers will park in some of the parking spaces along the north-western aisle of the car park (site accessway) within the site boundary. The 12 spaces will be more than sufficient to meet the expected parking demand.

General comments that could be addressed:

- *No parking restrictions may be required outside number 5 Wairere Avenue, in order to allow left turning heavy vehicles to exit. This will require the approval of Auckland Transport.*

  We agree that parking restrictions will be required between the site access and the driveway of 5 Wairere Avenue. Parking resolution will be sought from Auckland Transport as required, prior to construction.

- *Confirm if parking along access way would be used by contractors.*

  It can be confirmed that parking spaces along the accessway will be used by workers.

1.3 Lyon Avenue (AS2)

1.3.1 Information Required (Table, Section 1.3.1)

- *Cumulative effects of construction at multiple sites need consideration. This assessment should consider construction vehicle access to/from SH16 (both east and west), as well as traffic flows post Waterview Connection, with particular attention to the St Lukes Interchange during peak periods.*

  See detailed response in Section 1. In summary, the cumulative effects of construction at multiple sites are minimal.

- *The loss of 22 off street visitor parking spaces needs to be addressed.*

  The parking deck has recently been built over Watercare's overflow spillway structure. As discussed in Section 2.7 of the Section 92 Response Report, Watercare has an existing agreement with St Lukes Holdings Limited, Body Corporate No.346086 and St Lukes Garden Apartments Progressive Society Incorporated with respect to works over the existing spillway and future works relating to the Central Interceptor Project.

- *Detail is required regarding the location of contractors parking during construction.*

  The internal site layout is not fully confirmed at this stage. However, it is anticipated that workers will park within the site boundary.

General comments that could be addressed:

- *Remedial works may be required if damage is caused to the new roundabout on Morning Star Drive (to be addressed in the CTMP and CAR (Corridor Access Request) and any agreement made with property owners.*

  As noted above, Watercare has an existing agreement relating to this site. If any damage is caused to the road infrastructure on Morning Star Drive by site vehicles during construction, it will be remedied by Watercare.

1.4 Haverstock Road (AS3)

1.4.1 Information Required (Table, Section 1.4.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  It is anticipated that not all of these sites will be under construction at the same time. The construction timing at sites will differ to match the sequencing of the project and timing of tunnel advance and use of resources. For example shaft sinking operations which generate spoil will likely be staggered. As such volumes of construction generated traffic will tend to be spread. Furthermore, the trip generation/parking requirements for each construction site have been based on a conservative approach. Notwithstanding this,

further SIDRA analysis has been undertaken assuming six of the eight construction sites identified are in operation and generating traffic. This is considered an appropriate and realistic approach to examine any cumulative effects generated by multiple construction sites.

An assumption was made that simultaneous operations would be occurring at the primary site at May Road (WS2) and five small or intermediate sites. This is an appropriate scenario as with estimated relative construction lengths at the various sites, it is likely that the primary site will be in continuous or near-continuous operation throughout the project whilst the secondary sites will come on and off-stream as the project progresses.

The May Road WS2 site will generate a peak of 27 vehicle movements during the peak hour and the secondary sites will, at worst, produce nine vehicle movements individually during any peak hour. Thus the six sites will cumulatively generate a peak of 72 vehicle movements during the peak hour.

SIDRA analysis for the Maioro Street/SH20 Interchange, Dominion Road/SH20 Interchange, May Road/Stoddard Road/Denbigh Road intersection and Denbigh Road/Dominion Road intersection has been carried out on the basis of the cumulative construction traffic volumes detailed above and with forecast future traffic flows post Waterview Connection completion.

This analysis has indicated that in general the cumulative effects of construction at multiple sites are limited. Whilst there are some increases in delay and queue length it is considered these have minimal effect on the overall efficiency of the road network. Specific results from the SIDRA modelling are discussed as follows:

A revised SIDRA model for the Dominion Road/SH20 Interchange has been developed which assesses the signalised northbound and southbound off/on ramps intersections as a single signalised intersection.

Traffic volumes of the SIDRA model are based on the 2016 year flows as predicted by the WRR model. Construction traffic has been added on the basis of six local sites operating simultaneously as detailed in Section 1.4. The distribution of this construction traffic has been assigned on the basis of the truck routes presented in the TIA report and this letter report.

Tables 12 and 13 present summary results of this SIDRA modelling while more detailed results are provided in Appendix E.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH20 Northbound Off-Ramp	33.1	C	55	37.2	D	67
Dominion Road Internal Leg: East	13.6	B	35	16.6	B	75
Dominion Road East	15.9	B	20	22.1	C	59
SH20 Southbound Off-ramp	18.9	B	41	21.9	C	22
Dominion Road Internal Leg: West	3.7	A	18	4.9	A	16
Dominion Road West	15.0	B	23	15.0	B	14
Intersection	**16.0**	**B**	**55**	**20.5**	**C**	**75**

Table 12: Model Results for Dominion Road/SH20 Interchange – Base 2016 Year (no construction)

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH20 Northbound Off-Ramp	30.7	C	54	36.7	D	70
Dominion Road Internal Leg: East	15.6	B	39	15.4	B	75
Dominion Road East	15.8	B	20	23.3	C	66
SH20 Southbound Off-ramp	20.0	B	44	22.6	C	23
Dominion Road Internal Leg: West	3.1	A	15	5.7	A	19
Dominion Road West	14.9	B	23	16.8	B	17
Intersection	**15.9**	**B**	**54**	**20.9**	**C**	**75**

Table 13: Model Results for Dominion Road/SH20 Interchange – Construction 2016 Year (updated volumes/previous scenario)

As can be seen in the above tables the effect of the additional construction traffic is minor. The SH20/Dominion Road interchange is a relatively new facility and as such has more than sufficient spare capacity for the short-term effects of this project. It is noted that while the above tables suggest the overall performance of the interchange improves with the addition of the construction traffic, there is a minor increase in the degree of saturation for the interchange with the addition of the construction traffic and small increases in queue length (approximately 5m or one car length) on the internal legs of the interchange. In the afternoon models the increases in predicted delay are similarly minor (less than one second overall). Such changes are considered to be imperceptible to the average motorist.

The additional construction traffic is equivalent to approximately 1% of the total interchange volumes (excluding through traffic on SH20), therefore the very minor result changes from these additional vehicles are considered to be realistic.

- *Detail is required regarding the location of contractors parking during construction*

The internal site layout is yet to be confirmed at this stage. However, there would be sufficient room to provide some parking for workers on-site while accommodating the turnaround of trucks. Any parking overflow will use the available on-street parking on Haverstock Road and/or surrounding streets. Ample on-street parking was observed to be available as described below. We consider that the temporary loss of on-street parking can be accommodated without resulting in any significant effects.

- *Need confirmation that the width of the existing MASC access is suitable for two way access including trucks. Alternatively, describe operation and assess effects of one way movements and location and effects of an on street loading space.*

Although the option of using Hampstead Road for construction access was considered as a possibility if the other two potential access options to the site are unavailable, this option is not being pursued at this time. Access will either be from Haverstock Road or Camden Road.

- *Need to assess the effects should the access between 96 and 98 Haverstock Road to be one way at a time. Alternatively, describe operation and assess effects of one way movements and location and effects of an on street loading space.*

Approximately nine vehicle movements are anticipated to be generated by the site during the peak hour. The probability of two trucks accessing the site at one time is therefore considered low and if one-way operation is required, the access is likely to be managed manually (for example, by an on-site spotter) and/or using communication between trucks

to ensure that opposing site traffic can make sure that the driveway is clear of traffic before proceeding. This will minimise conflicts at the access and will be managed by means of a detailed traffic management plan during the construction stage. There are generally sufficient kerbside parking spaces available on Haverstock Road with no restriction. Should a truck be required to wait on-street before accessing the site, negligible adverse effects to the on-street parking are anticipated. A specific loading bay is considered unnecessary given the low volume of daily trips expected.

- *The effects of removing on street parking from Haverstock, Camden or Hampstead Roads needs assessing, particularly for Camden and Hampstead roads.*

Numerous site inspections had been carried out during weekdays and evening (when on-street parking demand for residential neighbourhoods is generally highest), and abundant parking is available on Haverstock Road, Camden Road, Hampstead Road and Euston Street. Haverstock Road is the preferable site access location and we consider that the temporary loss of parking can be accommodated without resulting in any significant effects. As noted above, the option of accessing the construction site via Hampstead Road is not being pursued at this time.

The following photographs were taken at these streets during a weekday evening inspection (and also 3pm weekday for Hampstead) and they demonstrate that the existing on-street parking demand is low.

Photograph 1: View of Camden Street from Euston Road (8pm)

Photograph 2: View of Euston Street southbound (8pm)

Photograph 3: View of Hampstead Road from Euston Road (8pm)

Photograph 4: Haverstock Road looking east (8pm)

Photograph 5: View of Hampstead Road (3pm weekday)

Construction access via Camden Road would only be considered if Haverstock Road access becomes unavailable. Camden Road currently provides eight kerbside spaces on the westbound side. These spaces would be removed if site access is gained from this cul-de-sac. During a site inspection (weekday evening) it was observed that only three vehicles were parked on Camden Road. It was observed that some 50 indented parking

spaces are provided along Euston Street and at the time of inspection, only seven vehicles were parked in these spaces. The removal of kerbside parking on Camden Road can therefore be compensated by the available spaces on Euston Road.

- *The viability of the suggested indented parking on Camden Road needs confirmation.*

It is considered that the provision of indented parking spaces (with a width of 1.5m to 2m into the existing berm) on Camden Road between existing trees is feasible if required by demand. However, we consider that the existing on-street parking demand is low and therefore it should not be necessary to pursue this option.

General comments that could be addressed:

- *Use of Fowlds Avenue rather than Haverstock Road could be a more appropriate option to access the site to and from SH16 and avoid potential issues at the Haverstock Road/Sandringham Road intersection. If considered, it should be examined in more detail with regard to truck and trailer tracking through the intersection of Fowlds Avenue and Haverstock Road.*

  We consider that it is a safer option to keep site vehicles on arterial roads (Sandringham Road) where possible. Although Fowlds Avenue is classified as a collector road, it is bordered by residential properties along the majority of its length which may generate more undesirable effects than if site vehicles were to travel along Sandringham Road.

- *The removal of on street car parking on any of Haverstock, Camden or Hampstead Roads (depending on the access option sought) at the access location and on Haverstock Road west of Sandringham Road requires Auckland Transport agreement.*

  Parking resolutions would be sought from Auckland Transport as required, prior to construction.

- *The use of Haverstock Road will have less traffic effects than using Camden Road or Hampstead Road.*

  Haverstock Road is the preferred access option for this site. However, the alternative access option of Camden Road may need to be used if the Haverstock Road access option is not available. As noted above, the option of accessing the construction site via Hampstead Road is not being pursued at this time.

- *Parking effects are considered to be more than minor for Camden Road and Haverstock Road.*

  Numerous site inspections have been carried out during weekdays and evening (when on-street parking demand for residential neighbourhoods is generally highest), and abundant parking is available on Haverstock Road, Camden Road, Hampstead Road and Euston Street. Haverstock Road is the preferable site access location and we consider that the temporary loss of parking can be accommodated without resulting in any significant effects.

1.5 Walmsley Road (AS4)

1.5.1 Information Required (Table, Section 1.5.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  See response in Section 1.4. In summary it is considered the cumulative effects of simultaneous construction occurring at a number of sites can be managed appropriately.

- *Detail is required regarding the location of contractors parking during construction.*

  The internal site layout is yet to be confirmed at this stage. However, there would be sufficient room to provide parking for workers on-site while accommodating the turnaround

of trucks. Any parking overflow will use the available on-street parking on Sandringham Road Extension. Numerous site inspections have been carried out during weekdays and ample on-street parking was observed to be available. We consider that the temporary loss of on-street parking can be accommodated without resulting in any significant effects.

The following photographs show the low level of existing on-street parking demand on Sandringham Road Extension and on Gifford Avenue.

Photograph 6: Sandringham Road Extension (looking south)

Photograph 7: Sandringham Road Extension (looking north)

Photograph 8: Gifford Avenue

- *Information is required regarding how trucks will not block following traffic on Sandringham Road Extension if they are waiting to enter the site.*

  The northbound lane of Sandringham Road Extension to the south of the access is over 5m wide and kerbside parking is restricted here. In the low probability event that a truck is required to wait on-street before entering the site, there is sufficient space for northbound traffic to pass the truck safely. Further, northbound traffic would be travelling at reduced speeds or just accelerating from slowing for the pedestrian crossing to the south. This will be managed through the detailed traffic management plan during the construction stage.

General comments that could be addressed:

- *The temporary loss of on street parking spaces on Sandringham Road Extension will require approval of Auckland Transport.*

  Parking resolution would be sought from Auckland Transport as required, prior to construction.

1.6 May Road (WS2)

This site will be one of the three primary construction sites, used for constructing the main tunnel over a period of five to six years. The site is presently vacant. Photograph 9 identifies the location of the site access to the May Road site, on Roma Road.

Photograph 9: May Road site access, Roma Road

1.6.1 Information Required (Table, Section 1.6.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  The approach to considering cumulative effects of multiple construction sites has been outlined in Section 1.4. Results from SIDRA analysis of the Maioro Road/SH20 Interchange and Denbigh Road/Dominion Road interchange are presented below. In summary, the general cumulative traffic effect of having multiple construction sites in operation simultaneously is minimal. Some more significant effects are noted at the May Road/Stoddard Road/Denbigh Avenue intersection although it is considered this is primarily driven by existing capacity constraints.

  As previously outlined, three model scenarios for each peak (AM period and PM period) have been developed, representing a base 2016 year and 2016 with construction traffic.

Data for the 2016 base year has come from either the WRR 2016 model or by applying appropriate growth factors to 2012 survey data as appropriate.

Tables 14 and 15 present summary results of this SIDRA modelling for the Maioro Road Interchange while more detailed results are provided in Appendix E.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH20 Northbound Off-Ramp	31.8	C	64	56.4	E	393
Maioro Road Internal Leg: East	8.9	A	24	28.1	C	152
Maioro Road East	20.8	C	62	46.7	D	95
SH20 Southbound Off-ramp	25.4	C	42	59.7	E	193
Maioro Road Internal Leg: West	12.2	B	72	13.9	B	143
Maioro Road West	16.1	B	84	27.1	C	184
Intersection	**18.1**	**B**	**84**	**37.8**	**D**	**393**

Table 14: Model Results for Maioro Road/SH20 Interchange – Base 2016 Year

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
SH20 Northbound Off-Ramp	32.1	C	67	57.4	E	402
Maioro Road Internal Leg: East	8.9	A	24	28.1	C	152
Maioro Road East	21.3	C	69	46.0	D	95
SH20 Southbound Off-ramp	25.4	C	42	59.7	E	193
Maioro Road Internal Leg: West	12.2	B	73	14.0	B	146
Maioro Road West	16.1	B	84	27.4	C	189
Intersection	**18.3**	**B**	**84**	**38.1**	**D**	**402**

Table 15: Model Results for Maioro Road/SH20 Interchange – Construction 2016 Year

It is noted that the WRR model predicts a high demand for the SH20 northbound off-ramp during the PM period. The above tables indicate that the effects of the construction traffic on the operation of this interchange are minimal, with predicted increases in delay of less than one second and increases in queue length of less than 10m.

Tables 16 and 17 present summary results of SIDRA modelling for the Dominion Road/Denbigh Avenue intersection while more detailed results are provided in Appendix E.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)

Dominion Road NB	8.4	A	43	12.6	B	62
Denbigh Avenue WB	9.4	A	16	16.8	B	50
Dominion Road SB	9.5	A	34	7.5	A	36
Denbigh Avenue EB	13.5	B	36	10.3	B	18
Intersection	**9.9**	**A**	**43**	**12.2**	**B**	**62**

Table 16: Model Results for May Road/Stoddard Road/Denbigh Avenue – Base 2016 Year

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Dominion Road NB	8.4	A	43	12.7	B	62
Denbigh Avenue WB	9.5	A	16	18.1	B	53
Dominion Road SB	9.7	A	36	7.8	A	39
Denbigh Avenue EB	13.7	B	38	10.4	B	19
Intersection	**10.0**	**A**	**43**	**12.7**	**B**	**62**

Table 17: Model Results for Dominion Road/Denbigh Avenue – Construction 2016 Year

The above results indicate the Dominion Road/Denbigh Avenue intersection operates at a high level of efficiency. The increase in traffic volumes due to construction traffic does not affect the ability of the intersection to operate efficiently at any material level.

- *Detail is required regarding the location of contractors' parking during construction*

Site workers will park in the parking area on-site as shown in the proposed site layout plan (In the AEE drawing set, Drawing AEE-MAIN-6.2).

- *Confirmation is required whether on street car parking is to be removed adjacent to the access, and the scale of this parking removal. Will parking then be reinstated following construction, or will the change be permanent?*

In order for heavy vehicles to safely access the site, no stopping restriction of around 23m would be required on the southern side of Roma Road east of the site access. This would result in a loss of four parking spaces including the proposed vehicle crossing for the site access. We consider that the temporary loss of on-street parking can be accommodated without resulting in any significant effects. The extent of no parking restrictions is shown on Figure 12a. This figure also indicates the proposed locations of advisory signage/ warning devices / signals to ensure to ensure heavy vehicles can enter and exit the site safely and efficiently without effecting existing users of Roma Road, while at the same time removal of parking on Roma Road is minimised.

Photograph 10 indicates the available parking resources on Roma Road outside of standard working hours. These photographs indicate that there is a substantial vacant parking resource at these times.

Photograph 10: Roma Road (evening)

During working hours theses spaces are used more by local staff working in the area however, as Photograph 11 below shows, ample spaces are still available at these times:

Photograph 11: Roma Road (3pm weekday)

It is considered that the parking restrictions would be removed post construction. However, the site access will be retained post construction to allow for maintenance access. The kerbside parking space at the location of the site access (one space) would therefore be removed permanently.

- *A more detailed assessment of the crash history of the May Road and Roma Road intersection is requested, comparing this with the typical crash rate for an intersection of this type.*

A detailed crash analysis has been carried out to examine all crashes that occurred within a 50m radius of the Roma Road/May Road intersection during a study period of 2007 to 2011 and all available crashes from 2012.

A total of three crashes including one minor injury crash were recorded to have taken place at the Roma Road intersection. Two non-injury crashes were caused by vehicles turning right from Roma Road onto May Road failing to give-way to through vehicles. A rear-end type crash occurred on May Road adjacent to Roma Road.

The TIA previously indicated that a total of nine crashes including three minor injury crashes were recorded in the vicinity of the site. This has been closely reviewed and it has been found that five crashes including two minor injury crashes were associated with the May Road/Christie Street intersection 50m north of Roma Road. A review of the LTNZ

Economic Evaluation Manual (EEM) Section A6.6 has been used to predict typical injury accident rates (reported injury accidents per year has been calculated as 0.31 injury accidents per year). With only three crashes (one injury) over the last five years, the crash history at the Roma Road intersection is considered typical for such an intersection.

General comments that could be addressed:

- *The effects of construction traffic at the intersection of May Road, Stoddard Road and Denbigh Avenue are significant, with delay and queue increases (by approach) of up to 25%, and levels of service reducing on some approaches from D to E and from E to F.*

  It is noted that this intersection experiences high traffic volumes and will be operating near to capacity in its current formation when the Waterview Connection opens. The SIDRA models developed for the 2016 base year indicate that a number of legs of the intersection will be operating with a degree of saturation in excess of 0.9, which is considered undesirable.

  At such high levels of usage small changes (increases) in demand can cause potentially critical effects to the operation of the intersection. It is acknowledged that the traffic effects of the proposed construction programme, whether with a single site operating or multiple sites represent such an increase. However, even the predicted additional traffic with six construction sites in simultaneous operation represents only an additional 30 vehicles (approximately) through this intersection, equivalent to between 1- 1.5% of the usual traffic volume. This increase is within the probable daily variations of traffic flow through this intersection. It is thus considered management of traffic volumes through this intersection is an on-going issue which more directly requires input from Auckland Transport, rather than close management of a single small scale component to the traffic flow.

  Nonetheless SIDRA analysis of the operation of this intersection has been undertaken. Three model scenarios for each peak (AM period and PM period) have been developed, representing a base 2016 year and 2016 with construction traffic.

  Tables 18 and 19 present summary results of this SIDRA modelling while more detailed results are provided in Appendix E.

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
May Road NB	44.1	D	273	82.8	F	243
Denbigh Avenue WB	41.8	D	109	72.2	E	411
May Road SB	44.0	D	79	80.8	F	277
Stoddard Road EB	51.7	D	81	94.3	F	171
Intersection	**44.9**	**D**	**273**	**80.3**	**F**	**411**

Table 18: Model Results for May Road/Stoddard Road/Denbigh Avenue – Base 2016 Year

Approach	Weekday AM Peak			Weekday PM Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
May Road NB	33.2	C	232	82.4	F	252
Denbigh Avenue WB	52.2	D	132	71.7	F	411
May Road SB	51.5	D	91	97.1	F	307
Stoddard Road EB	59.8	D	94	94.4	F	171
Intersection	**44.5**	**D**	**231.7**	**83.9**	**F**	**411**

Table 19: Model Results for May Road/Stoddard Road/Denbigh Avenue – Construction 2016 Year

As can be seen in the above tables, generally there is not a significant change in the intersection performance resulting from the additional construction traffic. It is however recognised that this intersection is the most congested in the area. Further, with both the Maioro-SH20 interchange and the Dominion Road interchange located either side of May Road/Stoddard Road/Denbigh Avenue intersection, it may be possible to restrict truck movements at this intersection for all sites except for the May Road (WS2) site. However, if required, May Road (WS2) trucks could only undertake left turns at this intersection (and avoid more difficult right turns) by leaving the WS2 site using the Maioro Interchange (via Stoddard Road) and entering the site via Dominion Road interchange (via Denbeigh Avenue). This could be outlined in the detailed CTMP.

- *Any removal of on street parking on Roma Road will require the approval of Auckland Transport.*

  Parking resolution would be sought from Auckland Transport as required, prior to construction.

1.7 Keith Hay Park (AS5)

1.7.1 Information Required (Table, Section 1.7.1)

- *Confirmation of whether the access will be for one direction at a time or two way traffic. If one way at a time then details of how this will be managed, together with an associated assessment of effects is needed. Ideally the access should be able to accommodate trucks turning in and then waiting off the street should another truck be exiting.*

  No more than 68 vehicle trips are expected to travel to the site per day and only nine trips are expected during the peak hour. The probability of two trucks accessing the site at one time is considered low and the proposed one-way access is likely to be managed manually (for example by an on-site spotter) and/or using communication between trucks to ensure that opposing site traffic can make sure that the driveway is clear of traffic before proceeding. This will avoid conflicts and reverse movements and will be managed by means of a detailed traffic management plan during the construction stage.

  Sufficient room will be provided on-site to accommodate the turnaround of trucks.

  A specific loading bay is considered unnecessary given the low volume of daily trips expected. There is ample kerbside parking available on Arundel Street with no restriction and the majority of adjacent properties can accommodate two vehicles. Should a truck be required to wait on-street before accessing the site, negligible adverse effects to the on-street parking is anticipated.

  The internal site layout is yet to be confirmed at this stage. However, there would be sufficient room to provide some parking spaces within the site for workers while accommodating the turnaround of trucks. Any parking overflow will use the available on-street parking on Arundel Street or Rainford Street. The Council car park on Rainford Street or parking spaces within Keith Hay Park may be used outside of peak times for activities at Keith Hay Park, subject to discussions with Auckland Council Parks.

Numerous site inspections have been carried out during weekdays and evening (considered peak time) and ample on-street parking was observed to be available on surrounding streets and within the public car park on Rainford Street. The on-street parking on Arundel Street has plenty of spare capacity during various inspections at different times of the day/evening. Minimal effects will be caused by removing approximately two parking spaces on Arundel Street due to the temporary works.

It is however noted that there is a high demand for parking in Rainford Street and the associated off-street public car park during sporting and cultural events at Keith Hay Park. Therefore it is recommended that use of the Rainford Street access and contractor parking on-street near this site, be restricted during events at Keith Hay Park. We consider that the temporary loss of parking can be accommodated without resulting in any significant effects.

Photographs 12 to 14 illustrate the weekend available parking resources in Arundel Street, and Rainford Street. Photographs 15 and 16 show the level of available parking on Rainford Street and in the off-street public car park (on a weekday evening around 8pm) without any particular events occurring at Keith Hay Park.

Photograph 12: Arundel Street, looking towards Cameron Swimming Pool

Photograph 13: Rainford Street, weekend event occupancy

Photograph 14: Rainford Street Public Carpark, weekend event occupancy

Photograph 15: Rainford Street, weekday evening occupancy

Photograph 16: Rainford Street Public Carpark, weekday evening occupancy

- *Provide a truck tracking assessment for access from Rainford Street, including access over the bridge and turnaround on site.*

A tracking curve demonstrating access into the site from Rainford Street is attached as Figure 14a.

One-way access via the existing bridge on Rainford Street is likely to be managed manually (for example by an on-site spotter) and/or using communication between trucks to ensure that opposing site traffic can make sure that the accessway is clear of traffic before proceeding. Some strengthening and widening works for the bridge is likely to be required.

- *Provide information on the feasibility of providing an alternative foot/cycle path into and through Keith Hay Park. If not feasible, then provide details of how pedestrian and cyclist safety and amenity will be provided for and an assessment of effects.*

  Watercare will consult with Auckland Council Parks prior to construction regarding temporary effects on pedestrian access and the feasibility of providing an alternative foot/cycle path.

  The Rainford Street access is a secondary access for micro tunnelling purposes only. The majority of the works will occur at 20/22 Gregory Place (and 49 Arundel Street) which will have minimal effects to the pedestrian/cyclist path in Keith Hay Park.

- *Provide detail regarding what vehicles and volume of traffic is proposed to enter and exit from the Gregory Place access, as noted on drawings AEE- MAIN-7.1. Provide an assessment of effects of this traffic.*

  The only access to Gregory Place will be post construction for maintenance proposed (eg: on vehicle each month). No construction access is proposed via Gregory Place.

General comments that could be addressed:

- *The CTMP should address timing the arrival of heavy vehicles to not coincide with the busy periods at the pools and the gymnasium to improve safety for school children and other pedestrians.*

  The access to the construction site off Arundel Street will need to be carefully managed given the volumes and types of traffic entering and leaving the site, construction driver education will be important and the timing of movements should as far as practical respect the use of the facilities in the area.

1.8 Pump Station 23 (AS6)

1.8.1 Information Required (Table, Section 1.8.1)

- *Detail is required regarding the location of contractors' parking during construction. If on street, then an assessment of the effects of this is required.*

  The internal site layout is not confirmed at this stage. However, given the steep topography of the driveway and limited land available on-site, it has been assumed that no parking spaces will be provided within the site. Parking required by workers would be accommodated by on-street parking. As less than ten workers are normally expected on-site at one time and some workers may carpool to site, we consider that the temporary loss of parking can be accommodated without resulting in any significant effects (see following section on effects).

- *Truck manoeuvres within the site during the construction of the temporary platform needs to be addressed. Smaller trucks may be necessary, as well as three point turns within the site. Confirmation is required that smaller trucks will be able to manoeuvre adequately.*

  Tracking curves of a single unit truck accessing the existing site is shown in Figure 16a attached. Adequate space is provided within the site for the truck to perform a three point turn before exiting the site in a forward motion.

- *Confirmation is sought as to the quantity of on street parking to be temporarily removed to allow truck movements into and out of the site.*

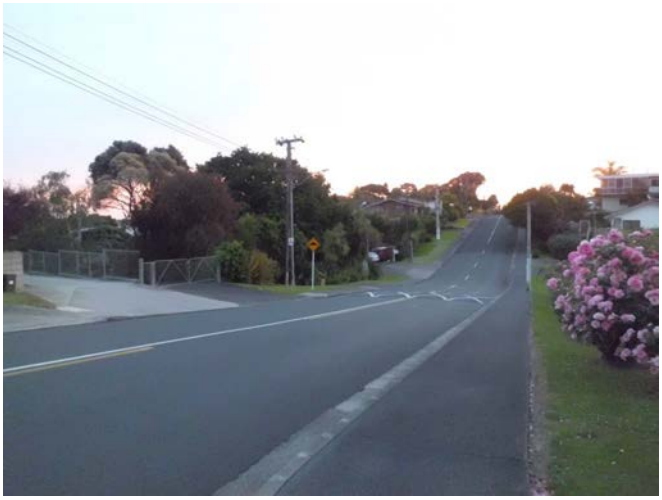
  Approximately four spaces will be temporarily removed to enable truck movements into and out of the site. This includes a temporary loading area on the southbound side of Fredrick Street and two spaces on the northbound side just south of the Pallister Drive intersection.

- *The effects of restricting on street parking in the location of the truck waiting area should similarly be assessed.*

  Fredrick Street and Pallister Drive have been observed to have significant spare on-street parking capacity during various inspections at different times of the day/evening. Minimal effects are expected to be caused by the parking removal due to the temporary works.

  The following photographs illustrate the available parking resources on Frederick Street and Pallister Drive on a weekday evening around 8pm (considered residential peak time).

Photograph 17: Frederick Street (looking north at 8pm)



Photograph 18: Frederick Street (looking south at 8pm)

Photograph 19: Pallister Drive (8pm)

The proposed truck waiting area is located within the Fredrick Street/Pallister Drive intersection. However, with an average of five heavy vehicle movements accessing the site per hour, it is anticipated that the loading area will be rarely used.

- *Truck tracking showing movements turning left into the site access requires assessment.*

  The revised tracking curves of a single unit and tandem dump truck turning left into the site access is shown in Figure 16 (version 2) attached. It is noted that the tandem dump (truck and trailer) will need to swing over the centre line to turn left into the site or utilise the adjacent driveway. Accordingly, within the detailed CTMP of this site the condition of the adjacent driveway should be reviewed and repaired accordingly following completion of works. Alternatively, the site should be restricted to single unit dump trucks (no trailers).

General comments that could be addressed:

- *Remedial work to the Queenstown Road/Frederick Street roundabout may be required following construction.*

  If any damage is caused to the road infrastructure by site vehicles during construction, it will be remedied by Watercare.

- *Resolutions are required for removal of on street car parking.*

  Parking resolutions would be sought from Auckland Transport as required, prior to construction.

1.9 Kiwi Esplanade (AS7)

1.9.1 Information Required (Table, Section 1.9.1)

- *Information with respect to the site access for the Kiwi Esplanade site within the Traffic Impact Assessment report (TIA) appears to be contradictory. Plans included in the TIA appendix and the drawing AEE-MAIN-9.1 show the site access as being via the reserve road which is accessed from Kiwi Esplanade. However, text within the TIA as well as Photograph 15 and the proposed truck routes all refer to a different Kiwi Esplanade site access opposite Andes Avenue.*

  It can be confirmed that the plans included in the TIA show the correct site location for Kiwi Esplanade and the text within the TIA refers to an older site option which has been superseded.

  The Kiwi Esplanade site is proposed to be accessed via the existing reserve road off Kiwi Esplanade, opposite 85 Kiwi Esplanade. The reserve road is approximately 7 m wide and will satisfactorily accommodate two-way truck traffic.

The site is located on the western side of the reserve south of the Manukau Yacht and Motor Boat Club. The access road forms a loop within the site and it operates in an anti-clockwise manner to enable entry and exit manoeuvres from the site to be carried out in a forward direction.

Vehicles are proposed to access the site via Kiwi Esplanade, turning right into the reserve road from Kiwi Esplanade and left out of the reserve road onto Kiwi Esplanade. Traffic volumes on Kiwi Esplanade are low so there should be minimal delay to general traffic and traffic accessing/exiting the site. Sight distances for the proposed site access are adequate given that vehicle speeds along the reserve road and Kiwi Esplanade will be low.

Although there is no pedestrian footpath alongside the reserve road, a continuous footpath is provided along the water front of the reserve.

Tracking provided in the TIA report shows that both a single dump truck and tandem dump truck (truck and trailer) can adequately access/egress the site.

- *Detail is required regarding the location of contractors' parking during construction.*

  The internal site layout is yet to be confirmed at this stage. However, there would be sufficient room to provide some parking spaces within the Kiwi Esplanade site for workers while accommodating the turnaround of trucks. Any parking overflow will be accommodated by the abundance of parking available on Kiwi Esplanade without resulting in any significant effects.

General comments that could be addressed:

- *Temporary loss of on street parking will be required during construction of the link sewer between the Central and Western Connectors (LS4). The scale and effects of this loss requires addressing and additionally requires Auckland Transport's consideration.*

  As detailed in the TIA report, the LS4 link sewer of 700m in length is proposed to be trenched from the Kiwi Esplanade site to the existing western interceptor on Witla Court. The proposed works will be carried out in stages while undertaking careful temporary traffic management measures to ensure minimal traffic disturbance is caused and also minimising the scale and effects of on-street parking loss. Stop-go control is proposed where traffic is to be restricted to a single lane of operation. On-street parking restrictions will be in place for the immediate section of the pipeline under construction and will be reinstated as the construction site shifts along the course of the pipeline. Observations of the vicinity suggest that ample on-street parking is available on these local streets to offset the parking removal as required by the works as well as parking required by workers.

1.10 Motions Road (L1S1)

1.10.1 Information Required (Table, Section 1.11.1)

- *Cumulative effects of construction at multiple sites need consideration. This assessment should consider construction vehicle access to/from SH16 (both east and west), as well as traffic flows post Waterview Connection. See Section 1.1.1*

  See Section 1. No significant negative effects have been identified.

- *Detail is required regarding the location of contractors' parking during construction*

  The internal site layout is not confirmed at this stage. However, there would be sufficient room to provide sufficient parking spaces within the site for workers while accommodating the turnaround of trucks. If required, any parking overflow will be accommodated by the parking spaces on Motions Road and Old Mill Road without resulting in any significant

effects. The following photographs identify the on-street parking opportunities on Motions Road in the off-peak periods.

Photograph 20: Motions Road looking south

Photograph 21: Old Mill Road

It is noted however, that during weekends and school holiday periods the parking on Motions Road is well used by visitors to the nearby Auckland Zoo. In these times it is suggested that contractors park on-site or on Old Mill Road. This can be detailed in the detailed CTMP for this site.

<u>General comments that could be addressed:</u>

- *The proposed vehicle crossing on Motions Road may be able to be reduced in width*

  The splay on the northern side of the access may be reduced as most site vehicles will be accessing the site from Great North Road to the south. This could reduce the vehicle crossing to approximately 8m thus reducing the distance for pedestrians to cross and improving pedestrian safety.

  Tracking showing this is attached as Figure 20 (version 2). It is agreed that the access width of the site boundary could be reduced to 8m in width.

- *The intersection of Motions Road/Great North Road is now controlled by traffic signals.*

  The Motions Road/Great North Road intersection has been signalised since the initial assessment. All site vehicles will be able to access this intersection in a safe and controlled manner without any turning restrictions.

1.11 Western Springs Depot (L1S2)

1.11.1 Information Required (Table, Section 1.12.1)

- *Cumulative effects of construction at multiple sites need consideration. This assessment should consider construction vehicle access to/from SH16 (both east and west), as well as traffic flows post Waterview Connection.*

  See Section 1. No significant negative effects have been identified.

- *Detail is required regarding the location of contractors' parking during construction*

  The internal site layout is not confirmed at this stage. However, there would likely be sufficient room to provide only one to two parking spaces within the site for workers while accommodating the turnaround of trucks. Any parking overflow will use the spare parking capacity of the 90 degree angled parking within the Stadium car park, subject to discussions with the landowner.

  As less than ten workers are normally expected on-site at one time and some workers may carpool to site, we consider that the temporary loss of parking within the Stadium car park can be accommodated without resulting in any significant effects, particularly as work will not be undertaken when a large event is taking place at the stadium.

General comments that could be addressed:

- *Consider providing a pedestrian crossing facility at the northern end of Stadium Road (See Section 1.1.2).*

  It is considered that a pedestrian crossing facility is not necessary given that heavy vehicle movements would be restricted during major events occurring at Western Springs Stadium. It is understood that during other times, the majority of pedestrians parking on this road will be travelling to MOTAT and the proposed construction of a 2m footpath and bus stop drop off area on the western side of Stadium Road are adequate measures to minimise pedestrian/site vehicle conflicts.

1.12 Rawalpindi Reserve (L2S1)

1.12.1 Information Required (Table, Section 1.13.1)

- *Detail is required regarding the location of contractors parking during construction.*

  The internal site layout is unconfirmed at this stage. However, it is considered that there would be adequate room to provide sufficient parking spaces within the site for workers while accommodating the turnaround of trucks. In the unlikely event that additional parking is required, any parking overflow will use the available on-street parking on Rawalpindi Street. Numerous site inspections have been carried out during weekdays and evening (when on-street parking demand for residential neighbourhoods is generally highest)). Ample on-street parking was observed to be available on Rawalpindi and surrounding streets. A recent inspection during a weekday evening indicated that a total of 13 vehicles were parked on the full length of Rawalpindi Street of approximately 280m.

  The following photographs show the low level of existing on-street parking demand on Rawalpindi Street.

Photograph 22: Rawalpindi Street looking north (8pm)

Photograph 23: Rawalpindi Street looking south

- *Confirmation is sought regarding whether or not the existing vehicle crossing is to be widened to accommodate the tracking as shown in the plans (Figure 24 of the TIA).*

  The site access will be widened as per the tracking curve diagram shown on Figure 24 of the TIA report. A vehicle crossing of some 6m will be required in order for heavy vehicles to access the site safely. It is considered to be an acceptable distance and pedestrians will be able to cross the site access safely as a continuous footpath is provided across the site access.

  We consider that the level of widening required at the crossing will cause minimal effects, and in particular the temporary removal of four parking spaces will not affect on-street parking in the area.

- *The means by which two way traffic is to be managed within the section of the site access that allows only one way operation is to be advised and effects assessed. This should include what is required to avoid congestion occurring on the street from vehicles waiting to turn into the site.*

  The proposed one-way access is likely to be managed manually for example by an on-site spotter and/or with communication between trucks to minimise conflicts and reverse movements. The spotter would indicate to the driver wishing to access the site to wait on-street if another vehicle is exiting the site. This will be managed by means of a detailed traffic management plan during the construction stage.

A specific loading bay is considered unnecessary given the low volume of daily trips expected and low volumes of traffic in Rawalpindi Street. There is considered more than sufficient kerbside parking spaces available on Rawalpindi Street with no restriction and the majority of adjacent properties can accommodate vehicles on-site. Should a truck be required to wait on-street before accessing the site, negligible adverse effects to the on-street parking are anticipated.

- *Truck tracking curves suggest that it may be necessary for some on street parking to be temporarily removed on Rawalpindi Street. An assessment of the scale and effects of any removal is required.*

  Four spaces would be removed to enable safe truck access. An updated tracking curves diagram (Figure 24 version 2) shows the extent of temporary parking removal. As explained previously, we consider that the total temporary loss of parking can be accommodated without resulting in any significant effects.

- *Proposed heavy vehicle routes to and from the site need reconsideration with regards to eastbound and westbound access onto SH16, and routes both to and from SH20.*

  An amended heavy vehicle route diagram is shown in Figure 25 version 2 of Appendix A.

General comments that could be addressed:

- *Temporary restrictions to on street parking on Rawalpindi Street will require resolutions by Auckland Transport.*

  Parking resolutions would be sought from Auckland Transport as required, prior to construction.

- *Widening of the accessway may require Council approval for the removal or trimming of trees.*

  If widening works require tree removal or trimming this will be determined at the time and approvals will be sought if necessary.

1.13 Norgrove Avenue (L2S2)

1.13.1 Information Required (Table, Section 1.14.1)

- *Cumulative effects of construction at multiple sites need consideration. This assessment should consider construction vehicle access to/from SH16 (both east and west), as well as traffic flows post Waterview Connection.*

  The issues surrounding cumulative traffic effects have been fully analysed and discussed in Sections 1.1 and 1.4. It is considered these effects can be appropriately accommodated on the road network.

- *Detail is required regarding the location of contractors parking during construction.*

  As the site is proposed to be located over a confined area of the carriageway on Norgrove Avenue, it has been assumed that no parking spaces will be provided within the site. Parking required by workers would be accommodated by on-street parking on surrounding streets. As less than ten workers are normally expected on-site at one time and some workers may carpool to the site, we consider that the temporary loss of parking can be accommodated without resulting in any significant effects.

  A recent inspection during a weekday evening (considered the peak time for on-street parking demand for a residential neighbourhood) indicated that a total of four vehicles were parked on the full length of Norgrove Avenue of approximately 120m. We consider that the total temporary loss of parking can be accommodated without resulting in any significant effects.

  The following photograph shows the low level on existing on-street parking demand on Norgrove Avenue.

Photograph 24: View of Norgrove Avenue from the northern end (8pm)

- *The effects of removing on street parking on Norgrove Avenue require assessment.*

  As outlined above given the current low level of parking demand on Norgrove Avenue it is considered that the effects of temporary minor on-street parking removal are considered to be minimal.

- *Clarification is requested regarding the length of Norgrove Avenue to be closed due to construction: 4m as referred to in the Traffic Impact Assessment Report, or 20m as shown in the associated plans.*

  It can be confirmed that 25m of the northern end of Norgrove Avenue is proposed to be closed to establish the construction site. The TIA report also states that the site access is proposed approximately 25m before the northern end of Norgrove Avenue.

- *Detail required in terms of how two way traffic flows are to be managed to the properties at number 14 and 16 Norgrove Avenue.*

  The daily traffic volumes accessing the four properties at 14 and 16 Norgrove Avenue is low thus there is low probability of opposing traffic on the accessway. A passing bay is provided on the accessway for outgoing traffic from 16 Norgrove Avenue should there be an incoming vehicle on the accessway.

- *We request that, should heavy vehicles be expected to turn right from Asquith Avenue onto New North Road, that this be assessed in terms of both safety and traffic operation. Conversely, heavy vehicles could be restricted to routes via St Lukes Interchange.*

  Following a review of the proposed truck routes, we agree that right turn from Asquith Avenue into New North Road should be avoided.

  A revised truck route diagram (Figure 28 version 2) indicates that heavy vehicles will be advised to avoid making the right turn from Asquith Avenue. Heavy vehicles will be routed via the St Lukes Interchange, by way of the detailed CTMP for this site.

<u>General comments that could be addressed:</u>

- *Reasons for the site being located in the carriageway could be stated to understand what has been considered in trying to avoid or minimise the traffic effects associated with it being located in the carriageway.*

  Response provided Section 2.7 of the Section 92 Response Report.

- *A suitable on street waiting area should be identified for heavy vehicles, as space exists for only one heavy vehicle on site at a time.*

Heavy vehicles will wait on the north-western side of the carriageway if another vehicle is exiting from the site. This is considered acceptable as kerbside parking in this area would have been removed as part of the traffic management plan. A specific loading bay is considered unnecessary given the low volume of daily trips expected.

- *The intersection of New North Road and Asquith Avenue requires assessment, in terms of both the safety and traffic impacts of heavy vehicles turning right at this location.*

  Heavy vehicle routes have been revised to avoid requiring these vehicles to turn right at this intersection. Figure 28 version 2, attached, indicates the revised routes.

- *The temporary restrictions to on street parking on Norgrove Avenue will require Auckland Transport consideration.*

  Parking resolutions will be sought from Auckland Transport as required, prior to construction.

1.14 Pump Station 25 (L3S1)

1.14.1 Information Required (Table, Section 1.15.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  See response in Section 1.4.1.

- *Detail is required regarding the location of contractors parking during construction*

  The internal site layout is not confirmed at this stage. However, there would be sufficient room to provide some parking spaces within the site for workers while accommodating the turnaround of trucks. Any parking overflow will be accommodated by the abundance of parking available on Miranda Street without resulting in any significant effects. Photograph 25 indicates the current parking demand on Miranda Street.

Photograph 25: View of Miranda Street from Blockhouse Bay Road (weekend)

- *Commentary requested regarding how the future signalisation of the intersection of Wolverton Street and Blockhouse Bay Road may be affected by heavy vehicle movements*

  The upgrade of the Wolverton Street/Blockhouse Bay Road intersection is part of Auckland Transport's Tiverton-Wolverton Road upgrade which commenced construction in July 2012 and is expected to be completed in 2014. The project will greatly improve traffic flow in the area and will provide five new signalised intersections, one of which will be at Wolverton Street/Blockhouse Bay Road intersection. This upgrade should greatly enhance the ability of trucks to gain access to the Miranda Reserve site (L3S1). The

addition of up to nine vehicles per hour as a result of the works will be well within the capacity of the upgraded network.

General comments that could be addressed:

- *Heavy vehicle tracking curves show swept paths that encroach beyond the existing 6m wide vehicle crossing. It may be necessary to remove some on street car parking in order to allow a tighter heavy vehicle turning movement*

  Tracking curves shown in Figure 29 of the original TIA report indicates that the splay of the vehicle crossing should be extended. However, with the proposed truck movement to be right-in/right-out, on-street parking restriction is considered unnecessary. Monitoring of the adjacent driveways should occur as part of the CTMP for this site to ensure any damage inflicted is fixed.

- *Any temporary restrictions to on street parking will require Auckland Transport consideration*

  No restrictions are considered necessary.

1.15 Miranda Reserve (L3S2)

1.15.1 Information Required (Table, Section 1.16.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  See response in Section 1.4.

- *Detail is required regarding the location of contractors parking during construction*

  The internal site layout is unconfirmed at this stage. However, there would be sufficient room to provide at least one to two parking spaces within the site for workers while accommodating the turnaround of trucks. Any parking overflow will use the available on-street parking on Blockhouse Bay Road or Margate Road.

  Numerous site inspections have been carried out during weekdays (including evenings) and significant spare parking capacity was observed to be available on Blockhouse Bay Road and surrounding streets. Photographs 26 and 27 (Margate Street) and 28 and 29 (Blockhouse Bay Road) below corroborate this. We consider that the temporary loss of parking and any contractors' vehicles can be accommodated without resulting in any noticeable effects.

Photograph 26: View of Margate Street from Blockhouse Bay Road

Photograph 27: View of Margate Street looking west

Photograph 28: View of Blockhouse Bay Road. Looking South

Photograph 29: View of Blockhouse Bay Road, looking north

- *If the site can only accommodate one truck at a time, then appropriate facilities for waiting need to be provided off site and an assessment of the effects of this waiting area needs to be provided*

  The proposed one-way access is likely to be managed manually (on-site spotter) and/or with communication between trucks to minimise conflicts and reverse movements. The spotter would indicate to the driver wishing to access the site to wait on-street if another vehicle is exiting the site. This should be managed by means of a detailed construction traffic management plan during the construction stage.

  A specific loading bay is considered unnecessary given the low volume of daily trips expected. There is considered more than sufficient kerbside parking spaces available on this section of Blockhouse Bay Road with no restriction and the majority of adjacent properties can accommodate vehicles on-site. Should a truck be required to wait on-street before accessing the site, negligible adverse effects to the on-street parking are anticipated.

- *Shifting the existing bus stop to the south may restrict visibility to and from the site access, and this safety concern requires addressing.*

  Heavy vehicles are restricted to turning right onto the site and would not be affected by the bus stop. The RTS-6 "Guidelines for Visibility at driveways" provides a recommended minimum sight distance for a driveway with less than 200vpd onto a Collector to be 45m. This sight distance can be achieved by relocating the bus stop 50m south of its existing location (10m further south than the originally proposed location). The existing bus stop should therefore be shifted 50m south of its existing position.

- *Similarly, the relocated bus stop will take the place of existing on street parking. The loss of this parking requires assessment.*

  As previously discussed, numerous site inspections have been carried out during weekdays and significant spare parking capacity was observed to be available on Blockhouse Bay Road and surrounding streets. We consider that the temporary loss of parking can be accommodated without resulting in any significant effects.

General comments that could be addressed:

- *Truck and trailer tracking curves suggest a vehicle crossing width of approximately 10m would be required, which is not desirable over a footpath. Options to reduce this width need exploring, and may include restricting heavy vehicle access to single unit trucks, or allowing anticlockwise vehicle circulation on site.*

  It is noted that heavy vehicle flows at this site are expected to be in the order of 4 truck trips per hour or less, ie: approximately one movement per quarter hour. It is recommended that a manual traffic controller be on hand to manage pedestrian movements across the site frontage during occasions when trucks enter/exist the site.

- *The proposed shifting of the existing bus stop and shelter on Blockhouse Bay Road requires Auckland Transport consideration.*

  Approval from Auckland Transport will be sought in due course. The proposed bus stop relocation is not expected to cause significant impact to the operation of the function of the bus stop, public transport network, or the road network.

1.16 Whitney Street (L3S3)

1.16.1 Information Required (Table, Section 1.17.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  See Section 1.4.

- *Clarification of the temporary traffic management methodology is required in order to assess the traffic effects should alternating flow be required. This may require restrictions on site works during peak travel times.*

  The Code of Practice for Temporary Traffic Management (COPTTM) provides guidance on assessing potential delays when a one lane two-way traffic system is required due to temporary road works. In COPTTM section C15-2 it is noted that "*if the sum* [of peak hourly two way traffic] *is greater than 500 vph and the work site is within 200 metres of an intersection then five minute delays are expected….if the thresholds are not exceeded then delays in excess of five minutes are not expected*".

  The surveyed peak hour two-way traffic volume on this section of Whitney Street is in the region of 350 vph. This is less than the 500 vph threshold, thus we would expect delays to be less than five minutes. Contingency plans for such works could include opening the closed traffic lane in the event delays exceed five minutes, but is acknowledged that such measures will not be feasible if excavation in the traffic lane is in progress. It is thus considered that promotion of alternative traffic routes during works (through detailed CTMP) should be encouraged to reduce through volumes on Whitney Street to a minimum.

- *Detail is required regarding the location of contractors parking during construction*

  It is anticipated that site workers would be parked in the available kerbside parking on the remaining sections of Whitney Street and on adjacent side streets. Numerous site inspections had been carried out during weekdays and spare parking capacity was observed in the vicinity of the site. We consider that the temporary loss of parking can be accommodated without resulting in any significant effects.

<u>General comments that could be addressed:</u>

- *The proposed temporary restriction of on street parking on Whitney Road requires Auckland Transport consideration.*

  Parking resolutions will be sought from Auckland Transport as required, prior to construction.

- *Provide comment on effects should useable carriageway width (excluding channel) not be sufficient to provide for two way flow as well as required longitudinal and lateral safety zones.*

  Consideration will be given to the work site planning to enable two lane two-way flows along Whitney Street where possible. Generally, it is considered that 6.1m of carriageway width will be the maximum required (2.75m lane and 0.6m central separation). The width of the work site should be minimised as much as possible. Considerations may be given to the type of barriers used to fence off the construction in order to reduce the required lateral safety zone from 1m to 0.5m. Should these options be unfeasible, one-lane alternate flows would therefore be implemented.

- *The proposed temporary islands sit opposite existing vehicle crossings, suggesting pedestrians are to cross the street using vehicle crossings. Safe places for pedestrians to cross Whitney Street both north and south of the works site will need to be identified in the CTMP, in order to maintain pedestrian access to and from the local shops.*

  The location of the proposed temporary pedestrian refuge has been reassessed. It is considered that the existing pedestrian refuge requiring to be removed due to the works will be replaced by a cut out of the existing island near the roundabout (and associated pram crossings). This will cater for pedestrian access to and from the local shops. This is shown on Figure 33 (version 2) of Appendix A and the revised CTMP is shown on Figure 34 (version 2).

It is considered that a separate pedestrian refuge to the north of the site may be inappropriate given the close proximities of vehicle crossings on Whitney Street. Existing traffic volumes on Whitney Street indicate that approximately seven vehicles travel on Whitney Street per minute in peak times. The low traffic volumes and space restrictions will allow pedestrians to cross the street without much difficulty.

If installed, a pedestrian refuge to the north of the site would likely need to be north of Trevola Street.

- *The issue of traffic performing u turns to the north of the site in order to access residential properties blocked by the proposed temporary pedestrian traffic islands requires addressing.*

  Both options discussed in the previous point (pedestrian crossings) will eliminate the issue of any traffic requiring to perform U-turns in order to access their properties.

1.17 Dundale Avenue (L3S4)

1.17.1 Information Required (Table, Section 1.18.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  See response in Section 1.4.1.

- *An assessment of the ability of the site to accommodate only one truck at a time or an assessment of the need for and effects of a waiting area for trucks on-street.*

  With nine vehicle movements anticipated to be generated by the site during the peak hour, the probability of two trucks accessing the site at one time is considered low and should the access be assessed as a one-way operation, the access is likely to be managed manually (for example by an on-site spotter) and/or with communication between trucks to ensure that opposing site traffic can make sure that the driveway is clear of traffic before proceeding. This will minimise conflicts at the access and should be managed by means of a detailed traffic management plan during the construction stage. There are generally sufficient kerbside parking spaces available on Dundale Avenue with no restrictions. Should a truck be required to wait on-street before accessing the site, negligible adverse effects to the on-street parking are anticipated. A specific loading bay is considered unnecessary given the low volume of traffic expected.

- *Detail is required regarding the location of contractors parking during construction. Especially in conjunction with the proposed loss of on-street parking.*

  The internal site layout is yet to be confirmed at this stage. However, there is likely to be sufficient room to provide some parking spaces for workers on the western side of the site while accommodating the turnaround of trucks on the eastern side. Any parking overflow will use the available on-street parking on Dundale Avenue. The following photographs illustrate the availability of on-street parking on Dundale Avenue. Numerous site inspections have been carried out during weekdays and ample on-street parking was observed to be available. We consider that the temporary loss of on-street parking can be accommodated without resulting in any significant effects.

Photograph 30: View of Dundale Street from Whitney Street (weekend)

Photograph 31: View of Dundale Street (weekend)

General comments that could be addressed:

- *Loss of 15 m of on-street parking requires Auckland Transport consideration.*

  The temporary parking restrictions required to enable the works is expected to have minimal effects of the available parking demand on Dundale Avenue and surrounding streets. Ample parking capacity was observed to be available during numerous site visits. Parking resolutions will be sought from Auckland Transport as required, prior to construction.

1.18 Haycock Avenue (L3S5)

1.18.1 Information Required (Table, Section 1.19.1)

- *Cumulative effects of construction at sites AS3, AS4, WS2 and L3S1 to L3S5 need consideration.*

  See response in Section 1.4.1.

- *Detail is required regarding the location of contractors parking during construction.*

  It is anticipated that site workers would park in the available kerbside parking on the remaining sections of Haycock Avenue and on adjacent side streets (no room is available on-site). Numerous site inspections have been carried out during weekdays and spare

parking capacity was observed in the vicinity of the site. We consider that the temporary loss of parking can be accommodated without resulting in any significant effects. The following photographs indicate the current demand on Haycock Avenue, Battersby Road and White Swan Road outside of working hours when on-street demand for residential properties is greatest.

Photograph 32: View of Haycock Avenue (weekend)

Photograph 33: View of Battersby Road, from Haycock Avenue (weekend)

Photograph 34: View of White Swan Road at intersection with Haycock Avenue (weekend)

Photograph 35: View of White Swan Road at intersection with Haycock Avenue (weekend)

- *Detail is required as to the provision of access for the neighbouring properties when lane closures are in place.*

  Provision of access for neighbouring properties will be detailed in the CTMP. All accesses will be maintained.

- *Details on potential delays on Haycock Avenue and White Swan Road should be provided to enable an assessment regarding operating times.*

  The two way 5-day ADT for Haycock Avenue is approximately 1,600vpd and the peak hour traffic volume is some 160-200vpd. In COPTTM section C15-2 it is noted that "*if the sum* [of peak hourly two way traffic] *is greater than 500 vph and the work site is within 200 metres of an intersection then five minute delays are expected….if the thresholds are not exceeded then delays in excess of five minutes are not expected*".

  While the site is with 200m of an intersection the sum of peak hour two-way traffic is less than half the 500 vph threshold, thus we would expect delays to be less than five minutes, and therefore acceptable in terms of COPTTM.

  The temporary signage proposed on White Swan Road may cause drivers to slow down when travelling through this section of the road. However, the temporary speed reduction only applies on Haycock Avenue thus minimal impact on the operating times is expected.

- *Details on the extent of parking restrictions with and without the lane closure are required.*

  The extent of parking restrictions required without the lane closure will be about five to six spaces on either side of the proposed site driveway to assist with left-in/left-out movements by single unit trucks. Numerous site inspections have been carried out at various times of the day and ample on-street parking was observed to be available on Haycock Avenue. We consider that the temporary loss of parking can be accommodated by the available kerbside parking not resulting in any significant effects.

  Approximately 30 parking spaces will be removed with the lane closure. Although the exact works period for the connection to the Western Interceptor is unconfirmed at this stage, a relatively short duration is anticipated for this works and the temporary effects as a result of the lane closure are not expected to be significant. Ample on-street parking is available on the remaining section of Haycock Avenue, Battersby Avenue and White Swan Road which will compensate for the temporary parking restriction caused by the works.

<u>General comments that could be addressed:</u>

- *It would be preferable that alternating flow traffic management is not required. It is unclear for how long, Haycock Avenue will be narrowed to one lane only.*

  The lane closure only relates to the final connection to the existing wastewater network.

  General site activities will take 6 to 8 months. Truck movements will be greatest during the shaft sinking taking around 4 months but two way traffic along Haycock will be maintained except for short periods (1 or 2 days) of special material delivery or large equipment removal. Later a connection will need to be made to the existing sewers in Haycock Avenue. Although the exact period for this connection to the Western interceptor is unconfirmed at this stage, a relatively short duration is anticipated for this works and the temporary effects as a result of the lane closure is not expected to be significant and likely last 2 – 3 weeks. Some delays are likely to be caused by the one lane operation however, dedicated detour routes will not be required. Given the low traffic volumes on Haycock Avenue, only minor effects to the surrounding road network are anticipated.

- *No on-street parking survey has been undertaken to assess the impact of on street parking loss.*

  The photographs above indicate that there is a surplus of on-street parking in the area. No more than a minor impact is forecast due the temporary loss of on-street car parking.

- *Tracking diagrams do not match with proposed access routes for heavy vehicles. Tracking indicates right in/right out only. Access routes indicate reverse direction*

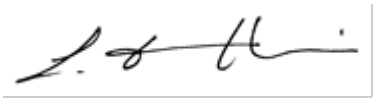
  Revised tracking curves are shown on Figure 38 (version 2) of Appendix A in this response showing the correct truck movements accessing the site, which will be restricted to left-in/left out without the lane closure.

- *Delays on White Swan Road have not been assessed. Pedestrians will have to use the northern footpath, and suitable crossing facilities need to be provided including kerb ramps to assist those with mobility vehicles and pushchairs.*

  No more than minor delays are anticipated on White Swan Road as a result of the works. The temporary signage proposed on White Swan Road may cause drivers to slow down when travelling through this section of the road. However, the temporary speed reduction only applies on Haycock Avenue thus minimal impact on the operating times is expected. The CTMP signage plan for this site has also been revised to minimise the signage on White Swan Road. This should minimise any delays for through traffic on White Swan Road. This is shown in Figure 39 (version 2) of Appendix A.

  Any details relating to pedestrian facilities can be addressed in the detailed CTMP for the site.

Yours sincerely
Traffic Design Group Ltd



Leo Hills
Associate

leo.hills@tdg.co.nz

enc: Appendix A: Figures
Appendix B: Generic CTMP
Appendix C: Beca Western Ring Route (WRR) Model Data
Appendix D: SIDRA results (WS1)
Appendix E: SIDRA results (WS2)

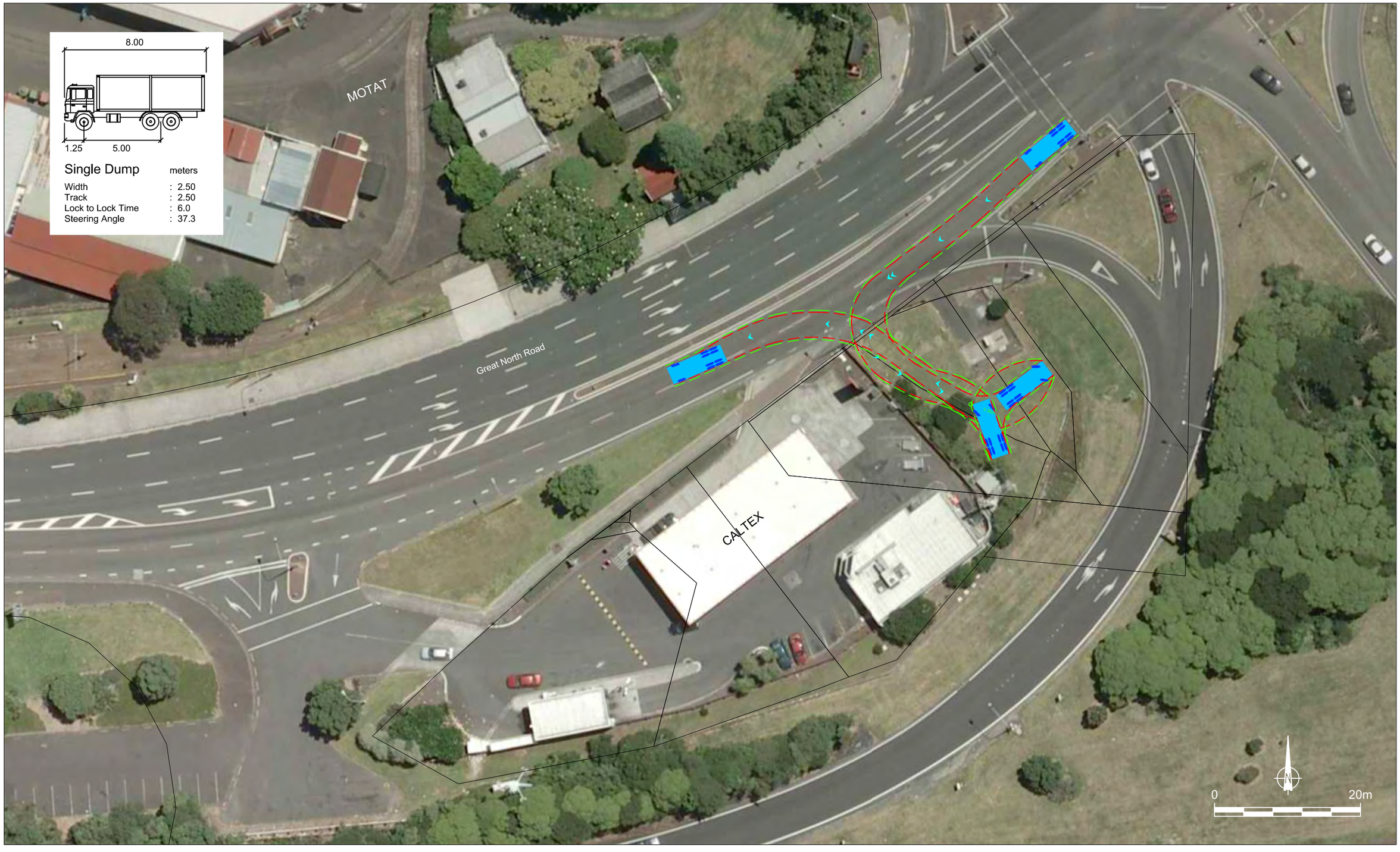
Appendix A

Figures

Note: Each figure is numbered the same as the figures for the corresponding sites in the original TIA report.

Figures that are revised versions of the original figures in the TIA report are labelled .v2 (e.g. Figure 2.v2 is version 2 of the original Figure 2 in the TIA report).

Figures supplementary to the TIA report are labelled with a letter (e.g. Figure 4a is an additional figure to support Figure 4 in the TIA report.



Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor - WS1 to CSO Collector

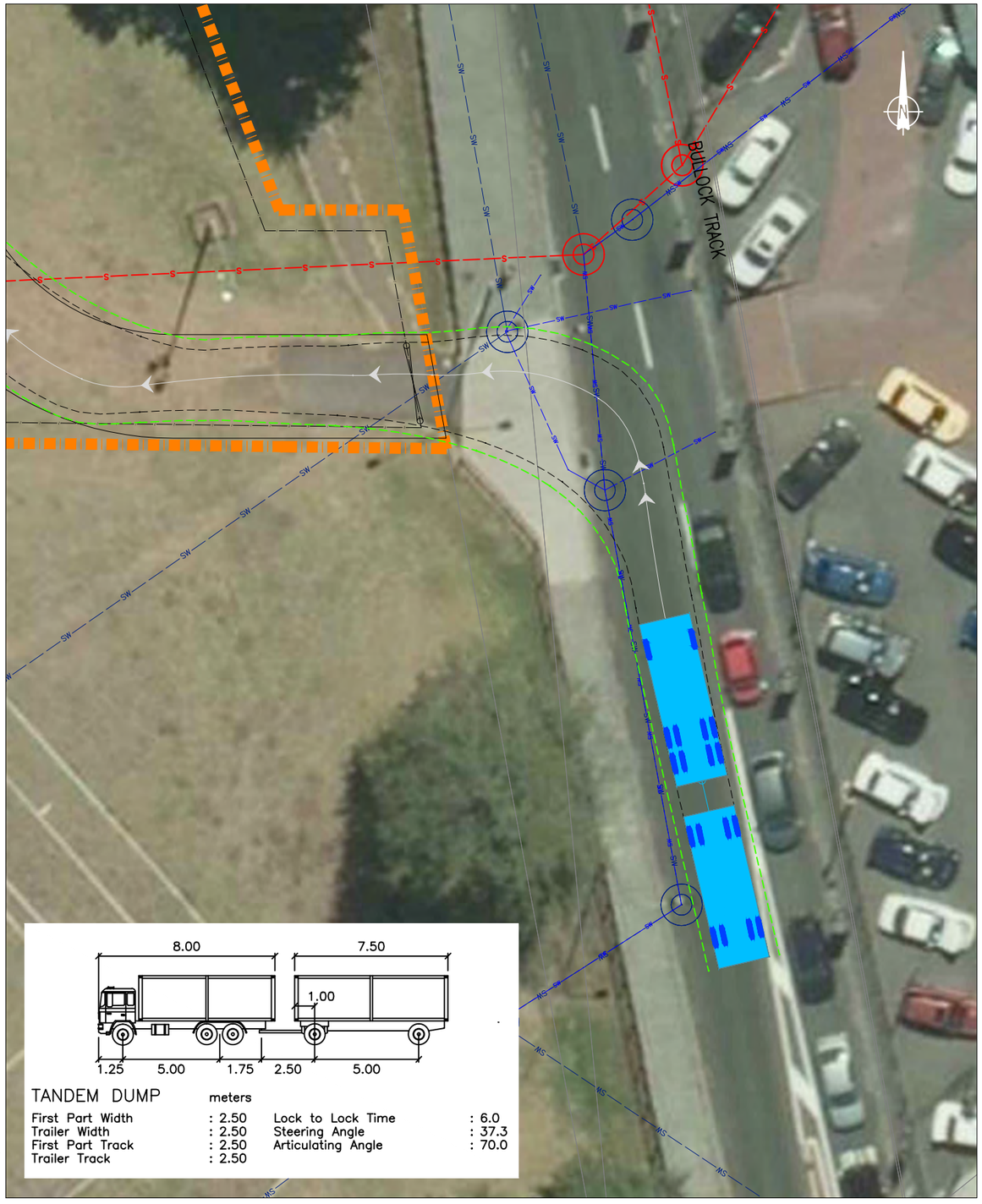
Access to Secondary Site

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:500@A3
DWG NO:11117A60A

Traffic Design Group

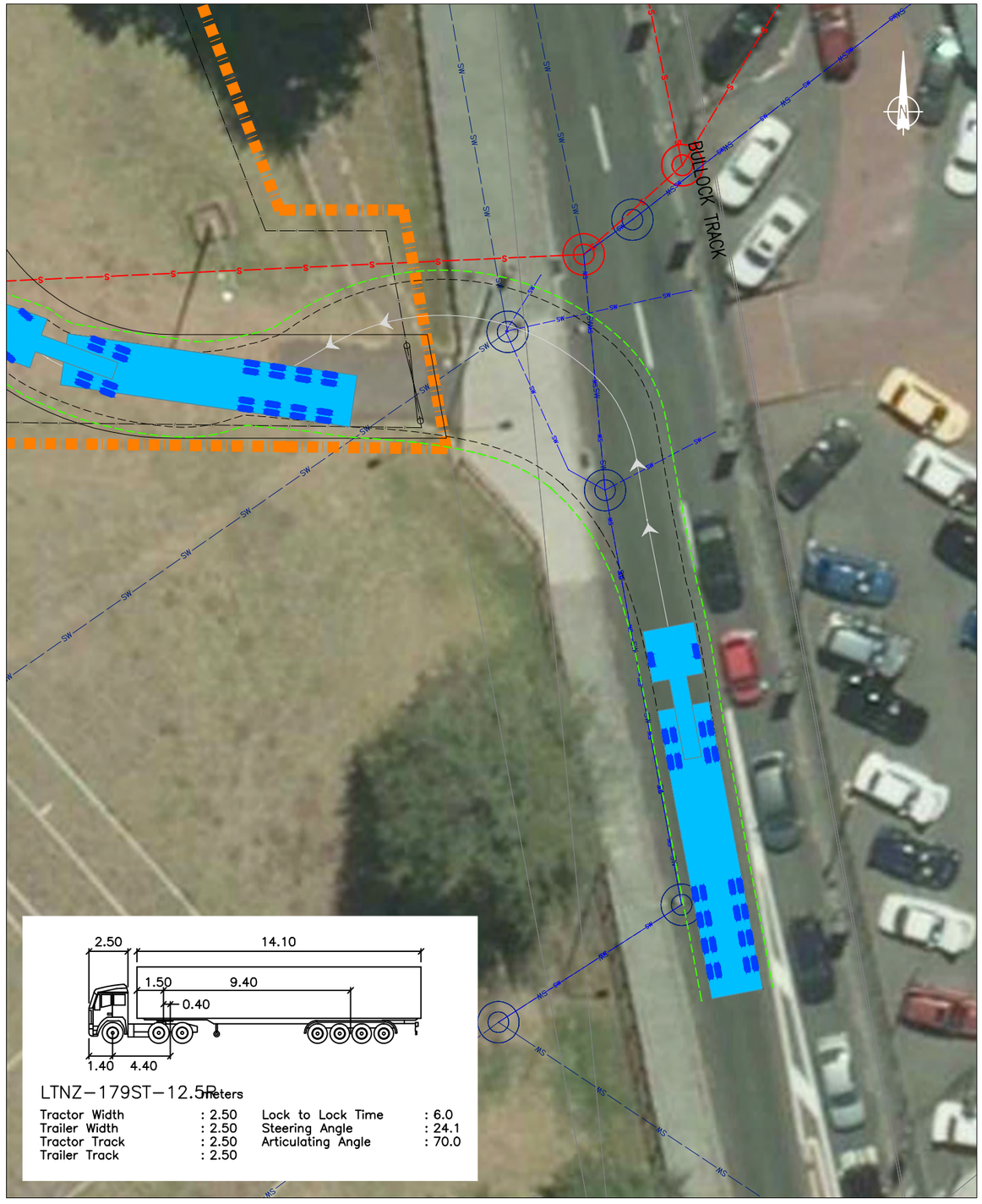
2a

J:\11100-49\11117\Drawings\11117A60a.dwg



TANDEM DUMP meters

First Part Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 37.3
First Part Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		



LTNZ–179ST–12.5R meters

Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 24.1
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-1.3.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Western Springs (WS1) - Truck Tracking

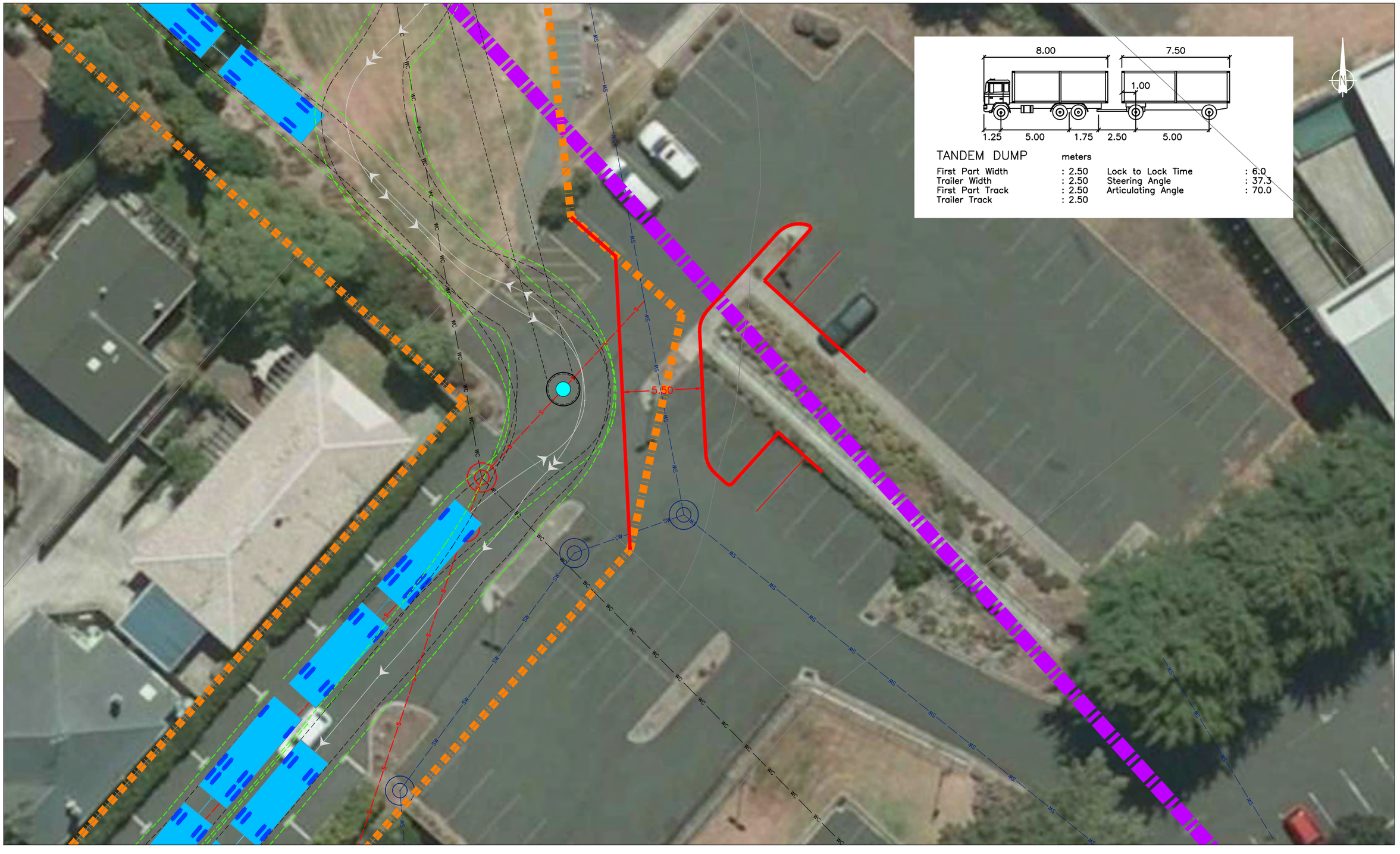
water Care services limited

DRAWN: SP/CTM
DATE: 05.12.2012
SCALE: 1:250@A3
DWG NO:11117A61A

Traffic Design Group

2b

J:\11100-49\11117\Drawings\11117A61a.dwg



TANDEM DUMP meters

First Part Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 37.3
First Part Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-2.2.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Mt Albert War Memorial (AS1) - Truck Tracking

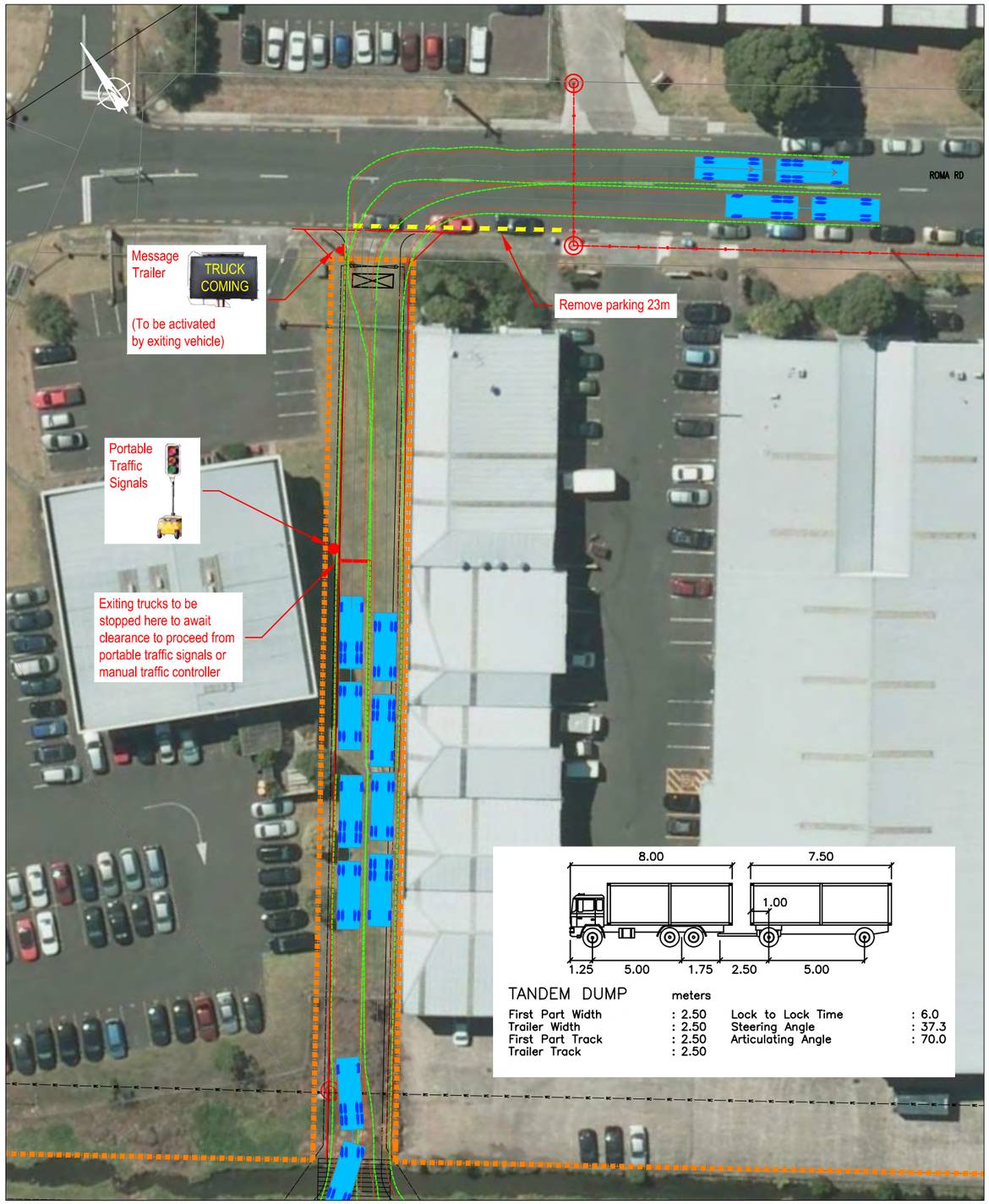
waterCare services limited

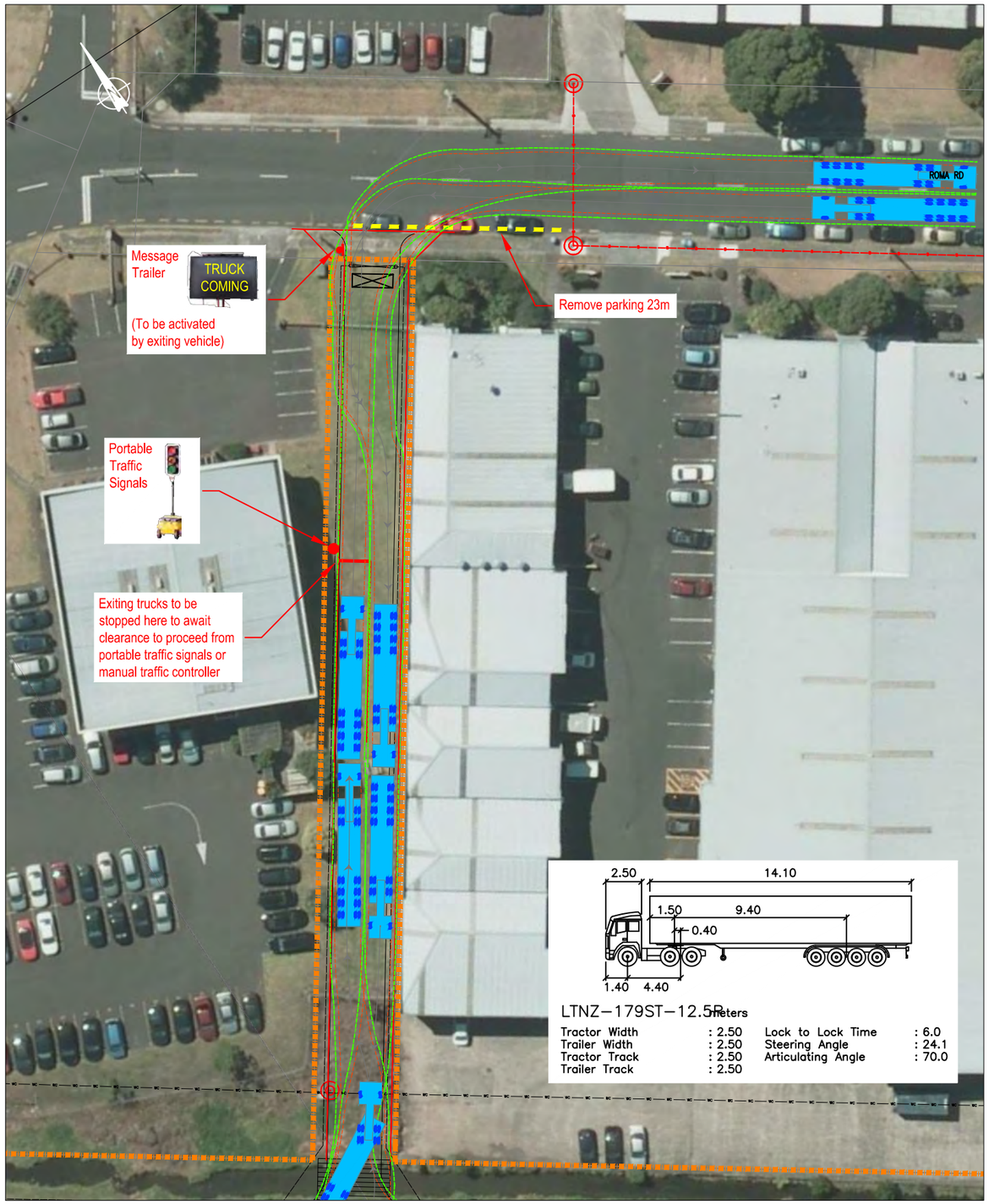
DRAWN: SP/CTM
DATE: 05.12.2012
SCALE: 1:250@A3
DWG NO:11117A48A

Traffic Design Group

4a

J:\11100-49\11117\Drawings\11117A48a.dwg





Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-6.2.dwg

Watercare Central Interceptor

May Road (WS2) - Truck Tracking

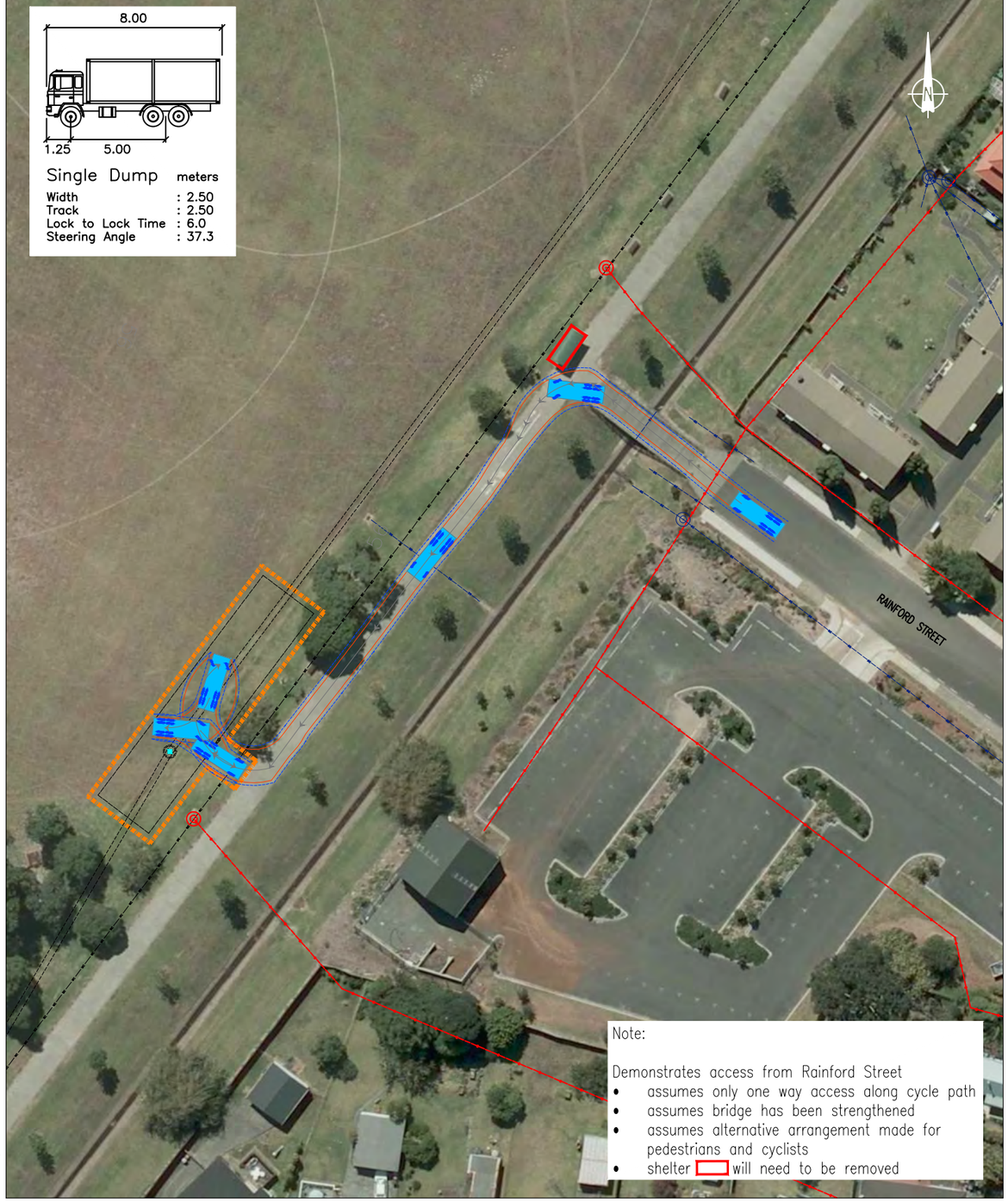
waterCare services limited

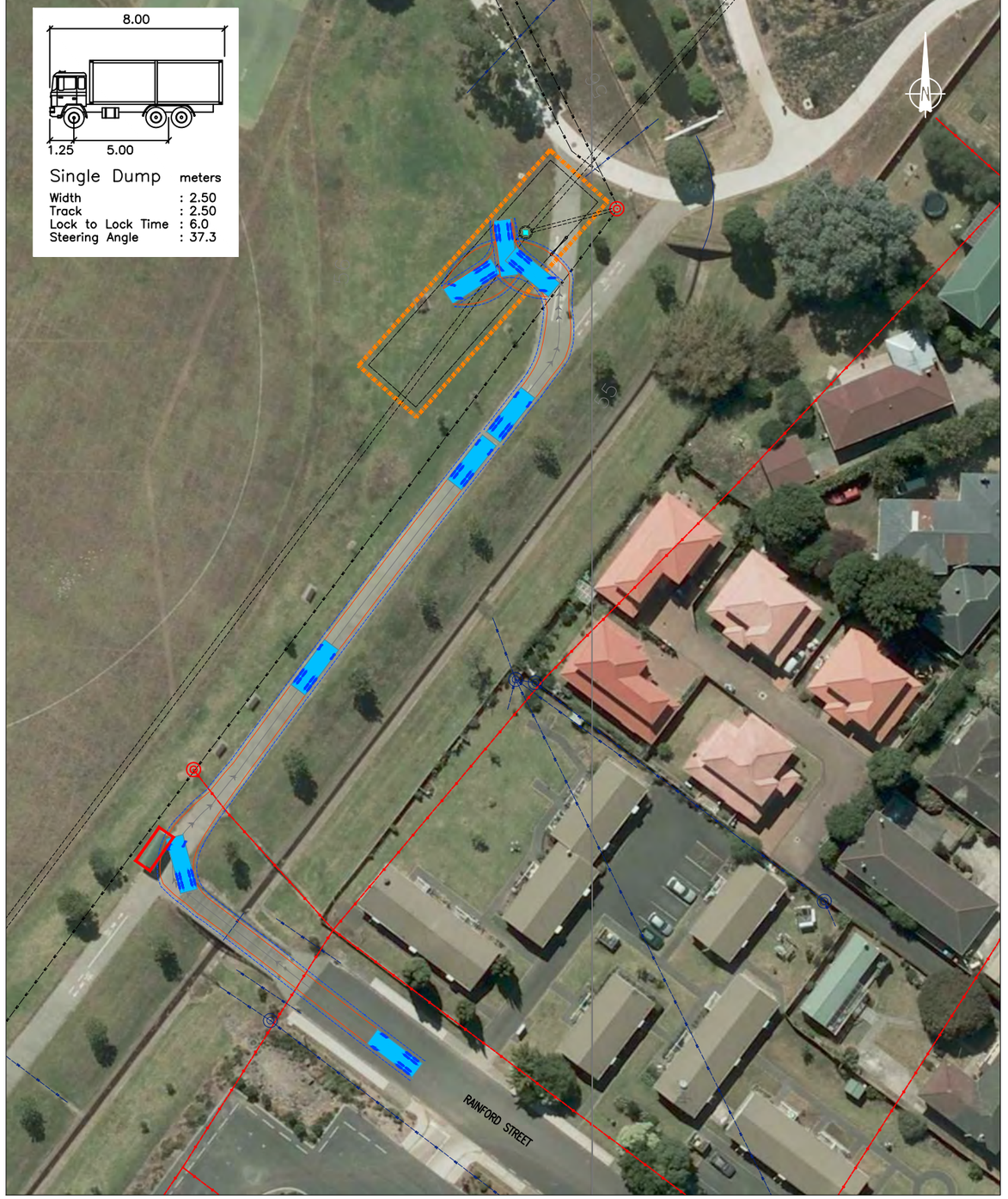
DRAWN: SP
DATE: 05.12.2012
SCALE: N.T.S
DWG NO:11117A49A

Traffic Design Group

12a

J:\11100-49\11117\Drawings\11117A49a.dwg





Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-7.2.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Keith Hay Park (AS5) - Truck Tracking

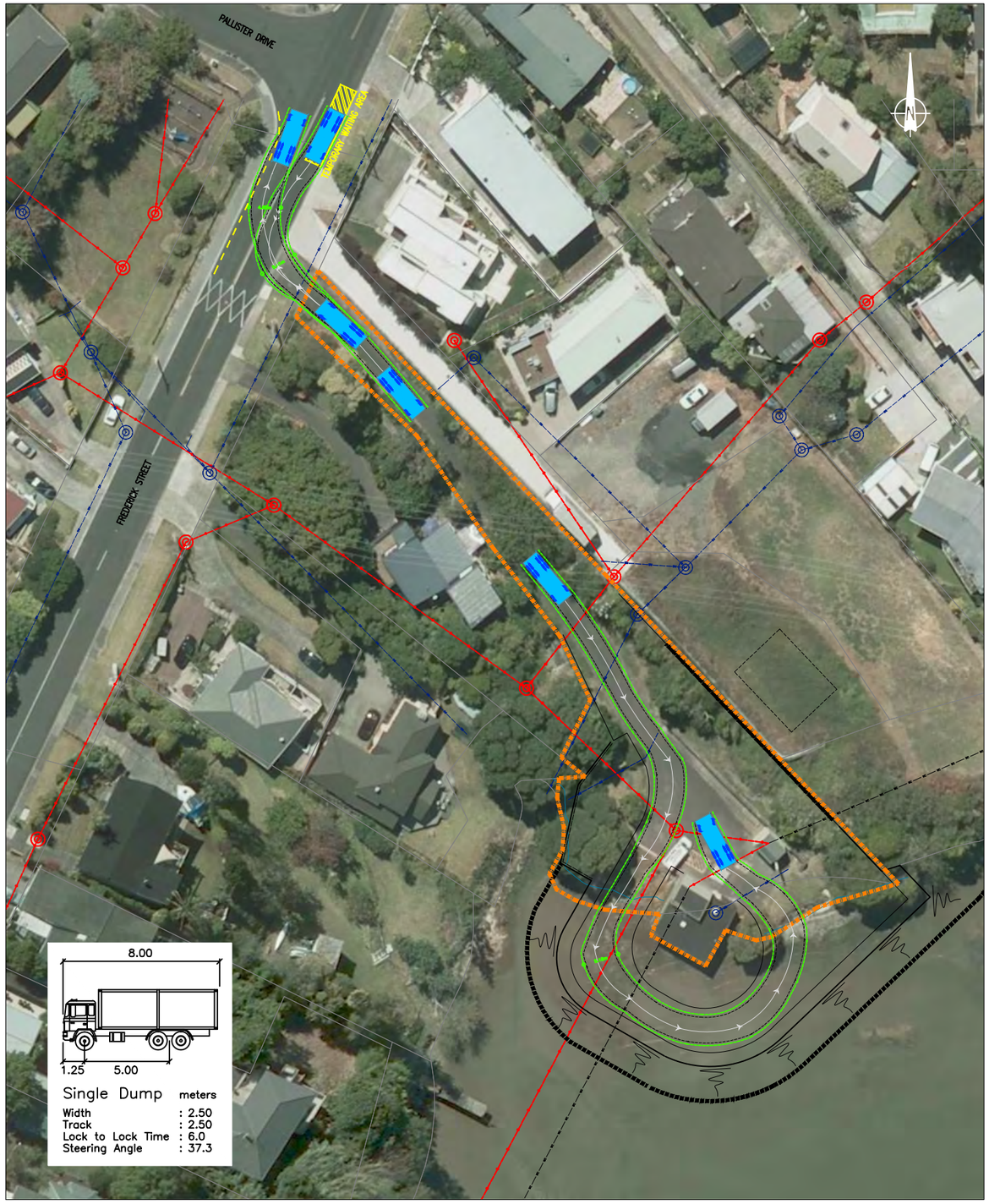
waterCare services limited

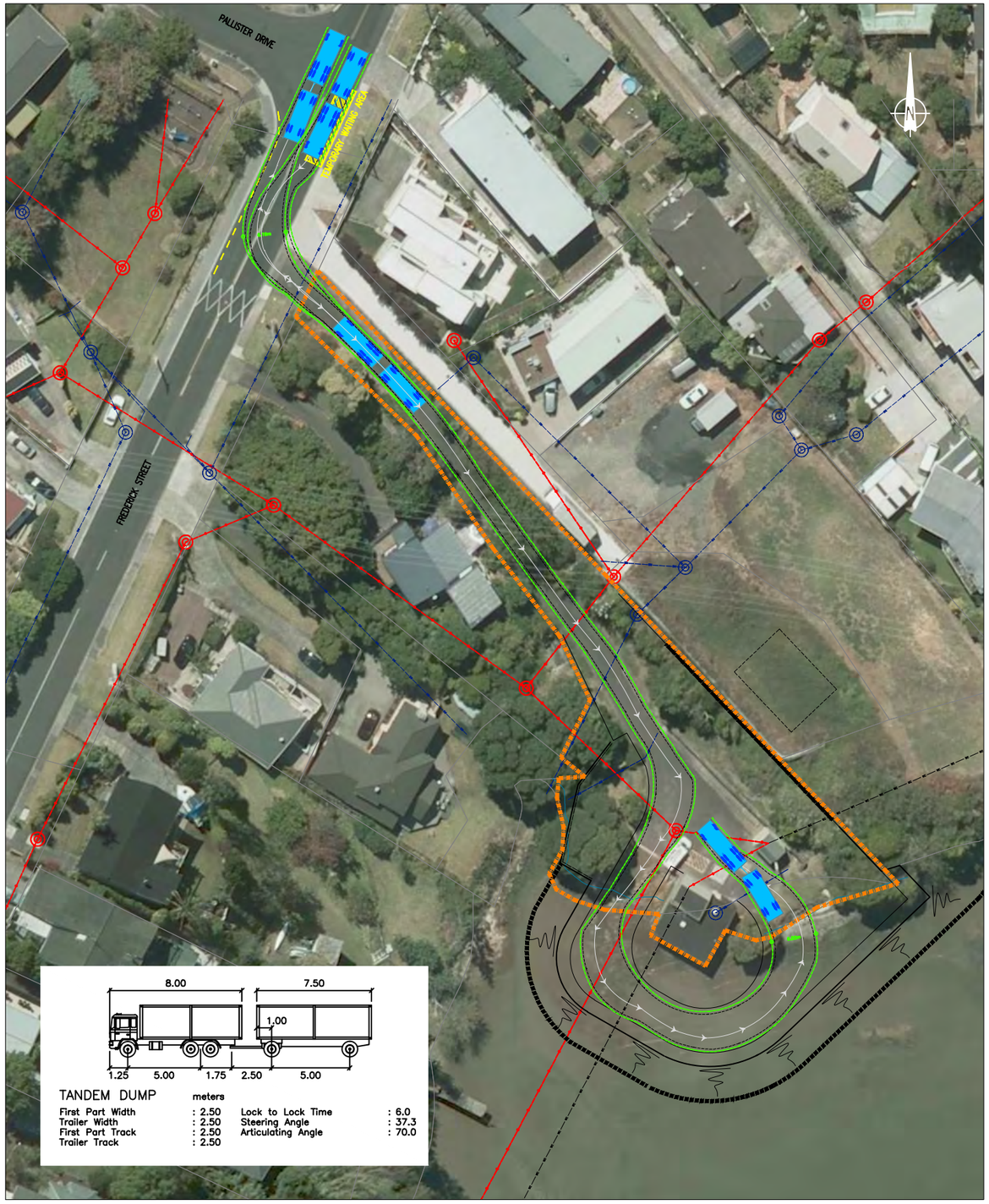
DRAWN: SP
DATE: 05.12.2012
SCALE: 1:750@A3
DWG NO:11117A50A

Traffic Design Group

14a

J:\11100-49\11117\Drawings\11117A50a.dwg





Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-8.2.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

PS23 (AS6) - Truck Tracking

waterCare services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:750@A3
DWG NO:11117A52A

Traffic Design Group

16.v2

J:\11100-49\11117\Drawings\11117A52a.dwg

Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-8.2.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

PS23 (AS6) - Truck Tracking (During Site Construction)

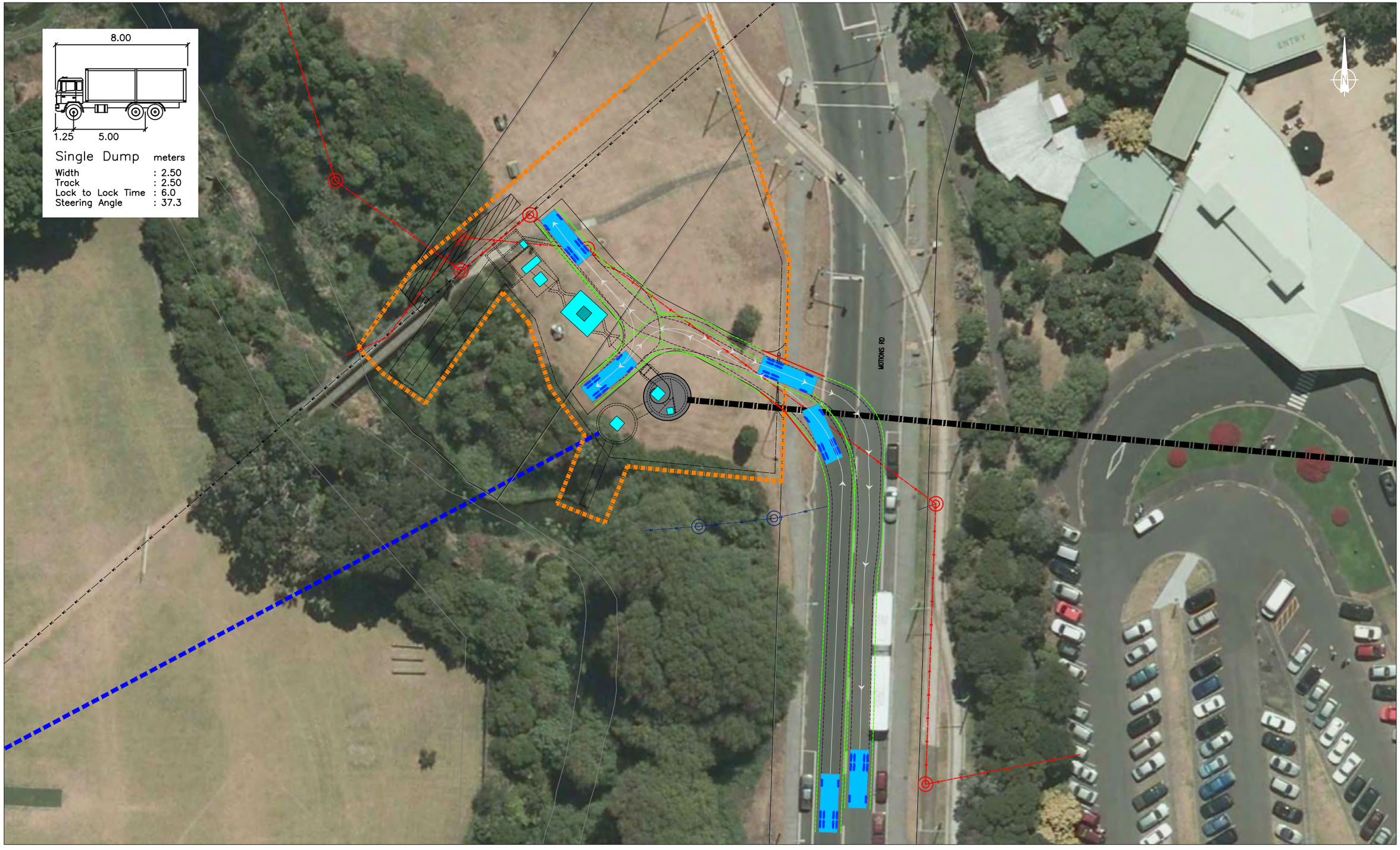
waterCare services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:250@A3
DWG NO:11117A52A

Traffic Design Group

16a

J:\11100-49\11117\Drawings\11117A52a.dwg



Thursday, 29 November 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-11.2.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Motions Road (L1S1) - Truck Tracking

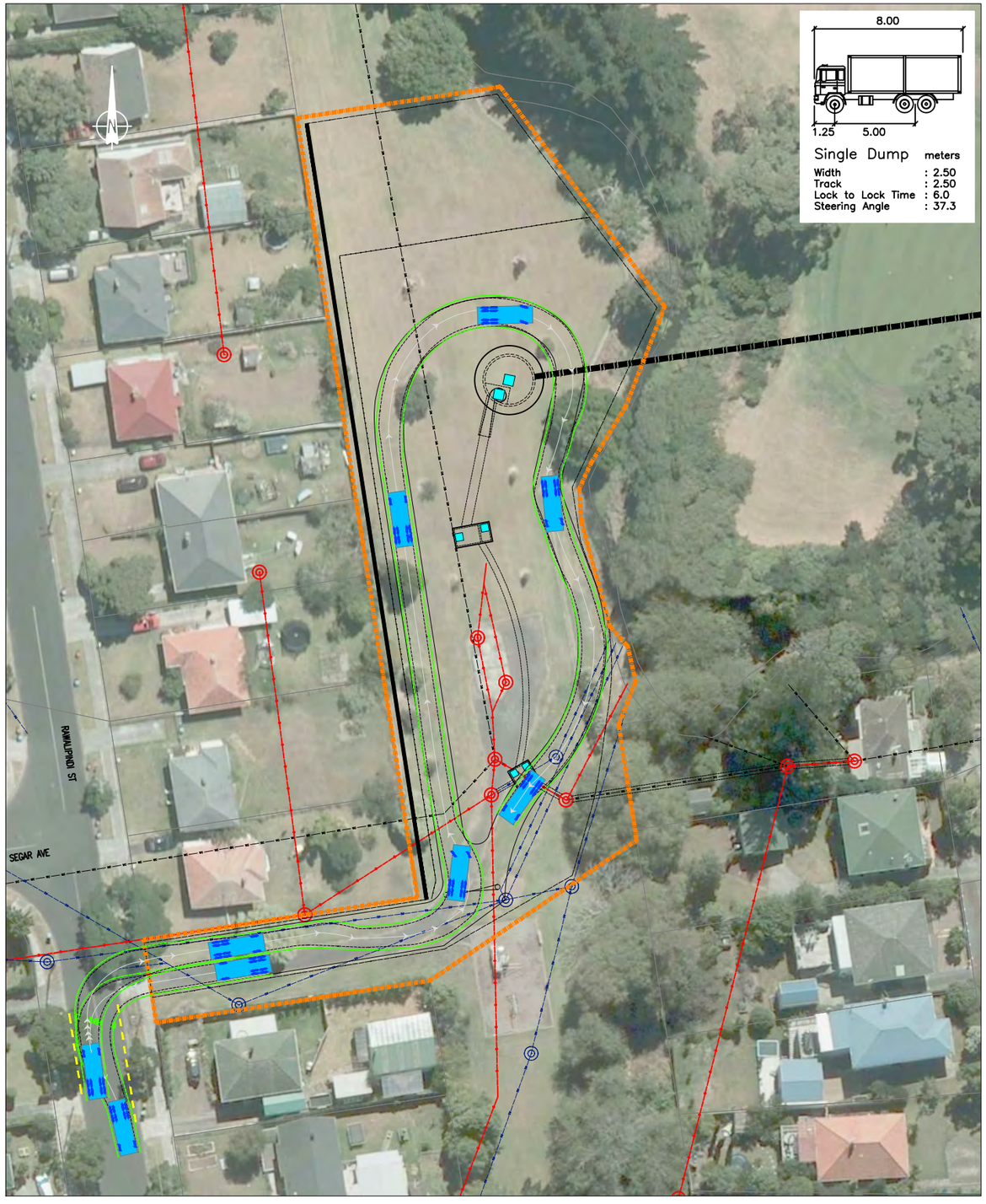
water Care services limited

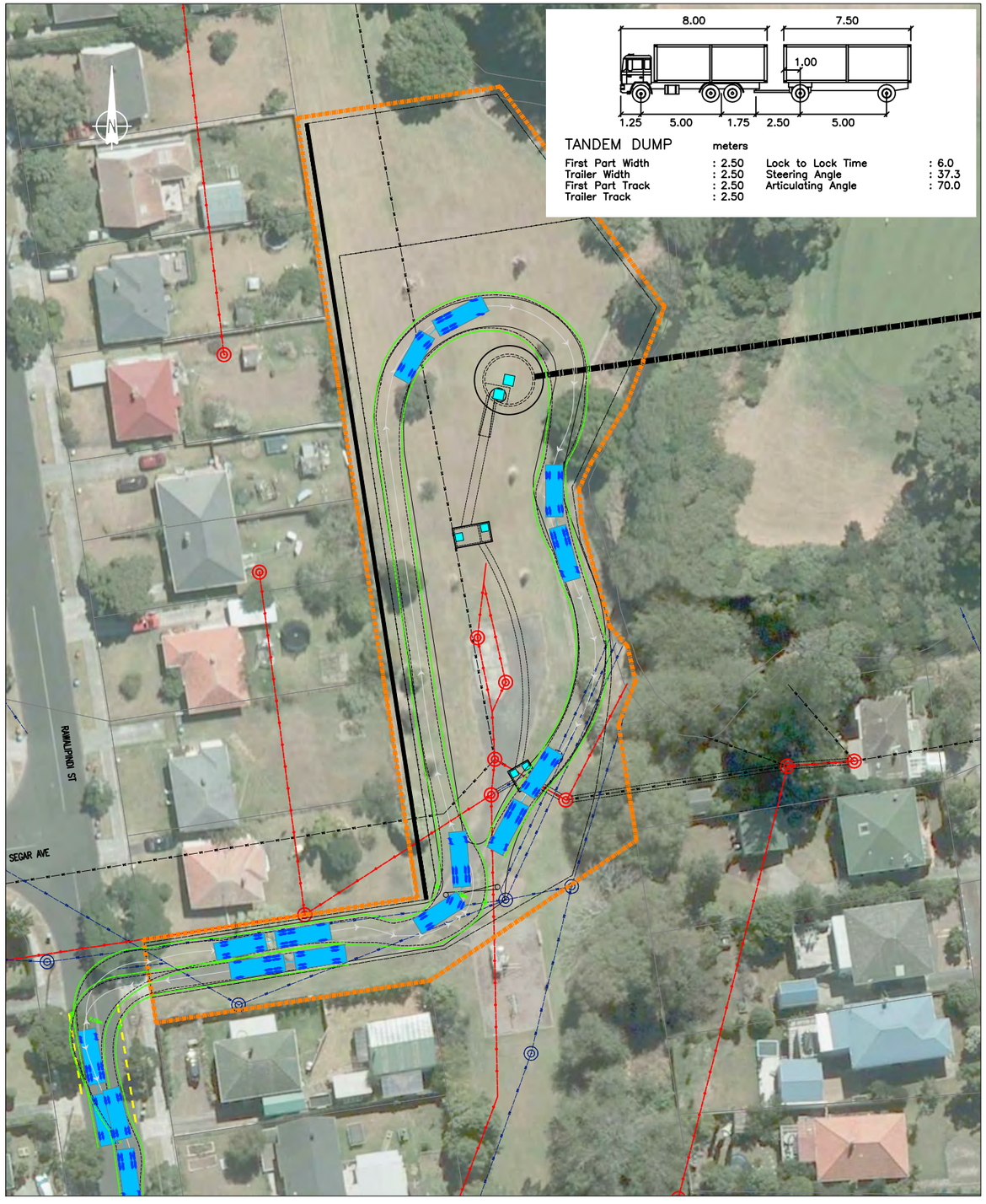
DRAWN: SP
DATE: 05.12.2012
SCALE: 1:500@A3
DWG NO:11117A53A

Traffic Design Group

20.v2

J:\11100-49\11117\Drawings\11117A53a.dwg





Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-13.2.dwg
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Rawalpindi Reserve (L2S1) - Truck Tracking

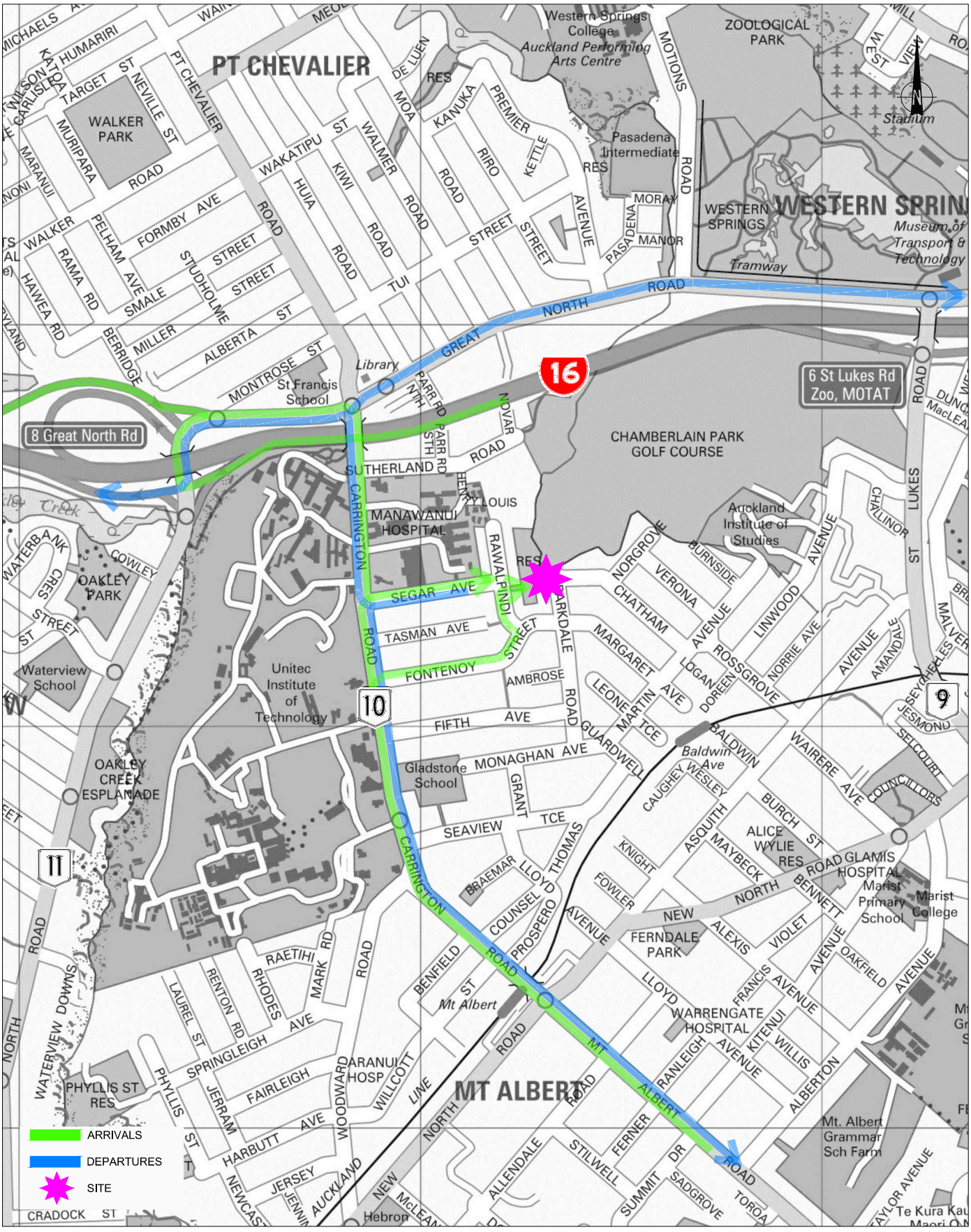
waterCare services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:750@A3
DWG NO:11117A54A

Traffic Design Group

24.v2

J:\11100-49\11117\Drawings\11117A54a.dwg



Thursday, 29 November 2012

Watercare - Rawalpindi Reserve (L2S1)

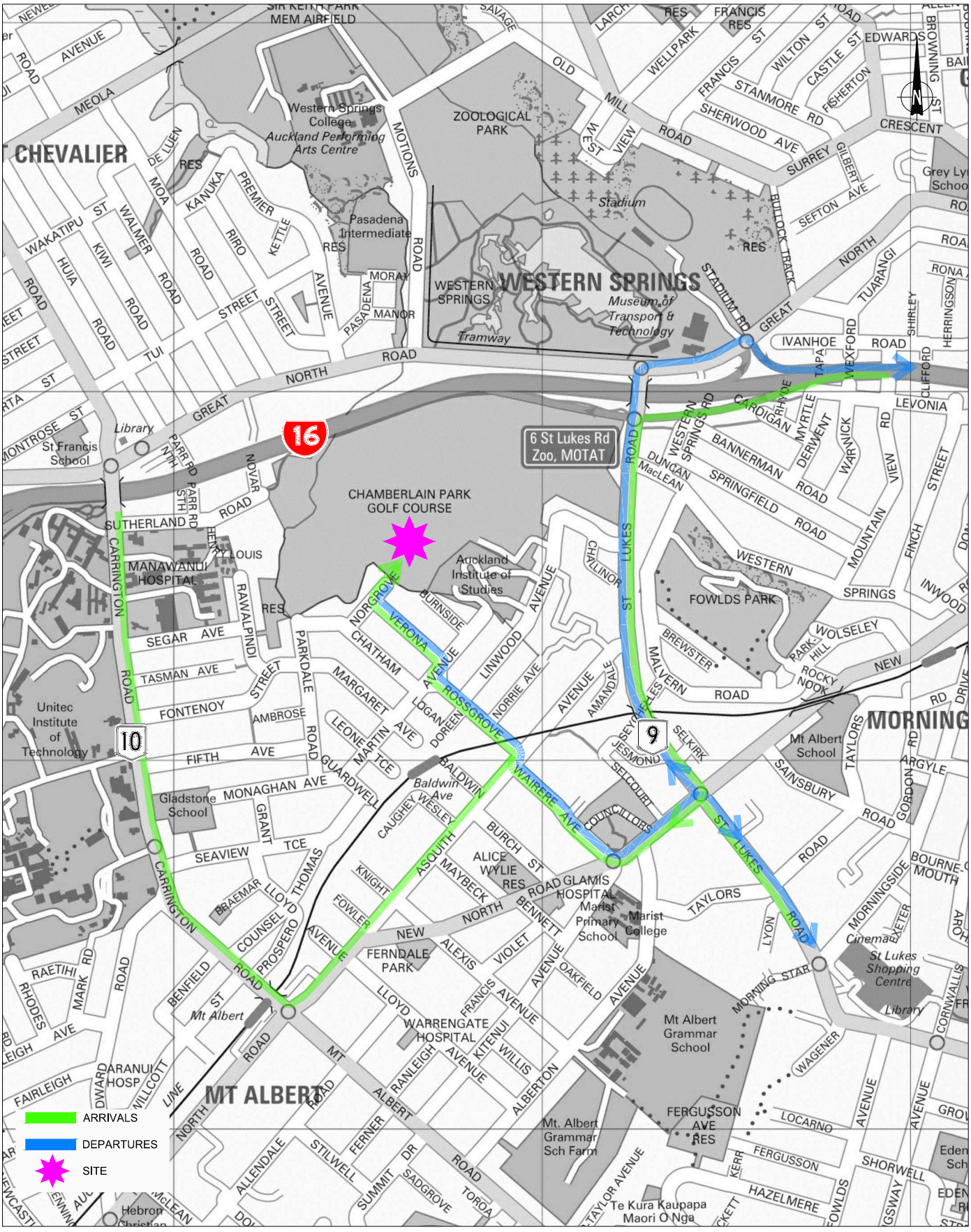
Truck Routes

Traffic Design Group

25.v2

SCALE: N.T.S

J:\11100-49\11117\Drawings\11117A55a.dwg



Thursday, 29 November 2012

Watercare - Norgrove Avenue (L2S2)

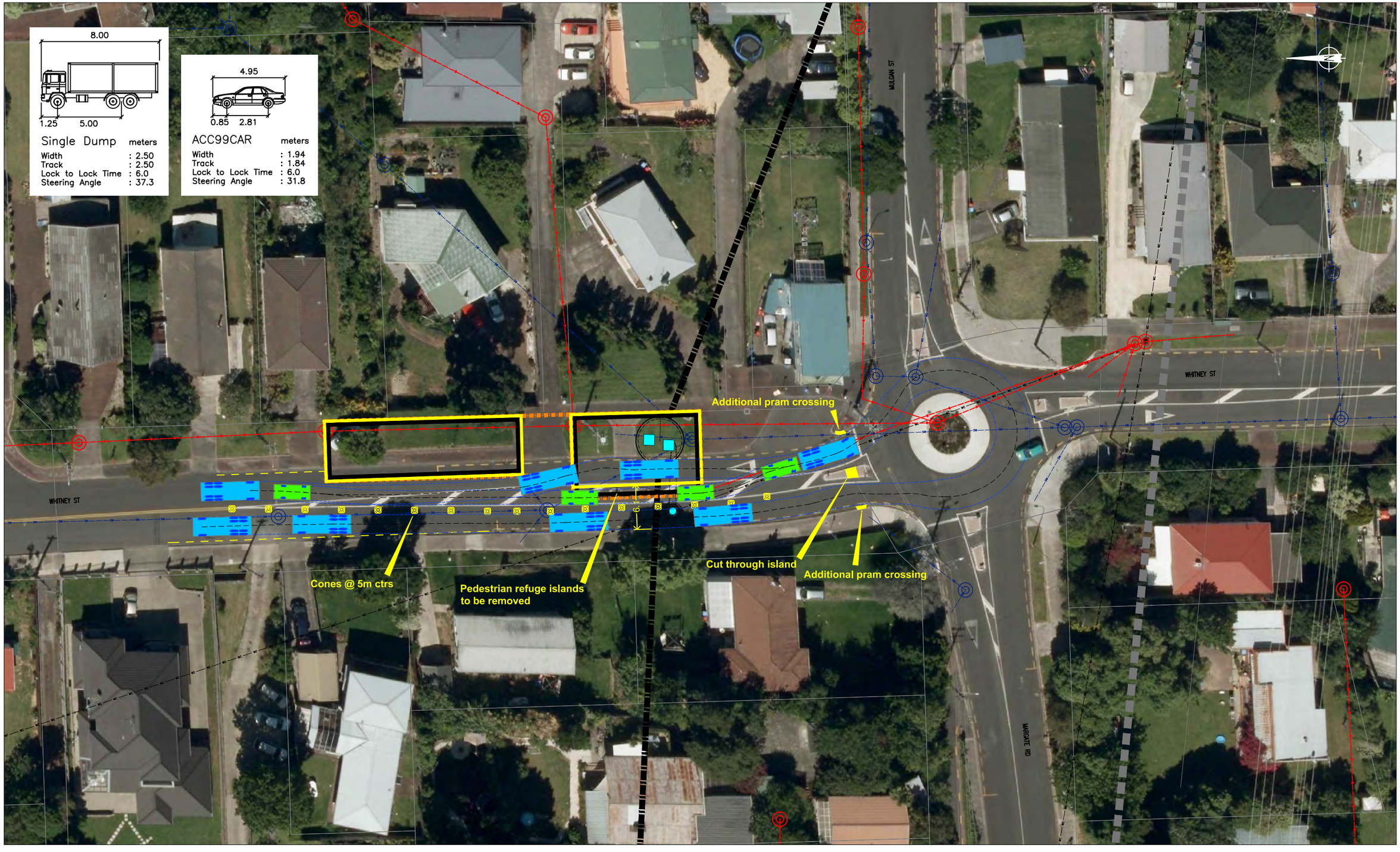
Truck Routes

Traffic Design Group

28.v2

SCALE: N.T.S

J:\11100-49\11117\Drawings\11117A55a.dwg



Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-17.2.dwg
A	24.07.2012	Sourced from Watercare - AEE-MAIN-17.2.pdf
B	08.08.2012	Vehicle tracking added
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Whitney Street (L3S3) - Truck Tracking

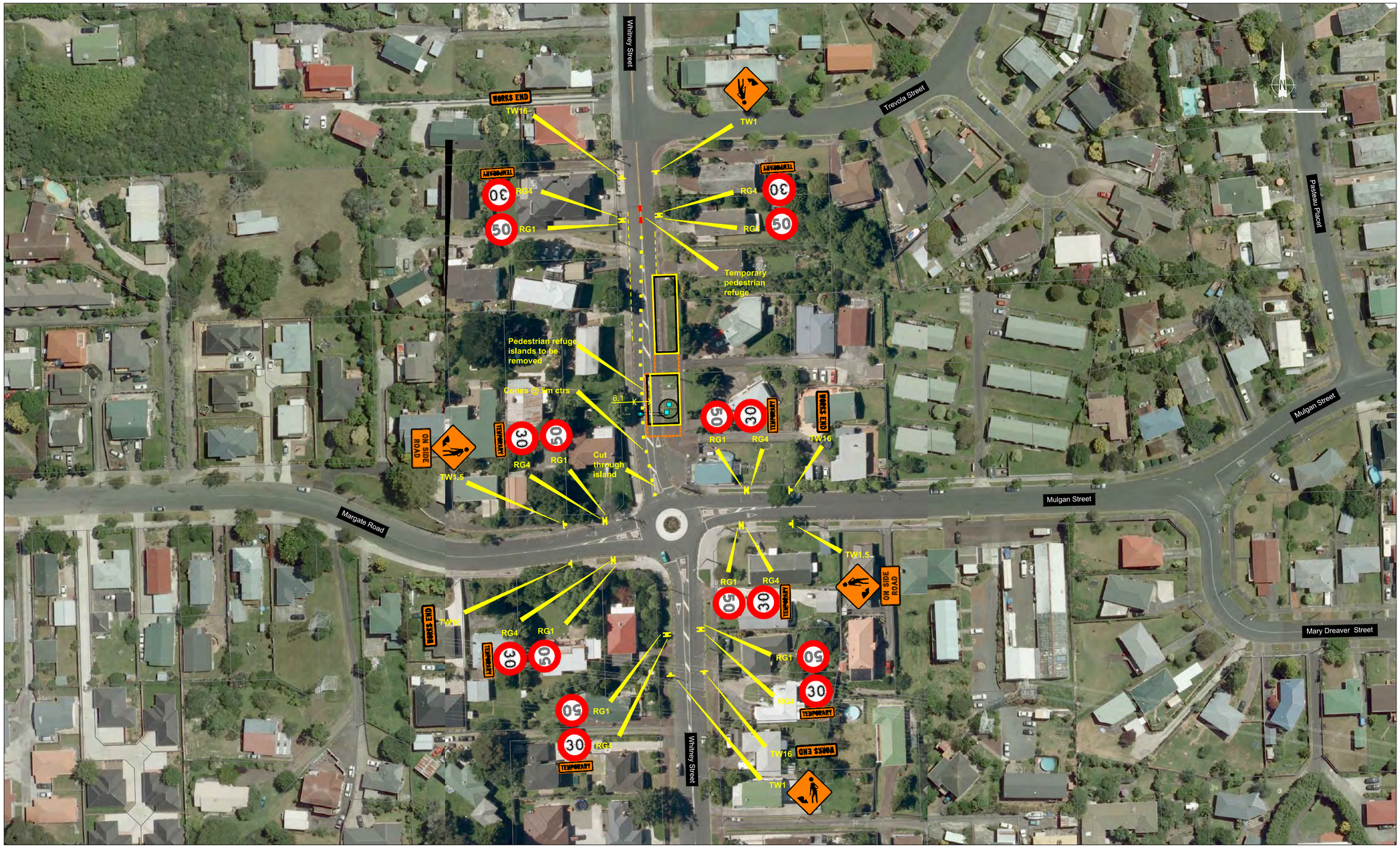
water Care services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:500@A3
DWG NO:11117A57A

Traffic Design Group

33.v2

J:\11100-49\11117\Drawings\11117A57a.dwg



Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
A	26.06.2012	New Location of Site
B	06.08.2012	Remove proposed islands and add temporary pedestrian refuge crossing
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

CTMP Whitney Street (L3S3)

waterCare services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:1250@A3
DWG NO:11117A58A

Traffic Design Group

34.v2

J:\11100-49\11117\Drawings\11117A58a.dwg

Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	05.06.2012	Sourced from Watercare - AEE-MAIN-1.1.dwg
A	29.06.2012	Sourced from Watercare - AEE-MAIN-19.2_Draft.pdf
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

Haycock Avenue (L3S5) - Truck Tracking

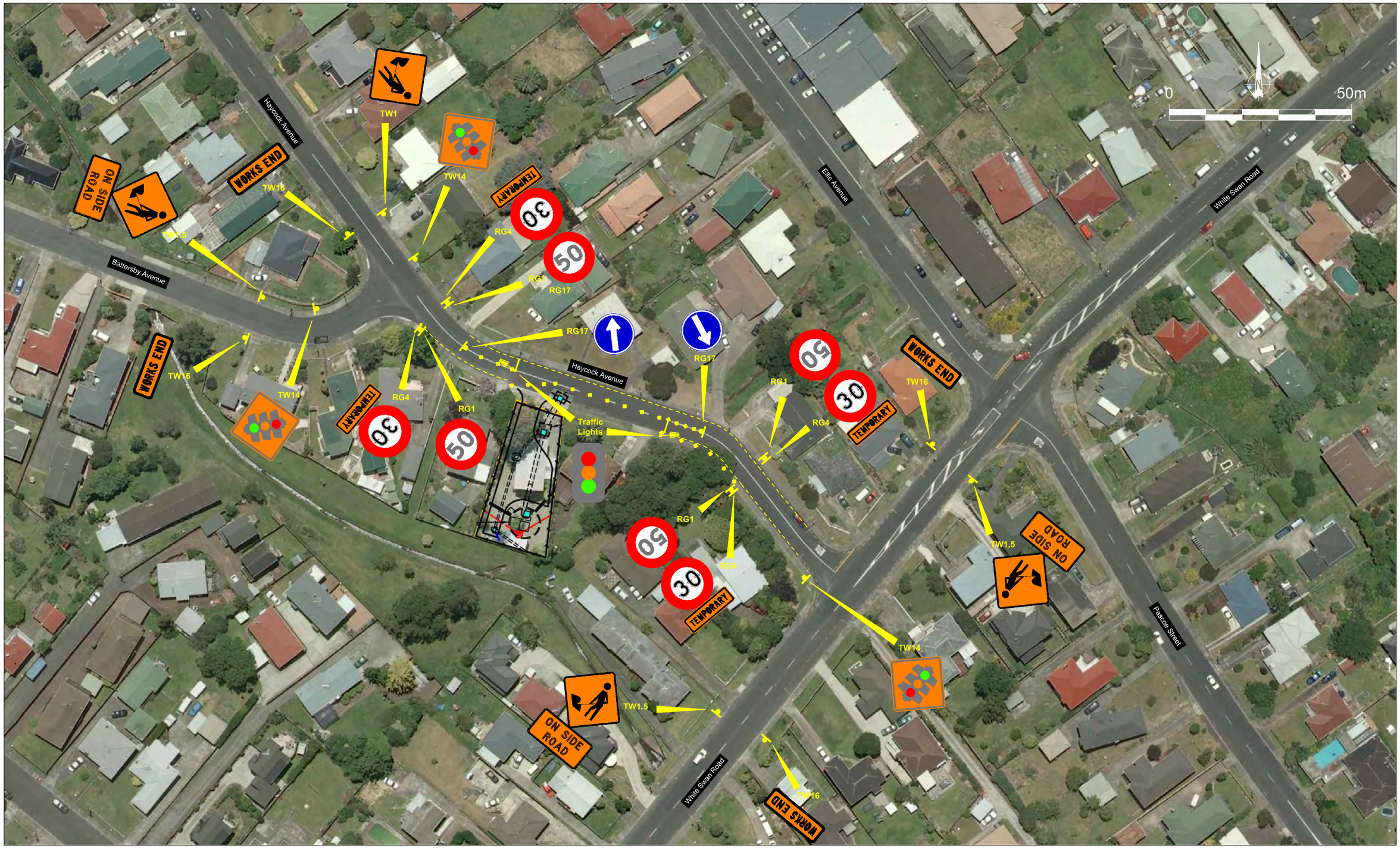
waterCare services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:500@A3
DWG NO:11117A59A

Traffic Design Group

38.v2

J:\11100-49\11117\Drawings\11117A59a.dwg



Wednesday, 5 December 2012

REVISION	DATE	DESCRIPTION
—	29.06.2012	Sourced from Watercare - AEE-MAIN-19.2_Draft.pdf
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—
—	—	—

Watercare Central Interceptor

CTMP Haycock Avenue (L3S5)

water Care services limited

DRAWN: SP
DATE: 05.12.2012
SCALE: 1:1000@A3
DWG NO:11117A58A

Traffic Design Group

39.v2

J:\11100-49\11117\Drawings\11117A58a.dwg

Appendix B

Generic CTMP

Watercare Services Limited

Central Interceptor Project

Generic Outline for Construction Traffic Management Plan

December 2012

Traffic Design Group

Watercare Services Limited

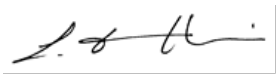
Central Interceptor Project

Generic Outline for Construction Traffic Management Plan
Quality Assurance Statement

Prepared by:

Alasdair McGeachie
Project Transportation Engineer

Reviewed & Approved for Issue by:



Leo Hills
Associate

Status: Final Report

Date: 12 December 2012

PO Box 2592, Shortland Street
Auckland
New Zealand

P: +64 9 531 5006

www.tdg.co.nz

Table of Contents

1. Introduction

This generic outline for a Construction Traffic Management Plan (CTMP) is a generic plan which considers the typical construction process, standard site issues and constraints and provides appropriate general solutions. Detailed design has not yet been undertaken and construction is a number of years away. It does not purport to cover every issue that a particular individual site within the construction corridor may present. It has been based on available information regarding earthworks and construction for the proposed development at this time. However, it will be updated prior to construction commencing, once detailed design is complete and construction methodologies are confirmed.

2. General

2.1 Site Location

Watercare is planning to construct a new wastewater tunnel "The Central Interceptor" to collect wastewater flows from the Auckland Isthmus area and transfer them across the Manukau Harbour to the Mangere Wastewater Treatment Plant (WWTP).

The Central Interceptor Scheme extends across the Auckland Isthmus from Western Springs in the north to the Mangere WWTP in the south.

TDG has prepared Traffic Impact Assessments for the two separate resource consent and Notice of Requirement packages: the Central Interceptor main project works (Technical Report E of Part D of the AEE) and the CSO Collector Sewers (Technical Report A of Part C of the AEE). This CTMP covers both packages of work as many of the issues are the same. It will be updated prior to construction commencing for each of the work packages.

Construction will be undertaken between 2017 and 2023 for the main project works and 2023 and 2027 for the CSO Collector Sewers. This report details generic traffic management measures during site preparation and construction works. The traffic management measures in this report have been devised to comply with the standards and practises detailed in the NZTA "Code of Practice for Temporary Traffic Management" (COPTTM) document.

2.2 Scope of Works

The three major construction sites will be used for launching and retrieving the tunnel boring machine (TBM) tunnel spoil removal, materials handling and storage and for permanent management facilities of the complete pipe network. Activities at the 16 secondary construction sites include shaft sinking, construction of link sewers and launching/retrieving the micro-tunnelling equipment.

The Central Interceptor Scheme has been developed to a concept design stage. It is likely that some details may change as the Central Interceptor Scheme moves through the detailed design process. Detailed construction methods and detailed site specific traffic management plans will be determined following appointment of a construction contractor.

2.3 Existing Site Conditions

2.3.1 Road Function and Condition

Immediately prior to construction commencing at each site a photographic survey of the site access to public roads at the main construction sites and adjacent road surrounds as determined by Watercare and the relevant road controlling authorities should be undertaken so that any detrimental effects on the structure of the road assets can be identified and quantified.

2.4 Traffic Volumes

Traffic volume data has been considered in preparation of the TIA. Prior to construction this should be reviewed to allow mitigation measures to be proposed (if required).

According to COPTTM roads with a daily traffic volume of:

- Less than 10,000 vehicles per day (vpd) are Level 1.
- Greater than 10,000 vpd and a speed limit of 75 km/h or less are Level 2.
- Greater than 10,000 vpd and a speed limit over 75 km/h are Level 3.

Of note, no sites will directly access the Level 3 Road network.

2.5 Road Safety

A search of the NZ Transport Agency's Crash Analysis System for all reported road accidents in 50m radius of site access has been undertaken and results are reported in the TIA. This should be reviewed prior to construction to cover the five year period prior to site works.

2.6 Occupation of Road & Road Reserve Requirements

Where works in the road reserve are required during the construction programme such works will be fully detailed within a specific CTMP prepared for that site and submitted to Auckland Transport as part of the normal Corridor Access Request (CAR) process.

3. Construction Operations

3.1 Pre- Work Notifications

Prior to commencement of works, a detailed communications plan will be developed. This will set out the methods and timing for communication with key stakeholders, including directly affected properties, owners, neighbours, organisations, interest groups and road users.

3.2 Site Traffic Volumes

Estimated trip generations for the three construction site types are understood to be:

Site type	Estimated Total Daily Trips	Estimated Daily Truck Trips	Estimated Peak Hour Traffic Volumes
Major construction site	164	104	27
Secondary construction site	68	56	9

Table 1: Traffic generation Main Project Works Sites

Site type	Estimated Total Daily Trips	Estimated Daily Truck Trips	Estimated Peak Hour Traffic Volumes
CSO	34	20	6

Table 3: Traffic generation CSO Collector Sewer Sites

3.3 Work Hours

The work hours will be as set out in the conditions of the designation.

Site operational arrangements will likely occur on the following general basis:

- Tunnelling and associated surface activities – 24 hours a day, 7 days a week operations will occur for all tunnelling activities related to the main tunnel works.
- Micro tunnelling, trenching and associated surface activities – this work would normally occur during normal working hours, 7 am to 6 pm, Monday to Friday and 8 am to 6 pm Saturday. However, in particular circumstances, Watercare may need to undertake micro-tunnelling works 24 hours a day 7 days a week (or alternative extended hours) to meet construction demands, provided that construction work can be managed to meet construction traffic, noise, and vibration requirements.
- Truck movements – normal working hours, 7 am to 6 pm, Monday to Friday, 8 am to 6 pm Saturday. Special deliveries – as required to address traffic management measures.
- General site activities – normal working hours, 7 am to 6 pm, Monday to Friday, 8 am to 6 pm Saturday, and with provision to extend hours during summer daylight savings periods as required.

3.4 Site Access

All site access points will be designed to ensure pedestrian safety.

All heavy vehicle movements will occur in a forwards direction where practicable and reserve manoeuvring avoided. Where appropriate, access should occur under the guidance of a manual traffic controller.

Where access driveways only allow for one-way traffic movement but two way traffic flow is required a system should be developed to either hold vehicles in a designated waiting area (on or off site) when a vehicle is using the access driveway or to control/manage vehicle movements so that waiting need not occur.

3.5 Construction Management

Other environmental controls relating to site accessways (wheel wash etc.) will be set out in the Construction Management Plan required by conditions of the designation. This will include:

- An outline construction programme, including an indication of when traffic management measures may be required;
- Location of site infrastructure including site offices, site amenities, contractors yards site access, equipment unloading and storage areas, contractor car parking, and security;
- Procedures for controlling sediment run-off, dust and the removal of soil, debris, demolition and construction materials (if any) from public roads or places adjacent to the work site;
- Procedures for ensuring that residents, road users and businesses in the immediate vicinity of construction areas are given prior notice of the commencement of construction activities and are informed about the expected duration and effects of the works;

4. Traffic Controls during site works

4.1 General

Appropriate traffic controls will be developed for an individual site to ensure safe access for vehicles to and from the site, safe passage for pedestrians past the site access and the safe operation of the adjacent road network.

The progress of the work may require that different methods and levels of traffic control are required at different stages of the work programme. The traffic control methods employed should be appropriate to the work in hand.

4.2 Public Transport Effects

Where site works require the temporary closure or relocation of public transport assets (eg: bus stops) prior liaison with and approval from Auckland Transport must occur.

4.3 Public Parking Effects

Where site works require the temporary or permanent closure or restriction of public parking such restrictions shall be properly notified and authorised through Auckland Transport.

4.4 Truck Movements to the Site

Truck movement routes are to be advised for individual sites, and should be based on the NoR documentation.

4.5 Truck Waiting

It is recommended that truck movements are controlled to avoid truck waiting. Where truck waiting is required, or otherwise occurs, trucks will be expected to use a designated waiting area.

4.6 Road Signs

All traffic and warning signs to be erected will conform to the standards specified in COPTTM. All on-road signs associated with the works will be covered at the completion of each work day or as otherwise appropriate.

All signs will be Code of Practice Level 1 or 2 size as per Auckland Transport advice on the COPTTM Road Level of the frontage roads to the site.

5. Parking

5.1 Workers and Subcontractor Vehicles

Workers and sub-contractors will be instructed to park on site where possible. Although on-street parking opportunities exist at all of the sites, parking on the roadside by site staff will be discouraged where practicable to minimise disruption to the local residents, businesses and road users

Workers and sub-contractors will be advised that if they are required to park outside of the on-site areas they will be required to park in accordance with normal traffic regulations.

5.2 Parking Restrictions

Where it is necessary to impose temporary or permanent parking restrictions in the vicinity of a site to allow construction works to occur or to permit the movement of heavy vehicles on or off-site, such restrictions shall be properly notified and authorised through Auckland Transport.

6. Pedestrian Safety

A number of sites are located within or near to public parks, reserves and schools. Such sites can draw a steady stream of pedestrians, especially younger age pedestrians.

It is thus considered important that appropriate barriers/safeguards are in place to prevent inadvertent / unauthorised access into the site by pedestrians.

Additionally, all movements by heavy vehicles to and from a site should be in a forwards direction and trucks drivers using the site should be warned of the potential for pedestrians at the site access points.

7. Liaison

7.1 Project Manager for the Project

TBA

7.2 Site Manager for the Project

TBA

7.3 Affected Parties

A communications plan will be developed prior to construction, in accordance with the conditions of the designation.

7.4 Utility Services

Where possible, access for utility services will be maintained.

8. Conclusion

The generic traffic management principles outlined in this report will assist to ensure that potential adverse effects on both the operating traffic environment and the local residents due to the proposed construction operations will be minimised.

Detailed traffic management plans for individual sites will be submitted to the Road Controlling Authority (RCA), Auckland Transport (or NZTA if appropriate) for approval prior to the commencement of works in accordance with the normal CAR approval process.

It is therefore concluded that the traffic management measures identified in this report will ensure that the site works necessary for the construction of the proposed Central Interceptor Scheme can occur with a minimum of disruption to neighbouring residents and the road network.

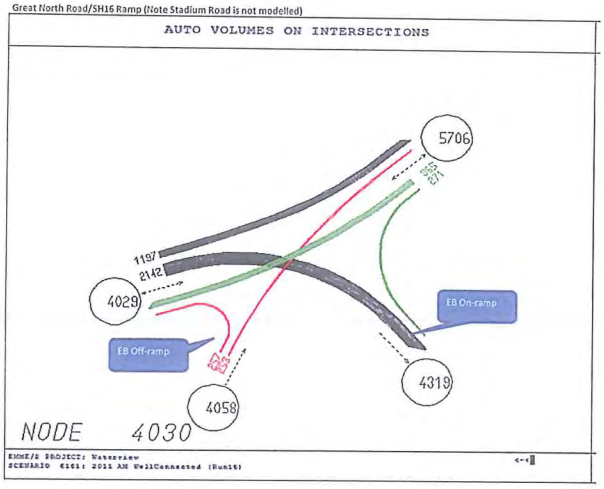
Traffic Design Group Ltd
12 December 2012

Appendix C

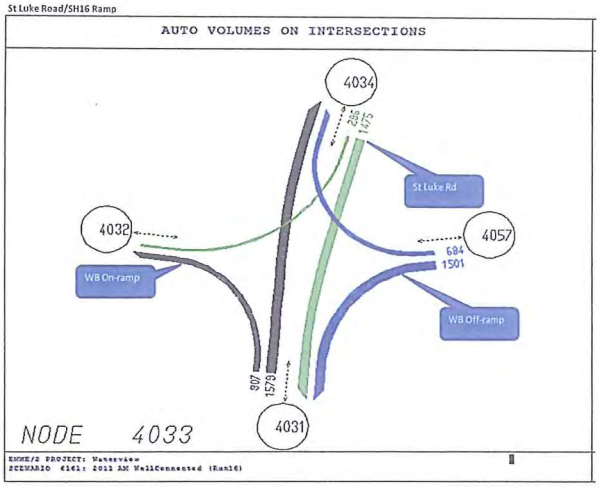
Beca Western Ring Route (WRR) Model Data

2011 AM Peak (2 hour Flows)

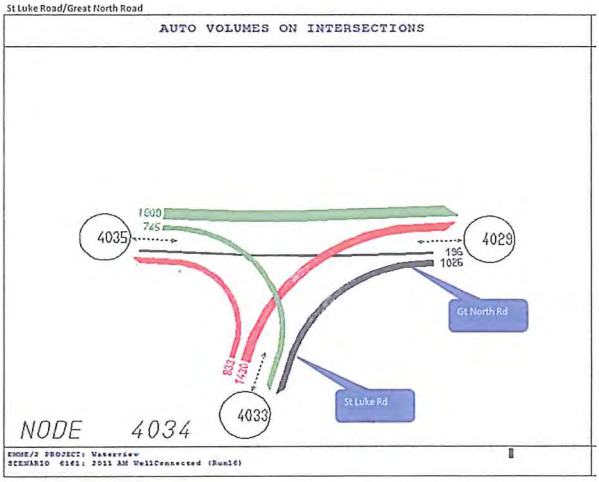
Great North Road/SH16 Ramp (Note Stadium Road is not modelled)



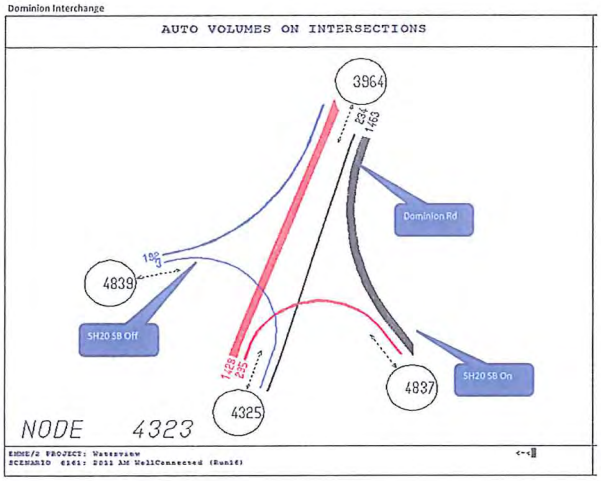
St Luke Road/SH16 Ramp



St Luke Road/Great North Road

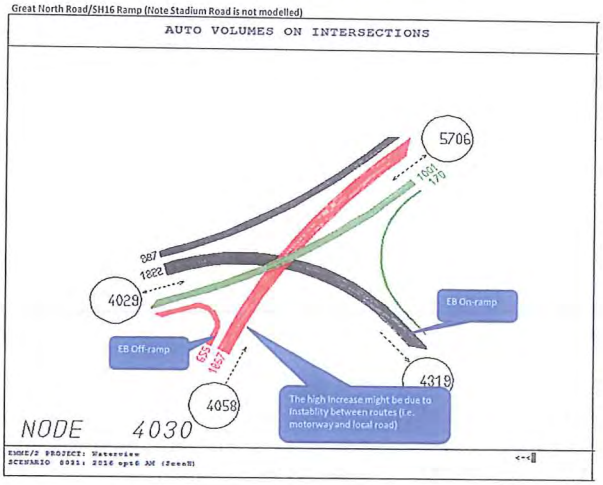


Dominion Interchange

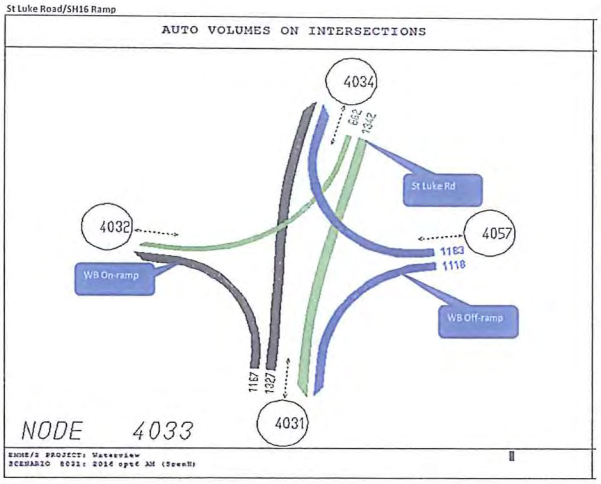


2016 AM Peak (2 hour Flows) with Waterview Connection

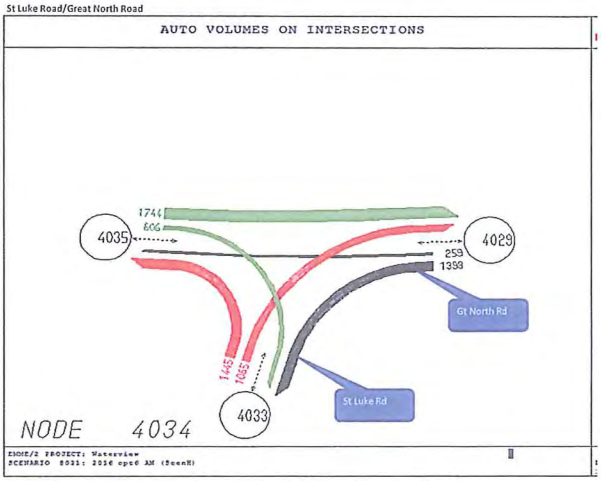
Great North Road/SH16 Ramp (Note Stadium Road is not modelled)



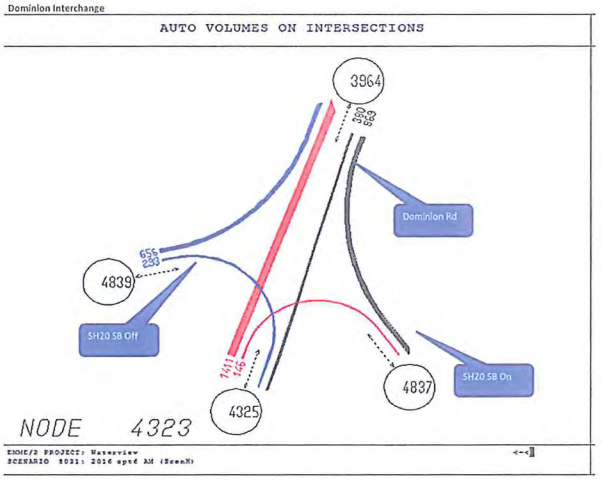
St Luke Road/SH16 Ramp



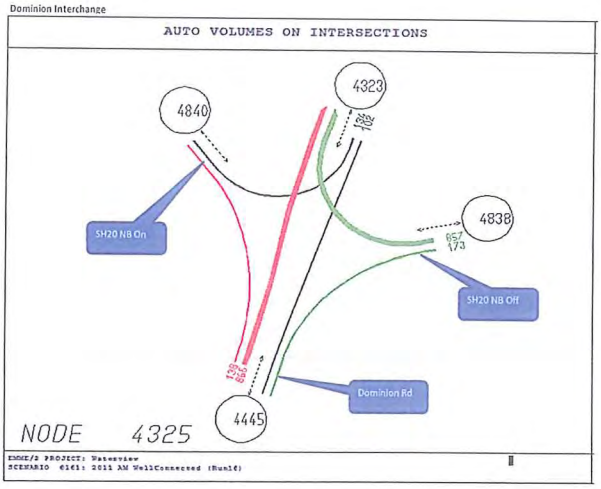
St Luke Road/Great North Road



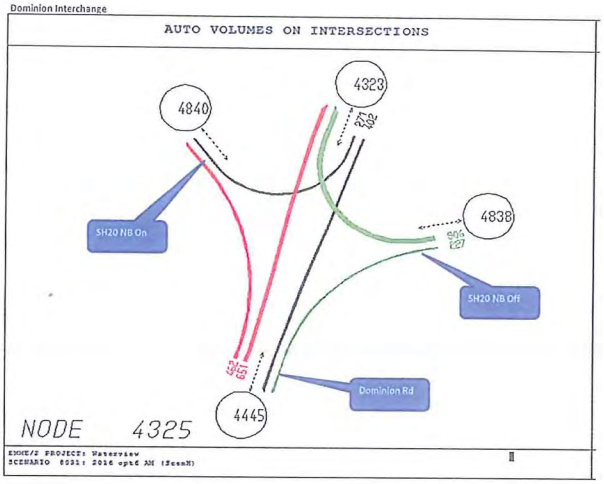
Dominion Interchange



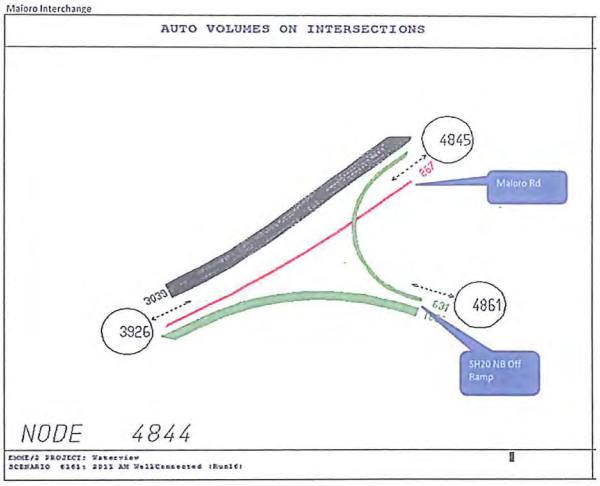
Dominion Interchange



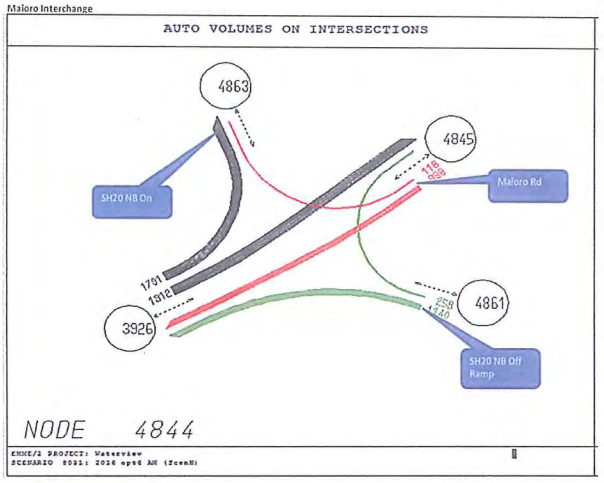
Dominion Interchange



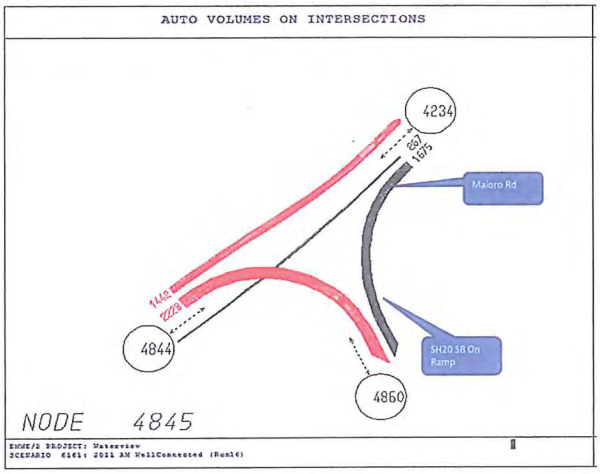
Maioro Interchange



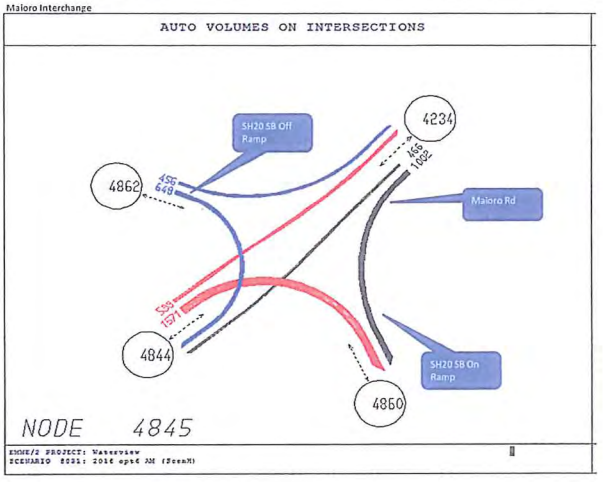
Maioro Interchange



Maioro Interchange

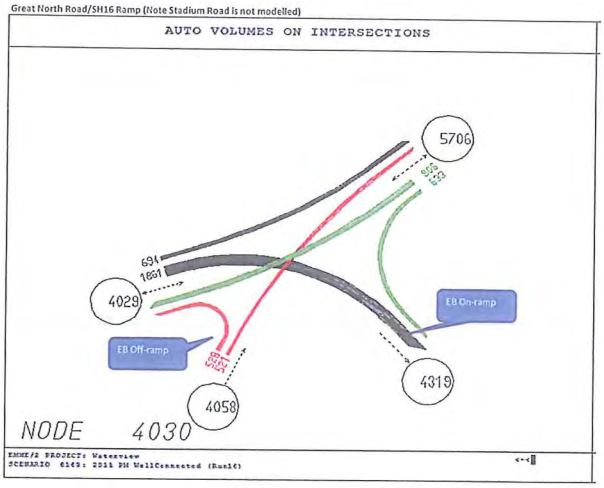


Maioro Interchange

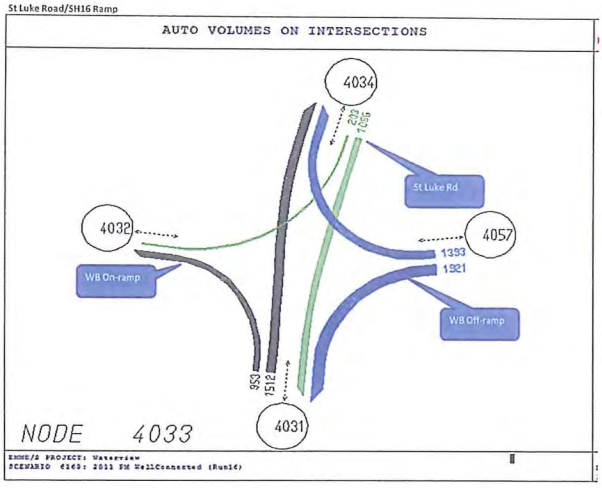


2011 PM Peak (2 hour Flows)

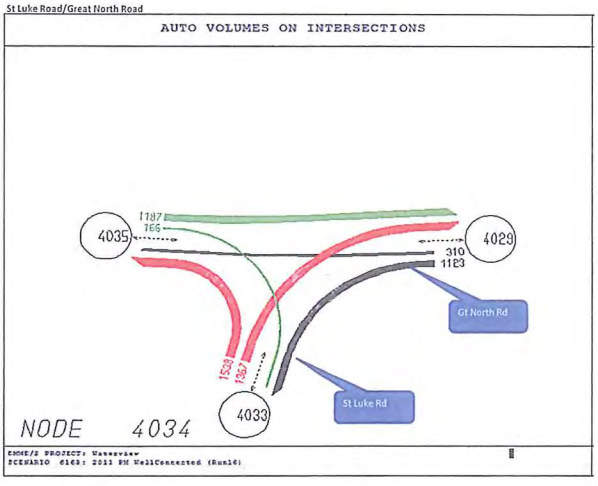
Great North Road/SH16 Ramp (Note Stadium Road is not modelled)



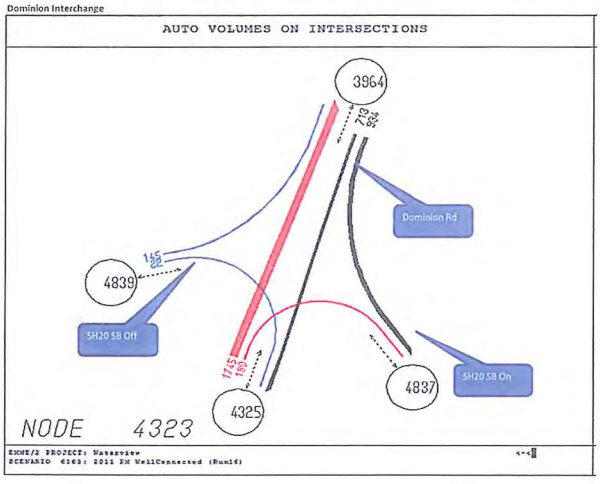
St Luke Road/SH16 Ramp



St Luke Road/Great North Road

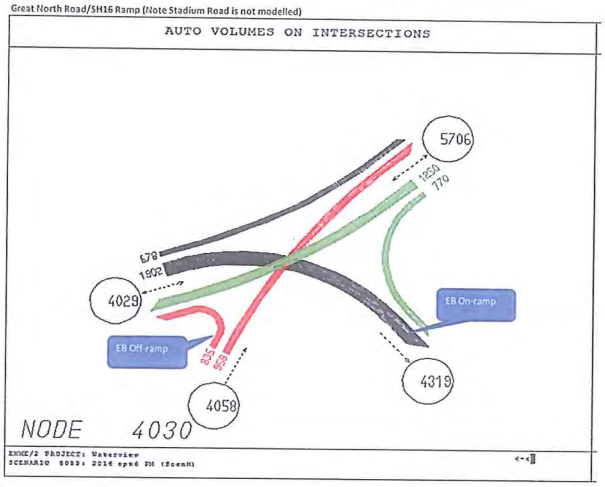


Dominion Interchange

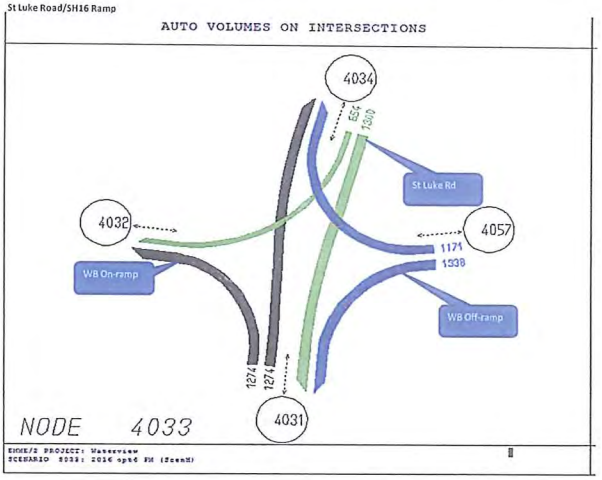


2016 PM Peak (2 hour Flows) with Waterview Connection

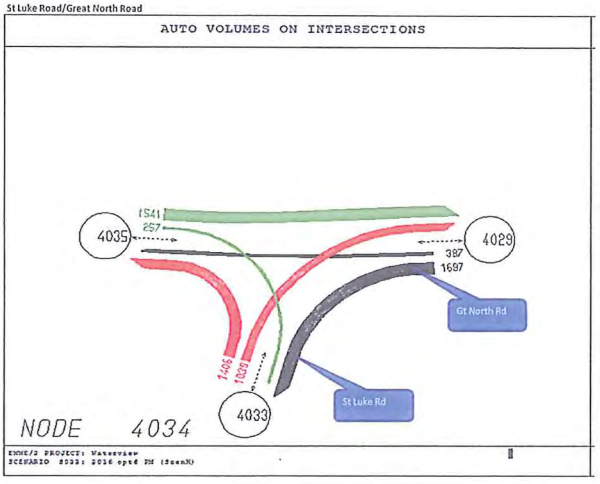
Great North Road/SH16 Ramp (Note Stadium Road is not modelled)



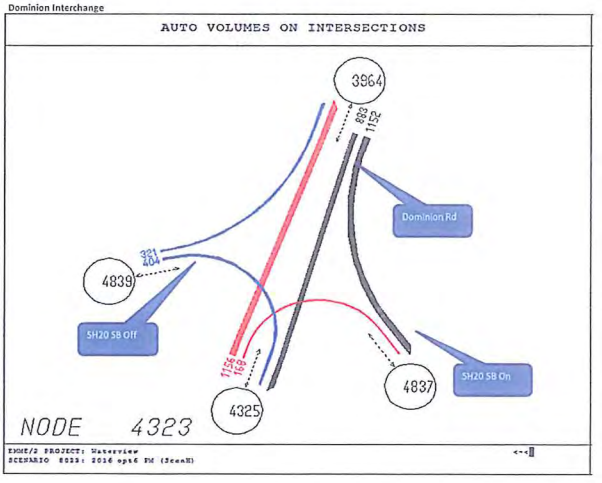
St Luke Road/SH16 Ramp



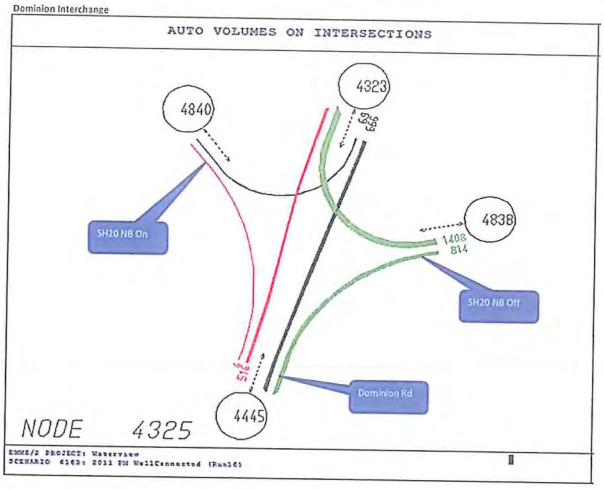
St Luke Road/Great North Road



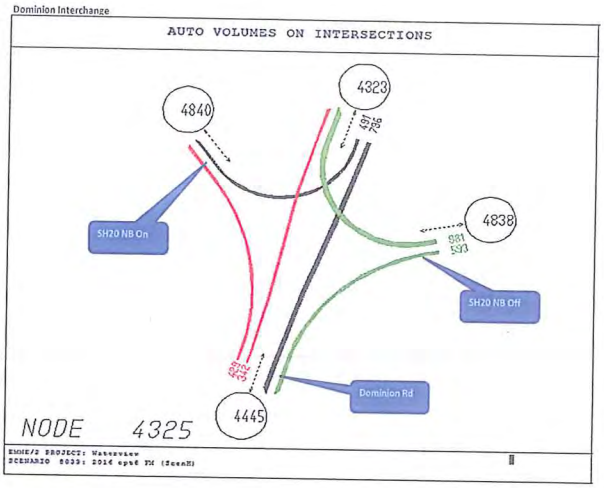
Dominion Interchange



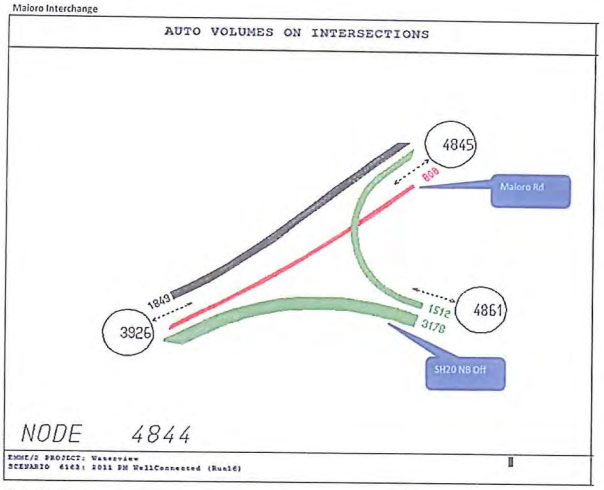
Dominion Interchange



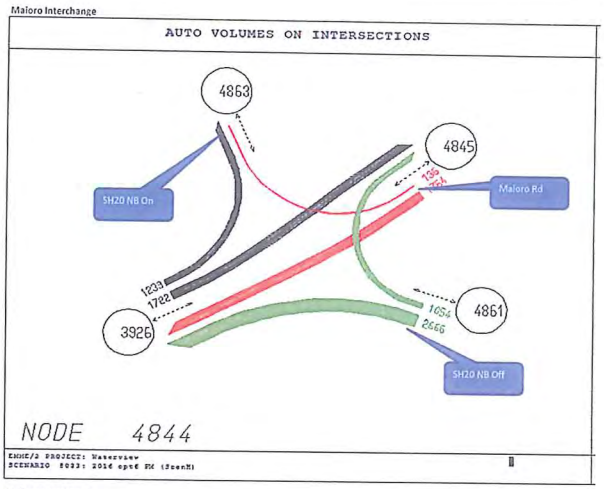
Dominion Interchange



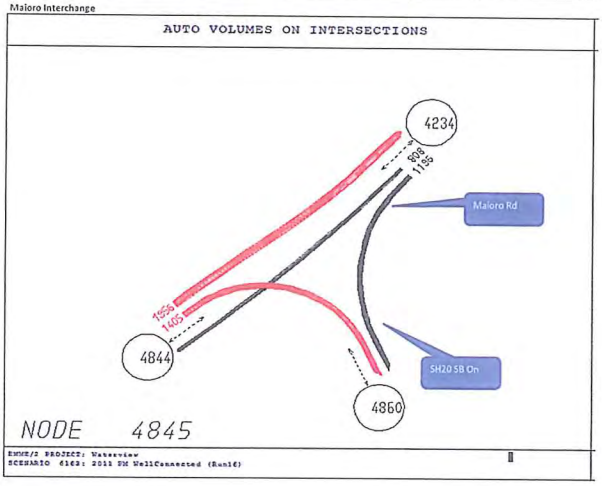
Maioro Interchange



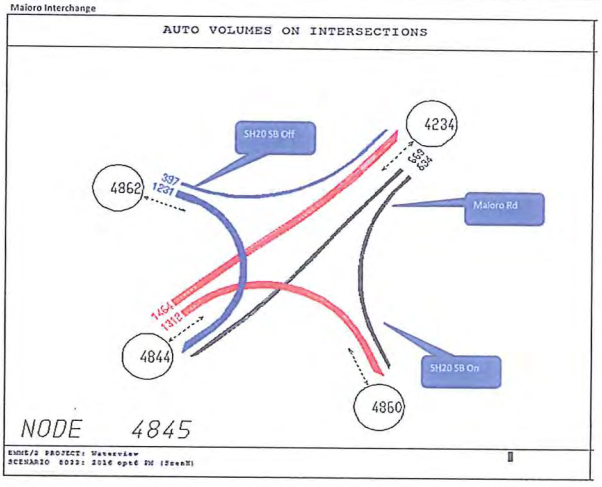
Maioro Interchange



Maioro Interchange



Maioro Interchange



Appendix D

SIDRA results (WS1)

MOVEMENT SUMMARY

St Lukes Road / GNR
AM existing 2016
Waterview Connection Operational

Signals - Fixed Time Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road											
1	L	629	10.4	1.000[3]	9.7	LOS A	6.5	49.3	0.72	0.77	40.4
3	R	798	2.6	0.905	45.5	LOS D	36.3	265.2	0.89	0.96	23.9
Approach		1426	7.1	1.000	29.7	LOS C	36.3	265.2	0.82	0.88	29.2
East: GNR WB											
4	L	794	2.3	0.605	11.7	LOS B	17.4	124.3	0.55	0.73	39.0
5	T	147	4.2	0.534	48.2	LOS D	7.5	54.6	0.97	0.79	22.3
Approach		941	2.6	0.605	17.4	LOS B	17.4	124.3	0.62	0.74	35.0
West: GNR EB											
11	T	991	5.5	0.526	0.1	X	X	X	X	0.00	49.9
12	R	344	3.9	0.998	100.0	LOS F	27.3	197.4	1.00	1.20	14.7
Approach		1335	5.1	0.998	25.9	LOS C	27.3	197.4	0.26	0.31	30.8
All Vehicles		3702	5.2	1.000	25.2	LOS C	36.3	265.2	0.56	0.64	31.1

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians								
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	49.2	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	53	44.6	LOS E	0.1	0.1	0.90	0.90
P7	Across W approach	53	17.5	LOS B	0.1	0.1	0.56	0.56
All Pedestrians		159	37.1	LOS D			0.80	0.80

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / GNR
AM future 2016
Waterview Connection Operational
WS1 AS1 L1S1 L1S2 Operational

Signals - Fixed Time Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road											
1	L	629	10.4	1.000[3]	9.7	LOS A	6.5	49.3	0.72	0.77	40.4
3	R	830	2.6	0.942	54.4	LOS D	42.5	311.0	0.90	1.01	21.7
Approach		1459	7.0	1.000	35.1	LOS D	42.5	311.0	0.82	0.90	27.2
East: GNR WB											
4	L	797	2.3	0.608	11.7	LOS B	17.5	125.2	0.55	0.73	39.0
5	T	147	4.2	0.534	48.2	LOS D	7.5	54.6	0.97	0.79	22.3
Approach		944	2.6	0.608	17.4	LOS B	17.5	125.2	0.62	0.74	35.0
West: GNR EB											
11	T	994	5.5	0.528	0.1	X	X	X	X	0.00	49.9
12	R	344	3.9	0.998	100.0	LOS F	27.3	197.4	1.00	1.20	14.7
Approach		1338	5.1	0.998	25.8	LOS C	27.3	197.4	0.26	0.31	30.8
All Vehicles		3741	5.2	1.000	27.3	LOS C	42.5	311.0	0.57	0.65	30.1

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	49.2	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	53	44.6	LOS E	0.1	0.1	0.90	0.90
P7	Across W approach	53	17.5	LOS B	0.1	0.1	0.56	0.56
All Pedestrians		159	37.1	LOS D			0.80	0.80

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / GNR
AM future 2016
Waterview Connection Operational
All site traffic routed via SH16/SH20 through St Lukes Interchange
WS1 AS1 L1S1 L1S2 Operational

Signals - Fixed Time Cycle Time = 130 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road											
1	L	821	10.4	0.570	8.0	LOS A	12.2	93.1	0.35	0.65	41.9
3	R	605	2.6	0.832	40.5	LOS D	32.0	229.0	0.89	0.90	25.3
Approach		1426	7.1	0.832	21.8	LOS C	32.0	229.0	0.58	0.76	32.9
East: GNR WB											
4	L	807	2.3	0.614	12.1	LOS B	20.4	145.8	0.53	0.73	38.7
5	T	154	4.2	0.658	60.7	LOS E	9.6	69.9	1.00	0.83	19.7
Approach		961	2.6	0.658	19.9	LOS B	20.4	145.8	0.60	0.74	33.6
West: GNR EB											
11	T	991	5.5	0.526	0.1	X	X	X	X	0.00	49.9
12	R	347	3.9	0.833	64.0	LOS E	22.8	165.2	1.00	0.93	19.7
Approach		1338	5.1	0.833	16.7	LOS B	22.8	165.2	0.26	0.24	35.6
All Vehicles		3725	5.2	0.833	19.5	LOS B	32.0	229.0	0.47	0.57	34.0

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	59.1	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	53	46.5	LOS E	0.2	0.2	0.85	0.85
P7	Across W approach	53	19.4	LOS B	0.1	0.1	0.55	0.55
All Pedestrians		159	41.7	LOS E			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / GNR
PM existing 2016
Waterview Connection Operational

Signals - Fixed Time Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road											
1	L	528	1.4	1.000[3]	10.9	LOS B	7.0	49.4	0.65	0.74	39.5
3	R	861	0.0	0.814	28.2	LOS C	30.5	214.9	0.77	0.86	29.9
Approach		1389	0.8	1.000	21.6	LOS C	30.5	214.9	0.72	0.81	33.0
East: GNR WB											
4	L	959	2.3	0.636	7.8	LOS A	13.7	97.9	0.38	0.67	42.0
5	T	220	6.1	0.880	66.1	LOS E	14.5	106.7	1.00	1.04	18.7
Approach		1179	3.0	0.880	18.7	LOS B	14.5	106.7	0.50	0.74	34.2
West: GNR EB											
11	T	876	7.5	0.471	0.1	X	X	X	X	0.00	49.9
12	R	146	0.5	0.593	60.5	LOS E	8.3	58.3	0.99	0.80	20.4
Approach		1022	6.5	0.593	8.7	LOS A	8.3	58.3	0.14	0.12	41.3
All Vehicles		3591	3.2	1.000	17.0	LOS B	30.5	214.9	0.48	0.59	35.4

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P7	Across W approach	53	13.5	LOS B	0.1	0.1	0.48	0.48
All Pedestrians		159	40.6	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / GNR
PM future 2016
Waterview Connection Operational
WS1 AS1 L1S1 L1S2 Operational

Signals - Fixed Time Cycle Time = 120 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road											
1	L	528	1.4	1.000[3]	10.9	LOS B	7.0	49.4	0.65	0.74	39.5
3	R	878	0.0	0.830	29.7	LOS C	32.5	228.8	0.78	0.87	29.2
Approach		1406	0.8	1.000	22.6	LOS C	32.5	228.8	0.73	0.82	32.5
East: GNR WB											
4	L	965	2.3	0.528	5.7	X	X	X	X	0.53	44.1
5	T	220	6.1	0.880	66.1	LOS E	14.5	106.7	1.00	1.04	18.7
Approach		1185	3.0	0.880	16.9	LOS B	14.5	106.7	0.19	0.62	35.3
West: GNR EB											
11	T	882	7.5	0.474	0.1	X	X	X	X	0.00	49.9
12	R	146	0.5	0.593	60.5	LOS E	8.3	58.3	0.99	0.80	20.4
Approach		1028	6.5	0.593	8.7	LOS A	8.3	58.3	0.14	0.11	41.3
All Vehicles		3620	3.1	1.000	16.8	LOS B	32.5	228.8	0.39	0.56	35.5

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P7	Across W approach	53	13.5	LOS B	0.1	0.1	0.48	0.48
All Pedestrians		159	40.6	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

St Lukes Road / GNR
PM future 2016
Waterview Connection Operational
All site traffic routed via SH16/SH20 through St Lukes Interchange
WS1 AS1 L1S1 L1S2 Operational

Signals - Fixed Time Cycle Time = 110 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road											
1	L	547	1.4	1.000[3]	10.6	LOS B	7.0	49.3	0.66	0.74	39.7
3	R	842	0.0	0.851	33.5	LOS C	31.9	224.5	0.83	0.90	27.8
Approach		1389	0.8	1.000	24.5	LOS C	31.9	224.5	0.76	0.84	31.5
East: GNR WB											
4	L	985	2.3	0.539	5.7	X	X	X	X	0.53	44.0
5	T	223	6.1	0.818	55.4	LOS E	12.8	94.2	1.00	0.97	20.7
Approach		1208	3.0	0.818	14.9	LOS B	12.8	94.2	0.18	0.61	36.6
West: GNR EB											
11	T	876	7.5	0.471	0.1	X	X	X	X	0.00	49.9
12	R	153	0.5	0.567	54.8	LOS D	7.9	55.2	0.98	0.80	21.6
Approach		1028	6.5	0.567	8.2	LOS A	7.9	55.2	0.15	0.12	41.7
All Vehicles		3626	3.1	1.000	16.7	LOS B	31.9	224.5	0.39	0.56	35.6

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	49.2	LOS E	0.2	0.2	0.95	0.95
P3	Across E approach	53	49.2	LOS E	0.2	0.2	0.95	0.95
P7	Across W approach	53	14.8	LOS B	0.1	0.1	0.52	0.52
All Pedestrians		159	37.7	LOS D			0.80	0.80

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: St Lukes / St lukes WB on/off ramp AM existing

St Lukes Road / St Lukes WB off/on ramps Int
AM existing 2016
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road NB											
1	L	713	1.2	0.387	5.7	X	X	X	X	0.53	44.1
2	T	811	1.8	0.956	90.1	LOS F	36.6	260.0	1.00	1.15	15.4
Approach		1523	1.5	0.956	50.6	LOS D	36.6	260.0	0.53	0.86	22.2
East: WB off-ramp											
4	L	682	5.8	0.383	5.7	X	X	X	X	0.52	44.1
6	R	722	8.0	0.964	84.5	LOS F	66.6	498.3	1.00	1.03	16.4
Approach		1404	7.0	0.964	46.2	LOS D	66.6	498.3	0.51	0.78	23.8
North: ST lukes Road SB											
8	T	819	3.7	0.872	39.9	LOS D	55.4	400.0	0.96	0.92	24.6
9	R	404	3.8	0.958	97.9	LOS F	37.0	267.2	1.00	1.03	14.8
Approach		1223	3.7	0.958	59.1	LOS E	55.4	400.0	0.98	0.95	20.2
All Vehicles		4151	4.0	0.964	51.6	LOS D	66.6	498.3	0.66	0.86	22.1

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	30.7	LOS D	0.1	0.1	0.64	0.64
P3	Across E approach	53	20.3	LOS C	0.1	0.1	0.52	0.52
All Pedestrians		106	25.5	LOS C			0.58	0.58

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes WB off/on ramps Int
AM future 2016
Waterview Connection Operational
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road NB											
1	L	713	1.2	0.387	5.7	X	X	X	X	0.53	44.1
2	T	819	1.8	0.965	94.1	LOS F	37.8	268.7	1.00	1.17	14.9
Approach		1532	1.5	0.965	52.9	LOS D	37.8	268.7	0.53	0.87	21.7
East: WB off-ramp											
4	L	683	5.8	0.383	5.7	X	X	X	X	0.52	44.1
6	R	746	8.0	0.981	92.8	LOS F	72.5	542.3	1.00	1.05	15.4
Approach		1429	7.0	0.981	51.2	LOS D	72.5	542.3	0.52	0.80	22.5
North: ST lukes Road SB											
8	T	822	3.7	0.887	43.5	LOS D	58.2	420.0	0.98	0.95	23.5
9	R	404	3.8	0.986	111.3	LOS F	39.5	285.8	1.00	1.07	13.5
Approach		1226	3.7	0.986	65.9	LOS E	58.2	420.0	0.99	0.99	18.9
All Vehicles		4187	4.0	0.986	56.1	LOS E	72.5	542.3	0.66	0.88	21.0

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	30.1	LOS D	0.1	0.1	0.63	0.63
P3	Across E approach	53	20.8	LOS C	0.1	0.1	0.53	0.53
All Pedestrians		106	25.4	LOS C			0.58	0.58

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes WB off/on ramps Int
AM existing 2016
Waterview Connection Operational
All site traffic routed via SH16/SH20 through St Lukes Interchange
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 150 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road NB											
1	L	715	1.2	0.388	5.7	X	X	X	X	0.53	44.1
2	T	811	1.8	0.956	90.1	LOS F	36.6	260.0	1.00	1.15	15.4
Approach		1525	1.5	0.956	50.5	LOS D	36.6	260.0	0.53	0.86	22.2
East: WB off-ramp											
4	L	682	5.8	0.383	5.7	X	X	X	X	0.52	44.1
6	R	722	8.0	0.979	93.0	LOS F	69.8	522.5	1.00	1.05	15.4
Approach		1404	7.0	0.979	50.6	LOS D	69.8	522.5	0.51	0.80	22.6
North: ST lukes Road SB											
8	T	820	3.7	0.861	37.5	LOS D	53.7	388.1	0.95	0.90	25.3
9	R	420	3.8	0.968	101.5	LOS F	39.3	284.2	1.00	1.04	14.5
Approach		1240	3.7	0.968	59.2	LOS E	53.7	388.1	0.97	0.95	20.2
All Vehicles		4169	4.0	0.979	53.1	LOS D	69.8	522.5	0.66	0.86	21.7

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	31.4	LOS D	0.1	0.1	0.65	0.65
P3	Across E approach	53	19.8	LOS B	0.1	0.1	0.51	0.51
All Pedestrians		106	25.6	LOS C			0.58	0.58

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes WB off/on ramps Int
PM existing 2016
Waterview Connection Operatonal
Signals - Fixed Time Cycle Time = 100 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road NB											
1	L	697	2.3	0.381	5.7	X	X	X	X	0.53	44.1
2	T	697	1.4	0.859	49.5	LOS D	18.7	132.6	1.00	1.03	22.0
Approach		1394	1.9	0.859	27.6	LOS C	18.7	132.6	0.50	0.78	29.5
East: WB off-ramp											
4	L	733	1.0	0.397	5.7	X	X	X	X	0.53	44.1
6	R	641	1.2	0.892	49.9	LOS D	35.3	249.8	1.00	0.99	22.7
Approach		1374	1.1	0.892	26.3	LOS C	35.3	249.8	0.47	0.74	30.7
North: ST lukes Road SB											
8	T	712	1.2	0.751	22.0	LOS C	27.9	197.1	0.87	0.79	31.3
9	R	358	2.0	0.888	59.7	LOS E	20.2	143.8	1.00	0.99	20.5
Approach		1069	1.5	0.888	34.6	LOS C	27.9	197.1	0.91	0.86	26.6
All Vehicles		3837	1.5	0.892	29.1	LOS C	35.3	249.8	0.60	0.79	29.0

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	25.2	LOS C	0.1	0.1	0.71	0.71
P3	Across E approach	53	14.0	LOS B	0.1	0.1	0.53	0.53
All Pedestrians		106	19.6	LOS B			0.62	0.62

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: St Lukes / St lukes WB on/off ramp PM future

St Lukes Road / St Lukes WB off/on ramps Int
PM future 2016
Waterview Connection Operatonal
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 100 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road NB											
1	L	697	2.3	0.381	5.7	X	X	X	X	0.53	44.1
2	T	702	1.4	0.908	56.9	LOS E	20.4	144.7	1.00	1.12	20.4
Approach		1399	1.9	0.908	31.4	LOS C	20.4	144.7	0.50	0.83	28.0
East: WB off-ramp											
4	L	734	1.0	0.398	5.7	X	X	X	X	0.53	44.1
6	R	653	1.2	0.886	48.0	LOS D	35.3	249.4	1.00	0.98	23.1
Approach		1386	1.1	0.886	25.6	LOS C	35.3	249.4	0.47	0.74	31.0
North: ST lukes Road SB											
8	T	718	1.2	0.773	23.3	LOS C	29.0	205.3	0.89	0.81	30.7
9	R	358	2.0	0.888	59.7	LOS E	20.2	143.8	1.00	0.99	20.5
Approach		1076	1.5	0.888	35.4	LOS D	29.0	205.3	0.93	0.87	26.3
All Vehicles		3861	1.5	0.908	30.4	LOS C	35.3	249.4	0.61	0.81	28.5

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.5	LOS C	0.1	0.1	0.70	0.70
P3	Across E approach	53	14.6	LOS B	0.1	0.1	0.54	0.54
All Pedestrians		106	19.5	LOS B			0.62	0.62

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: St Lukes / St lukes WB on/off ramp PM future v3

St Lukes Road / St Lukes WB off/on ramps Int
PM existing 2016
Waterview Connection Operational
All site traffic routed via SH16/SH20 through St Lukes Interchange
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: St Lukes Road NB											
1	L	4	2.3	0.002	5.6	X	X	X	X	0.53	44.1
2	T	697	1.4	0.862	54.0	LOS D	20.5	144.9	1.00	1.03	21.0
Approach		701	1.4	0.862	53.7	LOS D	20.5	144.9	0.99	1.02	21.1
East: WB off-ramp											
4	L	733	1.0	0.397	5.7	X	X	X	X	0.53	44.1
6	R	641	1.2	0.890	52.2	LOS D	37.9	268.3	1.00	0.98	22.1
Approach		1374	1.1	0.890	27.4	LOS C	37.9	268.3	0.47	0.74	30.2
North: ST lukes Road SB											
8	T	713	1.2	0.737	23.2	LOS C	30.0	212.3	0.86	0.78	30.8
9	R	389	2.0	0.900	64.7	LOS E	24.3	173.0	1.00	0.99	19.5
Approach		1102	1.5	0.900	37.9	LOS D	30.0	212.3	0.91	0.85	25.5
All Vehicles		3177	1.3	0.900	36.8	LOS D	37.9	268.3	0.74	0.84	26.1

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	27.0	LOS C	0.1	0.1	0.70	0.70
P3	Across E approach	53	14.8	LOS B	0.1	0.1	0.52	0.52
All Pedestrians		106	20.9	LOS C			0.61	0.61

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes EB on/off ramp
AM existing 2016
Waterview Connection Operational
SH16 off-ramp RT 1/2 of model prediction
Signals - Fixed Time Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: EB on/off ramp											
1	L	356	5.8	1.000[3]	13.0	LOS B	6.7	49.4	0.58	0.71	38.1
2	T	38	0.0	0.899	74.1	LOS E	27.4	200.2	1.00	1.00	17.1
3	R	652	5.2	0.899	80.2	LOS F	27.4	200.2	1.00	0.99	17.2
Approach		1045	5.4	1.000	57.1	LOS E	27.4	200.2	0.86	0.90	21.1
East: GNR WB											
4	L	100	2.4	0.055	5.6	X	X	X	X	0.53	44.1
5	T	591	7.5	0.960	93.8	LOS F	26.1	194.8	1.00	1.19	15.0
6	R	16	40.0	0.371	62.5	LOS E	0.9	8.9	0.87	0.68	20.1
Approach		706	7.5	0.960	80.6	LOS F	26.1	194.8	0.86	1.09	16.6
North: Stadium Road											
7	L	11	30.0	0.628	81.0	LOS F	5.8	43.6	1.00	0.80	17.4
8	T	216	4.9	0.628	68.3	LOS E	10.6	77.4	1.00	0.81	18.3
9	R	8	12.5	0.628	71.7	LOS E	10.6	77.4	1.00	0.81	18.9
Approach		235	6.3	0.628	69.0	LOS E	10.6	77.4	1.00	0.81	18.3
West: GNR EB											
10	L	243	5.2	0.136	5.7	X	X	X	X	0.53	44.1
11	T	582	6.8	0.481	41.9	LOS D	16.3	121.1	0.85	0.73	24.1
12	R	1074	2.2	0.906	71.1	LOS E	42.1	299.9	1.00	0.98	18.5
Approach		1899	4.0	0.906	53.8	LOS D	42.1	299.9	0.83	0.85	21.6
All Vehicles		3885	5.1	1.000	60.5	LOS E	42.1	299.9	0.85	0.90	20.2

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
P3	Across E approach	53	66.6	LOS F	0.2	0.2	0.96	0.96
P5	Across N approach	53	40.2	LOS E	0.2	0.2	0.74	0.74
P7	Across W approach	53	58.3	LOS E	0.2	0.2	0.90	0.90
All Pedestrians		212	56.8	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes EB on/off ramp
AM future 2016
Waterview Connection Operational
SH16 off-ramp RT 1/2 of model prediction
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: EB on/off ramp											
1	L	355	5.8	1.000[3]	13.0	LOS B	6.7	49.4	0.58	0.71	38.1
2	T	39	0.0	0.888	72.1	LOS E	26.6	194.5	1.00	0.98	17.4
3	R	642	5.2	0.888	78.2	LOS E	26.6	194.5	1.00	0.98	17.4
Approach		1036	5.4	1.000	55.7	LOS E	26.6	194.5	0.86	0.89	21.4
East: GNR WB											
4	L	100	2.4	0.055	5.6	X	X	X	X	0.53	44.1
5	T	591	7.5	0.960	93.8	LOS F	26.1	194.8	1.00	1.19	15.0
6	R	16	40.0	0.371	62.5	LOS E	0.9	8.9	0.87	0.68	20.1
Approach		706	7.5	0.960	80.6	LOS F	26.1	194.8	0.86	1.09	16.6
North: Stadium Road											
7	L	11	30.0	0.651	80.5	LOS F	6.3	47.4	1.00	0.82	17.5
8	T	225	4.9	0.651	68.5	LOS E	11.0	80.7	1.00	0.82	18.3
9	R	12	12.5	0.651	72.1	LOS E	11.0	80.7	1.00	0.82	18.8
Approach		247	6.3	0.651	69.2	LOS E	11.0	80.7	1.00	0.82	18.2
West: GNR EB											
10	L	249	5.2	0.139	5.7	X	X	X	X	0.53	44.1
11	T	602	6.8	0.497	42.1	LOS D	17.0	126.1	0.86	0.74	24.0
12	R	1078	2.2	0.909	71.9	LOS E	42.5	303.4	1.00	0.99	18.3
Approach		1929	4.0	0.909	54.1	LOS D	42.5	303.4	0.83	0.85	21.6
All Vehicles		3919	5.2	1.000	60.2	LOS E	42.5	303.4	0.85	0.90	20.2

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
P3	Across E approach	53	66.6	LOS F	0.2	0.2	0.96	0.96
P5	Across N approach	53	40.2	LOS E	0.2	0.2	0.74	0.74
P7	Across W approach	53	58.3	LOS E	0.2	0.2	0.90	0.90
All Pedestrians		212	56.8	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes EB on/off ramp
AM future 2016
Waterview Connection Operational
SH16 off-ramp RT 1/2 of model prediction
All site traffic routed via SH16/SH20 through St Lukes Interchange
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 145 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: EB on/off ramp											
1	L	355	5.8	1.000[3]	13.0	LOS B	6.7	49.4	0.58	0.71	38.1
2	T	45	0.0	0.893	72.3	LOS E	27.8	203.3	1.00	0.99	17.3
3	R	662	5.2	0.893	78.4	LOS E	27.8	203.3	1.00	0.99	17.4
Approach		1062	5.3	1.000	56.3	LOS E	27.8	203.3	0.86	0.90	21.3
East: GNR WB											
4	L	100	2.4	0.055	5.6	X	X	X	X	0.53	44.1
5	T	591	7.5	0.960	93.8	LOS F	26.1	194.8	1.00	1.19	15.0
6	R	16	40.0	0.371	62.5	LOS E	0.9	8.9	0.87	0.68	20.1
Approach		706	7.5	0.960	80.6	LOS F	26.1	194.8	0.86	1.09	16.6
North: Stadium Road											
7	L	11	30.0	0.634	81.0	LOS F	6.0	44.6	1.00	0.81	17.4
8	T	216	4.9	0.634	68.4	LOS E	10.7	78.2	1.00	0.81	18.3
9	R	12	12.5	0.634	71.8	LOS E	10.7	78.2	1.00	0.81	18.9
Approach		238	6.4	0.634	69.1	LOS E	10.7	78.2	1.00	0.81	18.3
West: GNR EB											
10	L	243	5.2	0.136	5.7	X	X	X	X	0.53	44.1
11	T	582	6.8	0.491	42.8	LOS D	16.5	122.4	0.86	0.74	23.8
12	R	1076	2.2	0.927	77.5	LOS E	44.3	315.7	1.00	1.01	17.5
Approach		1901	4.0	0.927	57.7	LOS E	44.3	315.7	0.83	0.86	20.8
All Vehicles		3907	5.1	1.000	62.1	LOS E	44.3	315.7	0.85	0.91	19.9

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	61.9	LOS F	0.2	0.2	0.92	0.92
P3	Across E approach	53	66.6	LOS F	0.2	0.2	0.96	0.96
P5	Across N approach	53	41.0	LOS E	0.2	0.2	0.75	0.75
P7	Across W approach	53	57.4	LOS E	0.2	0.2	0.89	0.89
All Pedestrians		212	56.7	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: St Lukes / St lukes EB on/off ramp PM existing

St Lukes Road / St Lukes EB on/off ramp
PM existing 2016
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: EB on/off ramp											
1	L	307	1.7	1.000[3]	14.7	LOS B	7.0	49.4	0.56	0.71	37.0
2	T	165	16.7	0.932	84.3	LOS F	30.3	217.7	1.00	1.04	15.8
3	R	535	3.6	0.932	90.4	LOS F	30.3	217.7	1.00	1.03	15.8
Approach		1006	2.8	1.000	66.3	LOS E	30.3	217.7	0.87	0.93	19.2
East: GNR WB											
4	L	429	5.1	0.240	5.7	X	X	X	X	0.53	44.1
5	T	698	5.5	0.959	93.8	LOS F	31.8	233.0	1.00	1.17	15.0
6	R	21	0.0	0.363	59.0	LOS E	1.2	8.7	0.85	0.69	20.6
Approach		1148	5.3	0.959	60.2	LOS E	31.8	233.0	0.62	0.92	20.1
North: Stadium Road											
7	L	18	0.0	0.370	59.6	LOS E	1.1	7.5	0.85	0.69	20.5
8	T	16	0.0	0.210	64.0	LOS E	3.3	23.0	0.94	0.71	18.8
9	R	34	0.0	0.210	69.9	LOS E	3.3	23.0	0.94	0.75	18.9
Approach		67	0.0	0.370	65.8	LOS E	3.3	23.0	0.91	0.72	19.3
West: GNR EB											
10	L	22	0.0	0.012	5.6	X	X	X	X	0.53	44.1
11	T	378	4.1	0.317	41.8	LOS D	10.4	75.5	0.81	0.68	24.2
12	R	1061	4.5	0.941	84.3	LOS F	46.5	337.7	1.00	1.02	16.5
Approach		1461	4.3	0.941	72.1	LOS E	46.5	337.7	0.94	0.93	18.2
All Vehicles		3683	4.1	1.000	66.7	LOS E	46.5	337.7	0.82	0.92	19.0

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	59.9	LOS E	0.2	0.2	0.89	0.89
P3	Across E approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P5	Across N approach	53	42.6	LOS E	0.2	0.2	0.75	0.75
P7	Across W approach	53	60.8	LOS F	0.2	0.2	0.90	0.90
All Pedestrians		212	58.1	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: St Lukes / St lukes EB on/off ramp PM future

St Lukes Road / St Lukes EB on/off ramp
PM future 2016
Waterview Connection Operational
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: EB on/off ramp											
1	L	305	1.7	1.000[3]	14.7	LOS B	7.0	49.4	0.56	0.71	37.0
2	T	167	16.7	0.934	85.0	LOS F	30.6	219.4	1.00	1.04	15.7
3	R	535	3.6	0.934	91.1	LOS F	30.6	219.4	1.00	1.04	15.7
Approach		1006	2.8	1.000	67.0	LOS E	30.6	219.4	0.87	0.94	19.1
East: GNR WB											
4	L	429	5.1	0.240	5.7	X	X	X	X	0.53	44.1
5	T	698	5.5	0.959	93.8	LOS F	31.8	233.0	1.00	1.17	15.0
6	R	21	0.0	0.363	59.0	LOS E	1.2	8.7	0.85	0.69	20.6
Approach		1148	5.3	0.959	60.2	LOS E	31.8	233.0	0.62	0.92	20.1
North: Stadium Road											
7	L	18	0.0	0.317	88.2	LOS F	1.4	9.7	1.00	0.70	16.0
8	T	35	0.0	0.317	65.1	LOS E	5.0	35.3	0.95	0.74	18.7
9	R	40	0.0	0.317	71.0	LOS E	5.0	35.3	0.95	0.77	18.7
Approach		93	0.0	0.317	72.1	LOS E	5.0	35.3	0.96	0.75	18.1
West: GNR EB											
10	L	25	0.0	0.014	5.6	X	X	X	X	0.53	44.1
11	T	386	4.1	0.325	41.9	LOS D	10.7	77.4	0.81	0.68	24.1
12	R	1068	4.5	0.947	86.7	LOS F	47.5	345.5	1.00	1.03	16.2
Approach		1480	4.3	0.947	73.6	LOS E	47.5	345.5	0.93	0.93	17.9
All Vehicles		3727	4.1	1.000	67.7	LOS E	47.5	345.5	0.82	0.92	18.9

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	59.9	LOS E	0.2	0.2	0.89	0.89
P3	Across E approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P5	Across N approach	53	42.6	LOS E	0.2	0.2	0.75	0.75
P7	Across W approach	53	60.8	LOS F	0.2	0.2	0.90	0.90
All Pedestrians		212	58.1	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

St Lukes Road / St Lukes EB on/off ramp
PM future 2016
Waterview Connection Operational
All site traffic routed via SH16/SH20 through St Lukes Interchange
WS1 AS1 L1S1 L1S2 Operational
Signals - Fixed Time Cycle Time = 150 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: EB on/off ramp											
1	L	292	1.7	1.000[3]	15.2	LOS B	7.0	49.4	0.55	0.70	36.7
2	T	187	16.7	0.942	86.9	LOS F	32.3	232.1	1.00	1.06	15.5
3	R	543	3.6	0.942	93.1	LOS F	32.3	232.1	1.00	1.05	15.5
Approach		1022	2.8	1.000	69.7	LOS E	32.3	232.1	0.87	0.95	18.6
East: GNR WB											
4	L	429	5.1	0.240	5.7	X	X	X	X	0.53	44.1
5	T	698	5.5	0.959	93.8	LOS F	31.8	233.0	1.00	1.17	15.0
6	R	21	0.0	0.363	59.0	LOS E	1.2	8.7	0.85	0.69	20.6
Approach		1148	5.3	0.959	60.2	LOS E	31.8	233.0	0.62	0.92	20.1
North: Stadium Road											
7	L	18	0.0	0.370	59.6	LOS E	1.1	7.5	0.85	0.69	20.5
8	T	16	0.0	0.322	65.2	LOS E	5.1	35.9	0.95	0.74	18.6
9	R	60	0.0	0.322	71.1	LOS E	5.1	35.9	0.95	0.77	18.6
Approach		94	0.0	0.370	67.9	LOS E	5.1	35.9	0.93	0.75	18.9
West: GNR EB											
10	L	22	0.0	0.012	5.6	X	X	X	X	0.53	44.1
11	T	378	4.1	0.324	42.6	LOS D	10.5	76.3	0.82	0.68	23.9
12	R	1061	4.5	0.961	93.0	LOS F	48.9	355.6	1.00	1.05	15.5
Approach		1461	4.3	0.961	78.7	LOS E	48.9	355.6	0.94	0.95	17.2
All Vehicles		3725	4.1	1.000	70.2	LOS E	48.9	355.6	0.82	0.94	18.4

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	59.9	LOS E	0.2	0.2	0.89	0.89
P3	Across E approach	53	69.1	LOS F	0.2	0.2	0.96	0.96
P5	Across N approach	53	43.3	LOS E	0.2	0.2	0.76	0.76
P7	Across W approach	53	59.9	LOS E	0.2	0.2	0.89	0.89
All Pedestrians		212	58.0	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: GNR / Bullock / Tuarangi - AM Existing

Great North Road / Bullock Track / Tuarangi Road intersection
Existing (2016) Traffic Volumes based on modelled data at GNR/ SH16 EBD Ramps
Weekday AM Peak Extra bunching 10%WB 20%EB Gap Acc RT Bullock 5.5
Waterview Connection Operational
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Tuarangi Road											
21	L	338	1.2	0.338	8.6	LOS A	1.7	12.2	0.50	0.72	41.4
22	T	1	0.0	0.338	7.4	LOS A	1.7	12.2	0.50	0.72	41.9
23	R	144	1.5	0.685	38.6	LOS E	3.6	25.8	0.93	1.21	25.9
Approach		483	1.2	0.685	17.6	LOS C	3.6	25.8	0.63	0.87	35.1
North East: Great North Road East											
24	L	17	0.0	0.022	6.7	LOS A	0.1	0.8	0.15	0.67	43.0
25	T	221	8.0	0.110	0.0	LOS A	0.1	0.8	0.01	0.00	49.8
Approach		238	7.4	0.110	0.5	NA	0.1	0.8	0.02	0.05	49.3
North West: Bullock Track											
27	L	5	0.0	0.725	39.8	LOS E	3.8	26.8	0.93	1.31	26.2
28	T	14	0.0	0.725	40.3	LOS E	3.8	26.8	0.93	1.27	26.1
29	R	142	0.5	0.725	39.8	LOS E	3.8	26.8	0.93	1.27	26.2
Approach		161	0.4	0.725	39.9	LOS E	3.8	26.8	0.93	1.27	26.1
South West: Great North Road West											
30	L	237	5.3	0.132	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
31	T	921	8.3	0.498	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
32	R	74	3.6	0.063	7.3	LOS A	0.2	1.6	0.25	0.60	42.4
Approach		1232	7.5	0.498	1.7	NA	0.2	1.6	0.02	0.15	48.0
All Vehicles		2114	5.5	0.725	8.1	NA	3.8	26.8	0.23	0.39	41.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: GNR / Bullock / Tuarangi - AM Future

Great North Road / Bullock Track / Tuarangi Road intersection
Future (2016) Traffic Volumes based on modelled data at GNR/ SH16 EBD Ramps
Weekday AM Peak Extra bunching 10%WB 20%EB Gap Acc RT Bullock 5.5
Waterview Connection Operational
WS1 AS1 L11 L1S2 Operational
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Tuarangi Road											
21	L	338	1.2	0.339	8.6	LOS A	1.7	12.2	0.50	0.72	41.4
22	T	1	0.0	0.339	7.4	LOS A	1.7	12.2	0.50	0.72	41.9
23	R	144	1.5	0.685	38.6	LOS E	3.6	25.8	0.93	1.21	25.9
Approach		483	1.2	0.685	17.6	LOS C	3.6	25.8	0.63	0.87	35.1
North East: Great North Road East											
24	L	17	0.0	0.022	6.7	LOS A	0.1	0.8	0.15	0.67	43.0
25	T	221	8.0	0.110	0.0	LOS A	0.1	0.8	0.01	0.00	49.8
Approach		238	7.4	0.110	0.5	NA	0.1	0.8	0.02	0.05	49.3
North West: Bullock Track											
27	L	5	0.0	0.735	40.9	LOS E	3.9	27.4	0.93	1.32	25.8
28	T	14	0.0	0.735	41.3	LOS E	3.9	27.4	0.93	1.28	25.8
29	R	142	0.5	0.735	40.9	LOS E	3.9	27.4	0.93	1.28	25.8
Approach		161	0.4	0.735	40.9	LOS E	3.9	27.4	0.93	1.28	25.8
South West: Great North Road West											
30	L	257	5.3	0.144	6.5	LOS A	0.0	0.0	0.00	0.61	43.3
31	T	921	8.3	0.498	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
32	R	74	3.6	0.063	7.3	LOS A	0.2	1.6	0.25	0.60	42.4
Approach		1252	7.4	0.498	1.8	NA	0.2	1.6	0.01	0.16	48.0
All Vehicles		2134	5.5	0.735	8.2	NA	3.9	27.4	0.22	0.39	41.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: GNR / Bullock / Tuarangi - PM Existing

Great North Road / Bullock Track / Tuarangi Road intersection
Existing (2016) Traffic Volumes based on modelled data at GNR/SH16 EBD Ramps
Weekday PM Peak Extra buniching 10%WB 20% EB Gap Acc RT Bullock 5.5
Waterview Connection Operational
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Tuarangi Road											
21	L	171	2.9	0.322	13.7	LOS B	1.5	10.5	0.70	0.94	37.7
22	T	2	0.0	0.322	12.4	LOS B	1.5	10.5	0.70	0.89	38.1
23	R	16	0.0	0.095	27.3	LOS D	0.3	2.1	0.85	0.94	30.2
Approach		188	2.7	0.322	14.8	LOS B	1.5	10.5	0.72	0.94	36.9
North East: Great North Road East											
24	L	28	3.7	0.072	7.0	LOS A	0.4	3.0	0.23	0.74	43.0
25	T	772	6.1	0.361	0.1	LOS A	0.4	3.0	0.03	0.00	49.6
Approach		800	6.0	0.361	0.3	NA	0.4	3.0	0.04	0.03	49.3
North West: Bullock Track											
27	L	4	0.0	1.323	348.6	LOS F	39.7	282.5	1.00	5.18	5.3
28	T	19	5.6	1.323	349.3	LOS F	39.7	282.5	1.00	3.69	5.4
29	R	195	1.5	1.323	348.7	LOS F	39.7	282.5	1.00	3.71	5.3
Approach		218	1.9	1.323	348.7	LOS F	39.7	282.5	1.00	3.74	5.4
South West: Great North Road West											
30	L	386	0.6	0.209	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
31	T	416	7.8	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
32	R	132	1.9	0.202	11.0	LOS B	0.7	4.8	0.60	0.85	39.5
Approach		934	4.0	0.224	4.2	NA	0.7	4.8	0.08	0.37	45.4
All Vehicles		2140	4.4	1.323	38.8	NA	39.7	282.5	0.22	0.64	25.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: GNR / Bullock / Tuarangi - PM Future

Great North Road / Bullock Track / Tuarangi Road intersection
Future (2016) Traffic Volumes based on modelled data at GNR/SH16 EBD Ramps
Weekday PM Peak Extra buniching 10%WB 20% EB Gap Acc RT Bullock 5.5
Waterview Connection Operational
WS1 AS1 L1S1 L1S2 Operational
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South East: Tuarangi Road											
21	L	171	2.9	0.322	13.7	LOS B	1.5	10.5	0.70	0.94	37.7
22	T	2	0.0	0.322	12.4	LOS B	1.5	10.5	0.70	0.89	38.1
23	R	16	0.0	0.095	27.3	LOS D	0.3	2.1	0.85	0.94	30.2
Approach		188	2.7	0.322	14.8	LOS B	1.5	10.5	0.72	0.94	36.9
North East: Great North Road East											
24	L	28	3.7	0.072	7.0	LOS A	0.4	3.0	0.23	0.74	43.0
25	T	772	6.1	0.361	0.1	LOS A	0.4	3.0	0.03	0.00	49.6
Approach		800	6.0	0.361	0.3	NA	0.4	3.0	0.04	0.03	49.3
North West: Bullock Track											
27	L	4	0.0	1.331	355.6	LOS F	40.3	286.7	1.00	5.22	5.3
28	T	19	5.6	1.331	356.3	LOS F	40.3	286.7	1.00	3.72	5.3
29	R	195	1.5	1.331	355.7	LOS F	40.3	286.7	1.00	3.74	5.3
Approach		218	1.9	1.331	355.7	LOS F	40.3	286.7	1.00	3.77	5.3
South West: Great North Road West											
30	L	395	0.6	0.214	6.4	LOS A	0.0	0.0	0.00	0.61	43.3
31	T	416	7.8	0.224	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
32	R	132	1.9	0.202	11.0	LOS B	0.7	4.8	0.60	0.85	39.5
Approach		942	4.0	0.224	4.2	NA	0.7	4.8	0.08	0.37	45.4
All Vehicles		2148	4.4	1.331	39.3	NA	40.3	286.7	0.21	0.64	25.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

Appendix E

SIDRA results (WS2)

MOVEMENT SUMMARY

SH20 - Dominion Road Interchange
Existing AM Peak
Base Year 2016
Waterview Connection Completed
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	132	8.0	0.206	29.5	LOS C	1.4	10.8	0.89	0.75	26.6
S_R	R	524	7.6	0.818	34.0	LOS C	7.4	54.9	1.00	0.98	19.8
Approach		656	7.7	0.818	33.1	LOS C	7.4	54.9	0.98	0.93	21.1
South East: East Internal											
EI_T	T	233	6.6	0.212	3.4	LOS A	1.6	11.5	0.29	0.24	40.2
EI_R	R	157	25.0	0.704	28.9	LOS C	4.2	35.4	1.00	0.92	21.5
Approach		389	14.0	0.704	13.6	LOS B	4.2	35.4	0.57	0.51	28.7
East: Dominion Road East											
E_L	L	503	3.2	0.210	10.6	LOS B	1.0	7.3	0.32	0.71	53.6
E_T	T	220	7.8	0.489	27.9	LOS C	2.7	20.4	0.98	0.77	35.4
Approach		723	4.6	0.489	15.9	LOS B	2.7	20.4	0.52	0.73	47.3
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	380	22.2	0.663	14.2	LOS B	4.9	40.9	0.64	0.83	40.1
N_R	R	169	6.5	0.338	29.5	LOS C	2.0	14.8	0.94	0.76	21.9
Approach		549	17.4	0.663	18.9	LOS B	4.9	40.9	0.73	0.80	33.2
North West: West Internal											
WI_T	T	817	4.8	0.345	2.6	LOS A	2.4	17.8	0.26	0.22	42.2
WI_R	R	84	3.0	0.121	13.9	LOS B	1.4	9.7	0.68	0.63	31.6
Approach		901	4.6	0.345	3.7	LOS A	2.4	17.8	0.30	0.26	40.7
West: Dominion Road West											
W_L	L	267	3.1	0.220	11.3	LOS B	1.6	11.5	0.38	0.71	53.1
W_T	T	377	3.0	0.277	17.7	LOS B	3.2	23.0	0.78	0.70	43.1
Approach		644	3.0	0.277	15.0	LOS B	3.2	23.0	0.61	0.71	47.3
All Vehicles		3863	7.6	0.818	16.0	LOS B	7.4	54.9	0.60	0.64	37.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

SH20 - Dominion Road Interchange
Existing AM Peak
Base Year 2016 Future
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Waterview Connection Completed
Signals - Fixed Time Cycle Time = 50 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	138	8.0	0.194	28.5	LOS C	1.5	11.0	0.87	0.75	27.2
S_R	R	544	7.6	0.764	31.3	LOS C	7.2	53.8	1.00	0.93	21.0
Approach		682	7.7	0.764	30.7	LOS C	7.2	53.8	0.97	0.89	22.3
South East: East Internal											
EI_T	T	233	6.6	0.220	4.0	LOS A	1.7	12.8	0.32	0.27	38.6
EI_R	R	157	25.0	0.821	32.8	LOS C	4.5	38.5	1.00	1.04	19.7
Approach		389	14.0	0.821	15.6	LOS B	4.5	38.5	0.59	0.58	26.9
East: Dominion Road East											
E_L	L	515	3.2	0.216	10.6	LOS B	1.1	7.6	0.32	0.71	53.6
E_T	T	220	7.8	0.489	27.9	LOS C	2.7	20.4	0.98	0.77	35.4
Approach		735	4.6	0.489	15.8	LOS B	2.7	20.4	0.52	0.73	47.4
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	380	22.2	0.689	15.2	LOS B	5.2	43.7	0.64	0.84	38.9
N_R	R	169	6.5	0.394	30.8	LOS C	2.1	15.3	0.96	0.76	21.2
Approach		549	17.4	0.689	20.0	LOS B	5.2	43.7	0.74	0.82	32.1
North West: West Internal											
WI_T	T	817	4.8	0.334	2.1	LOS A	2.1	15.0	0.22	0.19	44.1
WI_R	R	85	3.0	0.116	13.2	LOS B	1.3	9.5	0.66	0.62	32.4
Approach		902	4.6	0.334	3.1	LOS A	2.1	15.0	0.26	0.23	42.3
West: Dominion Road West											
W_L	L	267	3.1	0.215	11.0	LOS B	1.4	10.3	0.36	0.71	53.4
W_T	T	378	3.0	0.278	17.7	LOS B	3.2	23.1	0.78	0.70	43.1
Approach		645	3.0	0.278	14.9	LOS B	3.2	23.1	0.60	0.71	47.4
All Vehicles		3903	7.6	0.821	15.9	LOS B	7.2	53.8	0.59	0.64	37.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

SH20 - Dominion Road Interchange
Existing PM Peak
Base Year 2016
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	343	1.5	0.504	34.4	LOS C	4.8	33.7	0.95	0.80	24.0
S_R	R	568	1.3	0.834	38.9	LOS D	9.5	67.2	1.00	0.98	17.9
Approach		912	1.4	0.834	37.2	LOS D	9.5	67.2	0.98	0.91	20.2
South East: East Internal											
EI_T	T	461	2.0	0.384	3.3	LOS A	3.5	25.0	0.28	0.24	40.4
EI_R	R	284	8.0	0.873	38.2	LOS D	10.1	75.4	1.00	1.13	17.7
Approach		745	4.3	0.873	16.6	LOS B	10.1	75.4	0.55	0.58	25.9
East: Dominion Road East											
E_L	L	541	3.0	0.219	10.6	LOS B	1.3	9.1	0.29	0.71	53.8
E_T	T	512	2.3	0.791	34.2	LOS C	8.2	58.5	1.00	0.94	31.8
Approach		1053	2.7	0.791	22.1	LOS C	8.2	58.5	0.64	0.82	41.5
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	186	0.0	0.227	10.5	LOS B	1.0	6.9	0.30	0.71	43.5
N_R	R	234	0.0	0.340	30.9	LOS C	3.1	21.8	0.91	0.77	21.1
Approach		420	0.0	0.340	21.9	LOS C	3.1	21.8	0.64	0.74	28.7
North West: West Internal											
WI_T	T	673	1.6	0.280	3.1	LOS A	2.3	16.1	0.25	0.21	41.4
WI_R	R	97	6.1	0.154	17.6	LOS B	2.0	14.6	0.72	0.65	28.3
Approach		769	2.2	0.280	4.9	LOS A	2.3	16.1	0.31	0.27	38.7
West: Dominion Road West											
W_L	L	248	0.0	0.219	11.9	LOS B	2.1	14.4	0.39	0.71	52.4
W_T	T	198	4.7	0.141	19.0	LOS B	1.9	13.6	0.73	0.66	41.9
Approach		446	2.1	0.219	15.0	LOS B	2.1	14.4	0.54	0.69	47.7
All Vehicles		4345	2.3	0.873	20.5	LOS C	10.1	75.4	0.63	0.68	33.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

SH20 - Dominion Road Interchange
Future PM Peak
Base Year 2016
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Signals - Fixed Time Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On										
S_L	L	346	1.5	0.435	36.0	LOS D	5.3	37.6	0.91	0.80	23.3
S_R	R	577	1.3	0.724	37.1	LOS D	9.9	70.1	0.99	0.89	18.5
Approach		923	1.4	0.724	36.7	LOS D	9.9	70.1	0.96	0.85	20.4
South East: East Internal										
EI_T	T	461	2.0	0.386	4.0	LOS A	4.2	29.6	0.28	0.25	39.1
EI_R	R	284	8.0	0.747	34.0	LOS C	10.0	74.7	0.99	0.93	19.1
Approach		745	4.3	0.747	15.4	LOS B	10.0	74.7	0.55	0.51	26.9
East: Dominion Road East										
E_L	L	565	3.0	0.226	10.4	LOS B	1.3	9.5	0.25	0.70	54.0
E_T	T	512	2.3	0.769	37.6	LOS D	9.2	66.0	1.00	0.91	30.2
Approach		1077	2.7	0.769	23.3	LOS C	9.2	66.0	0.61	0.80	40.6
North: SH20 (SB) WB Off (NB) EB On										
N_L	L	186	0.0	0.217	10.4	LOS B	1.0	6.9	0.26	0.70	43.8
N_R	R	234	0.0	0.291	32.4	LOS C	3.4	24.1	0.88	0.77	20.4
Approach		420	0.0	0.291	22.6	LOS C	3.4	24.1	0.60	0.74	28.1
North West: West Internal										
WI_T	T	673	1.6	0.281	3.6	LOS A	2.7	19.1	0.25	0.22	40.1
WI_R	R	99	6.1	0.154	19.5	LOS B	2.3	17.1	0.71	0.65	26.8
Approach		772	2.2	0.281	5.7	LOS A	2.7	19.1	0.31	0.27	37.2
West: Dominion Road West										
W_L	L	248	0.0	0.230	12.2	LOS B	2.4	16.9	0.38	0.72	52.1
W_T	T	200	4.7	0.151	22.5	LOS C	2.3	16.4	0.75	0.67	39.1
Approach		448	2.1	0.230	16.8	LOS B	2.4	16.9	0.54	0.70	46.1
All Vehicles		4385	2.3	0.769	20.9	LOS C	10.0	74.7	0.61	0.65	33.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: SH20 - Maioro Road Interchange Existing AM

SH20 - Maioro Road Interchange
Existing AM Peak
Base Year 2016
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	660	4.0	0.638	30.7	LOS C	8.8	63.9	0.93	0.84	25.8
S_R	R	149	4.0	0.410	36.5	LOS D	2.2	16.1	0.98	0.76	18.8
Approach		809	4.0	0.638	31.8	LOS C	8.8	63.9	0.94	0.83	24.5
South East: East Internal											
EI_T	T	578	4.0	0.291	6.6	LOS A	3.3	24.0	0.41	0.35	33.2
EI_R	R	68	4.0	0.250	28.4	LOS C	1.9	13.5	0.92	0.72	21.5
Approach		646	4.0	0.291	8.9	LOS A	3.3	24.0	0.47	0.39	31.0
East: Maioro Road East											
E_L	L	580	4.0	0.675	14.4	LOS B	8.6	62.2	0.68	0.82	49.9
E_T	T	269	4.0	0.638	34.5	LOS C	3.8	27.6	0.99	0.81	31.7
Approach		849	4.0	0.675	20.8	LOS C	8.6	62.2	0.78	0.81	43.2
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	264	4.0	0.271	10.5	LOS B	1.2	8.8	0.29	0.71	43.6
N_R	R	376	4.0	0.687	35.8	LOS D	5.7	41.5	1.00	0.86	19.1
Approach		640	4.0	0.687	25.4	LOS C	5.7	41.5	0.70	0.80	26.2
North West: West Internal											
WI_T	T	346	4.0	0.277	2.1	LOS A	1.8	12.9	0.19	0.16	44.6
WI_R	R	909	4.0	0.554	16.0	LOS B	9.9	71.8	0.78	0.75	29.6
Approach		1256	4.0	0.554	12.2	LOS B	9.9	71.8	0.62	0.58	32.1
West: Maioro Road West											
W_L	L	1037	4.0	0.808	15.1	LOS B	11.6	83.7	0.54	0.83	49.4
W_T	T	1106	4.0	0.582	16.9	LOS B	11.1	80.6	0.78	0.75	43.8
Approach		2143	4.0	0.808	16.1	LOS B	11.6	83.7	0.66	0.79	46.7
All Vehicles		6344	4.0	0.808	18.1	LOS B	11.6	83.7	0.69	0.72	37.9

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

SH20 - Maioro Road Interchange
Future AM Peak
Base Year 2016
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	678	4.0	0.656	31.1	LOS C	9.2	66.5	0.93	0.85	25.7
S_R	R	161	4.0	0.441	36.6	LOS D	2.4	17.4	0.98	0.76	18.7
Approach		839	4.0	0.656	32.1	LOS C	9.2	66.5	0.94	0.83	24.3
South East: East Internal											
EI_T	T	578	4.0	0.291	6.6	LOS A	3.3	24.0	0.41	0.35	33.2
EI_R	R	68	4.0	0.250	28.4	LOS C	1.9	13.5	0.92	0.72	21.5
Approach		646	4.0	0.291	8.9	LOS A	3.3	24.0	0.47	0.39	31.0
East: Maioro Road East											
E_L	L	593	4.0	0.693	15.3	LOS B	9.5	68.5	0.72	0.83	49.1
E_T	T	269	4.0	0.638	34.5	LOS C	3.8	27.6	0.99	0.81	31.7
Approach		862	4.0	0.693	21.3	LOS C	9.5	68.5	0.80	0.82	42.8
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	264	4.0	0.274	10.5	LOS B	1.2	8.8	0.29	0.71	43.6
N_R	R	376	4.0	0.687	35.8	LOS D	5.7	41.5	1.00	0.86	19.1
Approach		640	4.0	0.687	25.4	LOS C	5.7	41.5	0.70	0.80	26.2
North West: West Internal											
WI_T	T	358	4.0	0.287	2.1	LOS A	1.9	13.5	0.19	0.16	44.5
WI_R	R	921	4.0	0.561	16.1	LOS B	10.1	73.0	0.79	0.75	29.6
Approach		1279	4.0	0.561	12.2	LOS B	10.1	73.0	0.62	0.58	32.1
West: Maioro Road West											
W_L	L	1037	4.0	0.808	15.1	LOS B	11.6	83.7	0.54	0.83	49.4
W_T	T	1118	4.0	0.588	17.0	LOS B	11.3	81.7	0.78	0.76	43.8
Approach		2155	4.0	0.808	16.1	LOS B	11.6	83.7	0.67	0.79	46.6
All Vehicles		6421	4.0	0.808	18.3	LOS B	11.6	83.7	0.70	0.72	37.7

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: SH20 - Maioro Road Interchange Existing PM

SH20 - Maioro Road Interchange
Existing PM Peak
Base Year 2016
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 140 seconds (Practical Cycle Time)

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	1543	4.0	0.897	56.2	LOS E	54.3	393.2	0.99	0.96	16.9
S_R	R	611	4.0	0.651	57.0	LOS E	18.6	134.9	0.95	0.84	13.3
Approach		2154	4.0	0.897	56.4	LOS E	54.3	393.2	0.98	0.93	16.0
South East: East Internal											
EI_T	T	998	4.0	0.587	26.3	LOS C	21.1	152.4	0.67	0.60	17.3
EI_R	R	79	4.0	0.195	50.5	LOS D	4.4	31.7	0.85	0.72	14.4
Approach		1077	4.0	0.587	28.1	LOS C	21.1	152.4	0.69	0.61	17.0
East: Maioro Road East											
E_L	L	367	4.0	0.375	14.0	LOS B	7.1	51.6	0.37	0.74	50.4
E_T	T	387	4.0	0.856	77.8	LOS E	13.1	94.6	0.99	0.92	18.9
Approach		755	4.0	0.856	46.7	LOS D	13.1	94.6	0.69	0.83	28.6
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	229	4.0	0.309	11.9	LOS B	3.5	25.4	0.29	0.72	42.2
N_R	R	713	4.0	0.882	75.1	LOS E	26.7	193.0	1.00	0.97	10.6
Approach		942	4.0	0.882	59.7	LOS E	26.7	193.0	0.83	0.91	13.7
North West: West Internal											
WI_T	T	847	4.0	0.480	6.4	LOS A	17.1	124.1	0.25	0.23	35.2
WI_R	R	760	4.0	0.480	22.2	LOS C	19.7	142.5	0.63	0.67	24.9
Approach		1607	4.0	0.480	13.9	LOS B	19.7	142.5	0.43	0.43	28.9
West: Maioro Road West											
W_L	L	717	4.0	0.593	10.6	LOS B	6.8	49.0	0.25	0.71	54.0
W_T	T	997	4.0	0.621	39.0	LOS D	25.4	184.0	0.84	0.79	29.6
Approach		1714	4.0	0.621	27.1	LOS C	25.4	184.0	0.59	0.76	37.7
All Vehicles		8248	4.0	0.897	37.8	LOS D	54.3	393.2	0.71	0.74	23.1

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

SH20 - Maioro Road Interchange
Future PM Peak
Base Year 2016
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Signals - Fixed Time Cycle Time = 140 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: SH20 (NB) EB Off (SB) WB On											
S_L	L	1553	4.0	0.903	57.5	LOS E	55.5	401.7	1.00	0.97	16.6
S_R	R	627	4.0	0.669	57.2	LOS E	19.3	139.5	0.96	0.84	13.3
Approach		2180	4.0	0.903	57.4	LOS E	55.5	401.7	0.99	0.93	15.7
South East: East Internal											
EI_T	T	998	4.0	0.587	26.3	LOS C	21.1	152.4	0.67	0.60	17.3
EI_R	R	79	4.0	0.195	50.5	LOS D	4.4	31.7	0.85	0.72	14.4
Approach		1077	4.0	0.587	28.1	LOS C	21.1	152.4	0.69	0.61	17.0
East: Maioro Road East											
E_L	L	389	4.0	0.401	14.4	LOS B	8.0	58.3	0.39	0.75	50.0
E_T	T	387	4.0	0.856	77.8	LOS E	13.1	94.6	0.99	0.92	18.9
Approach		777	4.0	0.856	46.0	LOS D	13.1	94.6	0.69	0.83	28.9
North: SH20 (SB) WB Off (NB) EB On											
N_L	L	229	4.0	0.311	11.9	LOS B	3.5	25.7	0.29	0.72	42.1
N_R	R	713	4.0	0.882	75.1	LOS E	26.7	193.0	1.00	0.97	10.6
Approach		942	4.0	0.882	59.7	LOS E	26.7	193.0	0.83	0.91	13.7
North West: West Internal											
WI_T	T	854	4.0	0.488	6.4	LOS A	17.6	127.7	0.25	0.23	35.3
WI_R	R	780	4.0	0.488	22.4	LOS C	20.1	145.8	0.63	0.67	24.8
Approach		1634	4.0	0.488	14.0	LOS B	20.1	145.8	0.43	0.44	28.8
West: Maioro Road West											
W_L	L	717	4.0	0.593	10.6	LOS B	6.8	49.0	0.25	0.71	54.0
W_T	T	1017	4.0	0.634	39.2	LOS D	26.1	189.0	0.84	0.79	29.5
Approach		1734	4.0	0.634	27.4	LOS C	26.1	189.0	0.60	0.76	37.5
All Vehicles		8343	4.0	0.903	38.1	LOS D	55.5	401.7	0.71	0.75	23.0

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: Denbigh / Dominion - AM existing

Denbigh / Dominion
AM estimated 2016 volumes
Waterview Connection Operational
Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Dominion Rd NB											
1	L	213	8.8	0.290	9.1	LOS A	1.7	13.0	0.60	0.72	41.1
2	T	555	4.5	0.613	7.1	LOS A	5.9	42.6	0.73	0.69	41.3
3	R	178	1.2	0.613	11.4	LOS B	5.9	42.6	0.73	0.79	40.1
Approach		945	4.9	0.613	8.4	LOS A	5.9	42.6	0.70	0.72	41.0
East: Denbigh Rd WB											
4	L	166	3.9	0.239	10.4	LOS B	1.5	11.0	0.75	0.81	40.0
5	T	235	2.3	0.314	8.2	LOS A	2.2	16.1	0.78	0.77	41.2
6	R	38	5.7	0.314	12.5	LOS B	2.2	16.1	0.78	0.86	39.5
Approach		439	3.2	0.314	9.4	LOS A	2.2	16.1	0.77	0.79	40.6
North: Dominion Rd SB											
7	L	19	11.8	0.036	11.0	LOS B	0.2	1.4	0.67	0.72	39.7
8	T	462	4.0	0.529	9.2	LOS A	4.7	34.4	0.84	0.86	40.9
9	R	33	6.7	0.529	13.5	LOS B	4.7	34.4	0.84	0.93	38.9
Approach		514	4.5	0.529	9.5	LOS A	4.7	34.4	0.84	0.86	40.7
West: Denbigh Rd EB											
10	L	107	17.3	0.276	14.8	LOS B	1.6	12.8	0.83	0.93	37.1
11	T	271	1.2	0.534	11.8	LOS B	5.1	36.4	0.95	0.99	38.6
12	R	126	4.3	0.534	16.2	LOS B	5.1	36.4	0.95	1.01	37.0
Approach		504	5.4	0.534	13.5	LOS B	5.1	36.4	0.92	0.98	37.8
All Vehicles		2402	4.6	0.613	9.9	LOS A	5.9	42.6	0.79	0.82	40.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Denbigh / Dominion
AM future 2016 volumes
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Dominion Rd NB											
1	L	226	8.8	0.301	9.0	LOS A	1.8	13.7	0.60	0.72	41.2
2	T	555	4.5	0.613	7.1	LOS A	5.9	42.7	0.73	0.69	41.3
3	R	178	1.2	0.613	11.4	LOS B	5.9	42.7	0.73	0.79	40.1
Approach		959	4.9	0.613	8.4	LOS A	5.9	42.7	0.70	0.72	41.1
East: Denbigh Rd WB											
4	L	166	3.9	0.242	10.5	LOS B	1.5	11.1	0.76	0.82	40.0
5	T	235	2.3	0.318	8.3	LOS A	2.3	16.4	0.78	0.77	41.2
6	R	38	5.7	0.318	12.6	LOS B	2.3	16.4	0.78	0.86	39.4
Approach		439	3.2	0.318	9.5	LOS A	2.3	16.4	0.77	0.80	40.6
North: Dominion Rd SB											
7	L	19	11.8	0.037	11.1	LOS B	0.2	1.5	0.67	0.72	39.6
8	T	465	4.0	0.537	9.3	LOS A	4.9	35.6	0.85	0.87	40.8
9	R	33	6.7	0.537	13.7	LOS B	4.9	35.6	0.85	0.94	38.8
Approach		517	4.5	0.537	9.7	LOS A	4.9	35.6	0.85	0.87	40.6
West: Denbigh Rd EB											
10	L	107	17.3	0.278	14.9	LOS B	1.6	12.8	0.83	0.93	37.0
11	T	271	1.2	0.544	12.0	LOS B	5.3	37.6	0.95	1.00	38.4
12	R	134	4.3	0.544	16.4	LOS B	5.3	37.6	0.95	1.02	36.8
Approach		512	5.4	0.544	13.7	LOS B	5.3	37.6	0.93	0.99	37.7
All Vehicles		2426	4.6	0.613	10.0	LOS A	5.9	42.7	0.79	0.82	40.1

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Denbigh / Dominion
PM estimated 2016 volumes
Waterview Connection Operational
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Dominion Rd NB											
1	L	631	1.0	0.658	12.1	LOS B	7.5	53.2	0.91	0.95	38.7
2	T	560	2.0	0.709	12.8	LOS B	8.7	61.6	0.95	1.05	38.1
3	R	33	3.3	0.709	17.2	LOS B	8.7	61.6	0.95	1.07	36.6
Approach		1223	1.5	0.709	12.6	LOS B	8.7	61.6	0.93	1.00	38.4
East: Denbigh Rd WB											
4	L	393	0.0	0.657	19.5	LOS B	7.1	49.4	0.99	1.19	34.0
5	T	387	3.4	0.573	14.0	LOS B	5.8	41.8	0.97	1.07	37.4
6	R	16	23.1	0.573	18.7	LOS B	5.8	41.8	0.97	1.11	35.9
Approach		796	2.1	0.657	16.8	LOS B	7.1	49.4	0.98	1.13	35.6
North: Dominion Rd SB											
7	L	7	0.0	0.010	8.1	LOS A	0.0	0.3	0.50	0.58	41.8
8	T	561	3.1	0.567	6.7	LOS A	4.9	35.9	0.71	0.66	41.5
9	R	108	12.1	0.567	11.2	LOS B	4.9	35.9	0.71	0.80	40.5
Approach		677	4.5	0.567	7.5	LOS A	4.9	35.9	0.70	0.69	41.4
West: Denbigh Rd EB											
10	L	135	3.3	0.209	10.2	LOS B	1.3	9.7	0.77	0.81	40.1
11	T	126	2.6	0.327	8.0	LOS A	2.5	17.6	0.81	0.77	40.6
12	R	152	0.7	0.327	12.3	LOS B	2.5	17.6	0.81	0.84	39.3
Approach		413	2.1	0.327	10.3	LOS B	2.5	17.6	0.80	0.81	39.9
All Vehicles		3108	2.4	0.709	12.2	LOS B	8.7	61.6	0.87	0.94	38.4

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Denbigh / Dominion
PM estimated 2016 volumes
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Dominion Rd NB											
1	L	637	1.0	0.666	12.2	LOS B	7.8	54.8	0.92	0.96	38.6
2	T	560	2.0	0.711	12.9	LOS B	8.7	62.2	0.95	1.05	38.1
3	R	33	3.3	0.711	17.3	LOS B	8.7	62.2	0.95	1.08	36.5
Approach		1229	1.5	0.711	12.7	LOS B	8.7	62.2	0.93	1.01	38.3
East: Denbigh Rd WB											
4	L	393	0.0	0.681	21.2	LOS C	7.6	53.3	1.00	1.22	33.0
5	T	387	3.4	0.592	15.0	LOS B	6.2	44.7	0.99	1.10	36.7
6	R	16	23.1	0.592	19.7	LOS B	6.2	44.7	0.99	1.13	35.3
Approach		796	2.1	0.681	18.1	LOS B	7.6	53.3	0.99	1.16	34.8
North: Dominion Rd SB											
7	L	7	0.0	0.010	8.2	LOS A	0.1	0.4	0.52	0.59	41.7
8	T	567	3.1	0.582	7.1	LOS A	5.3	38.8	0.73	0.69	41.4
9	R	108	12.1	0.582	11.6	LOS B	5.3	38.8	0.73	0.82	40.2
Approach		683	4.5	0.582	7.8	LOS A	5.3	38.8	0.73	0.71	41.2
West: Denbigh Rd EB											
10	L	135	3.3	0.213	10.3	LOS B	1.4	9.8	0.77	0.81	40.1
11	T	126	2.6	0.349	8.0	LOS A	2.7	19.0	0.82	0.78	40.6
12	R	169	0.7	0.349	12.3	LOS B	2.7	19.0	0.82	0.84	39.2
Approach		431	2.0	0.349	10.4	LOS B	2.7	19.0	0.80	0.82	39.9
All Vehicles		3139	2.4	0.711	12.7	LOS B	8.7	62.2	0.89	0.95	38.1

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: May / Denbigh AM Existing

May Road / Denbigh Avenue / Stoddard Road Signalised intersection
Estimated 2016 Volumes
Morning peak period
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 95 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: May Rd NB											
1	L	94	7.6	0.104	20.1	LOS C	2.3	17.0	0.56	0.72	33.7
2	T	661	1.4	0.929	50.8	LOS D	38.4	272.6	1.00	1.14	21.6
3	R	311	5.1	1.000[3]	37.0	LOS D	11.2	81.6	0.99	0.84	26.5
Approach		1066	3.2	1.000	44.1	LOS D	38.4	272.6	0.96	1.02	23.7
East: Denbigh Rd WB											
4	L	191	7.5	0.190	12.7	LOS B	2.7	19.8	0.53	0.72	38.4
5	T	202	5.8	0.934	62.5	LOS E	14.7	108.6	1.00	1.18	19.2
6	R	49	7.1	0.934	68.9	LOS E	14.7	108.6	1.00	1.18	19.3
Approach		442	6.7	0.934	41.8	LOS D	14.7	108.6	0.80	0.98	24.5
North: May Rd SB											
7	L	19	6.3	0.147	42.6	LOS D	1.9	14.1	0.88	0.76	25.2
8	T	252	8.0	0.735	43.3	LOS D	10.5	78.7	0.99	0.87	23.6
9	R	101	10.6	0.437	46.2	LOS D	4.3	32.9	0.94	0.77	23.7
Approach		372	8.6	0.735	44.0	LOS D	10.5	78.7	0.97	0.84	23.7
West: Stoodard Rd EB											
10	L	39	15.2	0.684	53.4	LOS D	11.2	81.1	0.98	0.91	22.6
11	T	219	1.6	0.684	46.7	LOS D	11.2	81.1	0.98	0.90	22.6
12	R	132	2.7	0.827	59.7	LOS E	6.8	48.6	1.00	0.96	20.6
Approach		389	3.3	0.827	51.7	LOS D	11.2	81.1	0.99	0.92	21.9
All Vehicles		2269	4.8	1.000	44.9	LOS D	38.4	272.6	0.93	0.97	23.5

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	11	41.7	LOS E	0.0	0.0	0.94	0.94
P3	Across E approach	11	41.7	LOS E	0.0	0.0	0.94	0.94
P5	Across N approach	11	41.7	LOS E	0.0	0.0	0.94	0.94
P7	Across W approach	53	25.8	LOS C	0.1	0.1	0.74	0.74
All Pedestrians		86	31.9	LOS D			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: May / Denbigh AM Future

May Road / Denbigh Avenue / Stoddard Road Signalised intersection
Future2016 Volumes
Morning peak period
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Signals - Fixed Time Cycle Time = 105 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: May Rd NB											
1	L	94	7.6	0.095	18.8	LOS B	2.3	16.9	0.51	0.71	34.5
2	T	671	1.4	0.824	33.2	LOS C	32.6	231.7	0.96	0.91	26.6
3	R	309	5.1	1.000[3]	37.5	LOS D	11.2	81.6	1.00	0.84	26.3
Approach		1074	3.2	1.000	33.2	LOS C	32.6	231.7	0.93	0.87	27.0
East: Denbigh Rd WB											
4	L	204	7.5	0.209	12.3	LOS B	2.9	21.5	0.50	0.72	38.6
5	T	202	5.8	0.982	83.3	LOS F	17.9	131.7	1.00	1.28	16.1
6	R	49	7.1	0.982	89.6	LOS F	17.9	131.7	1.00	1.28	16.2
Approach		456	6.7	0.982	52.2	LOS D	17.9	131.7	0.78	1.03	21.8
North: May Rd SB											
7	L	19	6.3	0.163	48.0	LOS D	2.1	15.9	0.90	0.76	23.6
8	T	252	8.0	0.813	51.6	LOS D	12.2	91.2	0.99	0.93	21.5
9	R	101	10.6	0.485	52.0	LOS D	4.8	37.0	0.95	0.78	22.2
Approach		372	8.6	0.813	51.5	LOS D	12.2	91.2	0.97	0.88	21.8
West: Stoodard Rd EB											
10	L	39	15.2	0.756	63.5	LOS E	13.1	94.2	1.00	0.97	20.4
11	T	219	1.6	0.756	56.7	LOS E	13.1	94.2	1.00	0.97	20.3
12	R	132	2.7	0.813	63.9	LOS E	7.4	52.8	1.00	0.94	19.7
Approach		389	3.3	0.813	59.8	LOS E	13.1	94.2	1.00	0.96	20.1
All Vehicles		2291	4.8	1.000	44.5	LOS D	32.6	231.7	0.92	0.92	23.6

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	11	46.7	LOS E	0.0	0.0	0.94	0.94
P3	Across E approach	11	46.7	LOS E	0.0	0.0	0.94	0.94
P5	Across N approach	11	46.7	LOS E	0.0	0.0	0.94	0.94
P7	Across W approach	53	24.0	LOS C	0.1	0.1	0.68	0.68
All Pedestrians		86	32.7	LOS D			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

May Road / Denbigh Avenue / Stoddard Road Signalised intersection
Estimated 2016 Volumes
PM peak period
Waterview Connection Operational
Signals - Fixed Time Cycle Time = 125 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: May Rd NB											
1	L	140	2.3	0.205	33.9	LOS C	4.9	34.8	0.61	0.74	27.5
2	T	376	0.8	1.032	113.9	LOS F	34.3	242.5	1.00	1.33	13.0
3	R	208	2.6	1.000[3]	59.3	LOS E	11.4	81.6	0.97	0.81	20.6
Approach		724	1.8	1.032	82.8	LOS F	34.3	242.5	0.92	1.07	16.4
East: Denbigh Rd WB											
4	L	482	4.1	0.537	19.2	LOS B	12.1	87.5	0.75	0.81	34.2
5	T	523	1.9	1.029	113.8	LOS F	57.8	411.3	1.00	1.38	13.0
6	R	79	2.8	1.029	120.0	LOS F	57.8	411.3	1.00	1.38	13.1
Approach		1084	2.9	1.029	72.2	LOS E	57.8	411.3	0.89	1.13	18.0
North: May Rd SB											
7	L	9	0.0	0.202	48.0	LOS D	4.1	28.8	0.77	0.81	23.8
8	T	539	0.2	1.010	89.9	LOS F	39.4	276.6	0.97	1.19	15.4
9	R	173	0.6	0.752	54.1	LOS D	8.9	62.3	0.84	0.83	21.7
Approach		721	0.3	1.010	80.8	LOS F	39.4	276.6	0.93	1.10	16.6
West: Stoodard Rd EB											
10	L	37	0.0	0.717	63.9	LOS E	11.9	85.1	0.99	0.89	20.2
11	T	172	2.5	0.717	57.5	LOS E	11.9	85.1	0.99	0.88	20.2
12	R	268	0.8	1.031	121.9	LOS F	24.2	170.9	1.00	1.20	12.7
Approach		477	1.4	1.031	94.3	LOS F	24.2	170.9	0.99	1.06	15.2
All Vehicles		3006	1.8	1.032	80.3	LOS F	57.8	411.3	0.92	1.10	16.8

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	11	40.0	LOS D	0.0	0.0	0.80	0.80
P3	Across E approach	11	44.9	LOS E	0.0	0.0	0.85	0.85
P5	Across N approach	11	56.6	LOS E	0.0	0.0	0.95	0.95
P7	Across W approach	53	49.3	LOS E	0.2	0.2	0.89	0.89
All Pedestrians		86	48.5	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: May / Denbigh PM Future

May Road / Denbigh Avenue / Stoddard Road Signalised intersection
Future 2016 Volumes
PM peak period
Waterview Connection Operational
WS2 AS3 AS4 L3S1 L3S2 L3S5 Operational
Signals - Fixed Time Cycle Time = 125 seconds (Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: May Rd NB											
1	L	140	2.3	0.201	33.0	LOS C	4.8	34.0	0.60	0.74	27.9
2	T	391	0.8	1.030	112.6	LOS F	35.6	251.7	1.00	1.32	13.1
3	R	211	2.6	1.000[3]	59.0	LOS E	11.4	81.6	0.97	0.81	20.7
Approach		742	1.8	1.030	82.4	LOS F	35.6	251.7	0.92	1.07	16.5
East: Denbigh Rd WB											
4	L	488	4.1	0.535	18.8	LOS B	12.0	86.7	0.74	0.81	34.4
5	T	523	1.9	1.029	113.8	LOS F	57.8	411.3	1.00	1.38	13.0
6	R	79	2.8	1.029	120.0	LOS F	57.8	411.3	1.00	1.38	13.1
Approach		1091	2.9	1.029	71.7	LOS E	57.8	411.3	0.88	1.12	18.1
North: May Rd SB											
7	L	9	0.0	0.210	48.9	LOS D	4.2	29.3	0.79	0.81	23.5
8	T	539	0.2	1.048	111.2	LOS F	43.8	307.4	0.97	1.30	13.3
9	R	173	0.6	0.763	55.5	LOS E	9.0	63.6	0.85	0.84	21.4
Approach		721	0.3	1.048	97.1	LOS F	43.8	307.4	0.94	1.19	14.7
West: Stoodard Rd EB											
10	L	37	0.0	0.717	64.1	LOS E	11.9	85.1	0.99	0.89	20.1
11	T	172	2.5	0.717	57.7	LOS E	11.9	85.1	0.99	0.88	20.1
12	R	268	0.8	1.031	121.9	LOS F	24.2	170.9	1.00	1.20	12.7
Approach		477	1.4	1.031	94.4	LOS F	24.2	170.9	0.99	1.06	15.2
All Vehicles		3031	1.8	1.048	83.9	LOS F	57.8	411.3	0.92	1.11	16.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

3 x = 1.00 due to short lane. Refer to the Lane Summary report for information about excess flow and related conditions.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	11	40.0	LOS D	0.0	0.0	0.80	0.80
P3	Across E approach	11	45.8	LOS E	0.0	0.0	0.86	0.86
P5	Across N approach	11	56.6	LOS E	0.0	0.0	0.95	0.95
P7	Across W approach	53	48.4	LOS E	0.2	0.2	0.88	0.88
All Pedestrians		86	48.0	LOS E			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.