Watercare Services Limited

Central Interceptor Project

Traffic Impact Assessment

July 2012

Traffic Design Group

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Watercare Services Limited

Central Interceptor Project

Traffic Impact Assessment Report Quality Assurance Statement

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1. Introduction

Traffic Design Group Ltd (TDG) has been commissioned by Watercare Services Limited (Watercare) to investigate the traffic engineering and safety implications of a proposal to construct an underground wastewater network from central Auckland through to the existing Mangere Wastewater Treatment Plant (MWWTP), in order to ease the existing and future pressure on the current network. This project is known as “The Central Interceptor”.

Watercare is planning to construct a new wastewater tunnel to collect wastewater flows from the Auckland isthmus area and transfer them across the Manukau Harbour to the Mangere WWTP. The Central Interceptor Project arose out of the Three Waters Plan (2008) which identified the need to provide trunk sewer capacity to central Auckland to reduce wet weather wastewater overflows and provide capacity for growth.

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

This traffic impact assessment (TIA) report includes any subsequent refinements of the site layouts and designs resulting from analysis and feedback of the first phase scoping report undertaken by Traffic Design Group. It also considers the traffic safety and engineering implications of construction works on the various ground level sites that will be required during the construction process.

By way of summary, it has been found that subject to minor recommendations in this report, the construction works can be established in such a way that the effects to the function, capacity or safety of the surrounding road network are no more than minor.

2. Proposed Works

2.1 Central Intercept Project

The overall concept proposed for the Central Interceptor is a gravity tunnel from the Western Springs area to the Mangere WWTP with various link sewers and pipelines connecting the existing network to the main tunnel at key locations along this route.

The key elements of the Central Interceptor project include:

- An approximately 13 km long 4.5m diameter main tunnel from Western Springs to Mangere WWTP, up to 110m below ground.
- Four link sewers connecting the main tunnel to the existing sewerage network.
- Associated connections to existing sewers.
- Associated structures at key sites along the route and at connections. At each site facilities include access shafts, drop shafts, and flow control structures. Grit traps, air intakes, air vents, or air treatment facilities are proposed at some sites.
- A limited number of overflow structures in nearby watercourses to enable the safe discharge of occasional overflows from the tunnel.
- A pump station located at the Mangere WWTP.
- Other associated works at and in the vicinity of the Mangere WWTP, including a rising main to connect to the WWTP and an emergency pressure relief structure to enable the safe discharge of flows in the event of pump station failure.

The main tunnel, link sewers, connection pipes and many of the associated structures will be underground. The tunnel and link sewers will be constructed by tunnelling methods, with access provided from around 19 surface construction sites. These surface construction sites include:

- Three major construction sites (at Western Springs, May Road and Mangere WWTP).
- 16 secondary (small and intermediate) sites to provide connections to the main tunnel and link sewers.

The major construction sites will be used for launching or retrieving the tunnel boring machine and materials for tunnel construction would be delivered and stored, tunnel spoil removed, and permanent facilities constructed. Activities at the small and intermediate sites on the main tunnel will include shaft sinking and the construction of surface facilities and at the link sewer sites will also include launching or retrieving the microtunnel boring machine.

Other construction activities include removal of vegetation, service relocations, establishment of construction yards, lay down areas and site accessways, traffic management, earthworks and site reinstatement.

The duration of construction will range from generally around 5 to 6 years at the major sites, 12 to 18 months at intermediate sites and 6 to 8 months at the small sites. Due to the nature of construction at the intermediate and small sites the total period of occupation will be longer than this (ranging between 2 and 5 years) with some periods of time where no active construction works will occur at the sites.

The Central Interceptor project has been developed to a concept design stage. It is likely that some details may change as the Central Interceptor project moves through the detailed design process. Detailed construction method will be determined following appointment of a construction contractor.

During the construction phase of this project, it is expected that there will be significant numbers of trucks entering and exiting the sites, transporting materials for tunnel construction and removing tunnel spoil.

2.2 Site Location and Numbers

Figure 1 shows the proposed location for each site and the surrounding road network. The exact location as well as the site layout of each site during and post construction can be referred to within the AEE Drawing Set.

In total, there are 19 sites proposed to enable construction of the tunnel network and to allow for regular maintenance of the tunnels following construction. The Central Interceptor Main Tunnel consists of ten sites (including three major scale sites) and the remaining nine sites are micro-tunnelling or small scale sites as part of the Link Sewer Tunnels.

The key properties along the preferred corridor are defined in the following categories:

- Key Connection Points – points required to link the Main Tunnel and Link Sewers to the existing network.
- Work Shaft Sites (WS1 – WS3) – possible Tunnel Boring Machine (TBM) launch and retrieval sites (the launch sites requiring a significantly greater working surface area for efficient tunnelling operations).
- Access Shaft Sites (AS1 – AS7) – sites for which permanent access to the tunnel will be provided; these are generally located at Key Connection Points.
- Link Sewer Sites (L1S1 – L4S1) – construction sites identified to date required for construction of the link sewers using micro-tunnelling / pipe-jacking.

The Central Interceptor is defined and annotated as follows:

- Main Tunnel 1 (MT-1) – Western Springs to May Road.
- Main Tunnel 2 (MT-2) – May Road to Mangere Pump Station.
- Link Sewer 1 (LS-1) – Motions Road to Western Springs.
- Link Sewer 2 (LS-2) – Rawalpindi Reserve to Mount Albert War Memorial Reserve.
- Link Sewer 3 (LS-3) – PS25 to May Road.
- Link Sewer 4 (LS-4) – Western Interceptor (in vicinity of Witla Court to Kiwi Esplanade).

3. Construction Traffic Information

The construction sites are classified as “Major”, “Intermediate” or “Small” sites, and carry with them different construction traffic information. The traffic generation information used throughout this traffic assessment is as per the traffic generation information described in the AEE.

3.1 Major Scale Construction Sites

The work shaft sites at Western Springs Park (WS1), May Road (WS2) and Mangere Pump Station (WS3) will serve as the three “Major” construction sites. These sites will involve the launching or recovery of a Tunnel Boring Machine (TBM) and will have a construction period of three to five years. They will typically be served by large “truck and trailer” units with a typical capacity of up to 15m^3.

Construction is likely to be split into three subsequent stages as described in the following sections.

3.1.1 Initial Stage (Shaft Excavation)

The initial stage (main shaft excavation) is expected to last for around six months, and will operate over 24 hours per day, seven days per week. Excavation works will typically be carried out for twelve hours per day (day time).

3.1.2 Second Stage (Tunnel Excavation)

The second stage of the tunnelling process will be construction of the tunnel, and is likely to take over two years to complete. It is proposed that a substantial number of truck-loads of material will be required to be removed at each site to excavate materials, and will normally only operate during daytime. There will also be truck movements associated with delivery of tunnel segments and other construction materials. WS3 is the proposed main pump station which entails heavier construction and subsequently more truck movements may be generated at this site, than the other two sites.

3.1.3 Third Stage (permanent works and connections)

The third stage of the Central Interceptor project will require similar or lower levels of truck volumes to that of the initial stage, and is expected to last for one year. This stage is likely to involve the construction of permanent works such as chambers and air treatment facilities. This stage will have a construction period ranging between six to 18 months.

3.2 Intermediate and Small Scale Construction Sites

The access shaft sites and link sewers sites will generally be “Intermediate” or “Small” scale construction sites. It is intended that these sites will not be major bases for tunnelling and consequently the number and size of trucks accessing the site will be lower than that of the “Major Scale” construction sites. However, the sizes and scale of works are different at each site and the trip generation of each site therefore will also vary. This report will assess all small and intermediate sites with the expected trip generation at Lyon Avenue (AS2) as a worst case scenario for these sites.

It is expected that single unit ($7m^3$) trucks will generally be accessing these sites with some large "truck and trailer" units throughout the entirety of the Central Interceptor project. These sites will also be constructed over three stages as follows.

3.2.1 Initial Stage (Shaft Excavation)

The initial stage of the Central Interceptor project is expected to last six months, and will involve excavating tunnelling shafts at each site.

3.2.2 Second Stage (Tunnel Excavation)

The intermediate and small scale sites that are part of the link sewers (see figure 1) will involve a second stage – 'micro tunnelling'. Micro tunnelling involves tunnelling from one site towards its neighbouring site in either direction. Up to $5,000m^3$ will be removed from each site, and this phase is expected to last six months. Given that the majority of the sites are constrained, it is expected that they will be served by single unit trucks.

3.2.3 Third Stage (permanent works and connections)

The third stage of the Central Interceptor project will require similar levels of truck volumes as the initial stage (20 truck movements per day), and will likely take six months to complete.

3.3 Traffic Distribution

In terms of the inbound and outbound distribution of vehicle movements at the intermediate and small sites, the light vehicle movements are likely to be tidal due to staff arrivals and departures (predominantly inbound in the morning and outbound during the evening) while the heavy-vehicle movements will be relatively even throughout the day. In terms of the distribution, the following has been assumed for all intermediate and small sites:

- 80% inbound / 20% outbound distribution for light vehicles during the morning peak hour and vice versa during the evening peak hour.
- 50% inbound / 50% outbound distribution for heavy vehicles during both peak hours.

It is considered that the traffic distribution assumptions may change depending on which road provides the quickest route, generally providing a less congested network overall.

The traffic distributions of the three major sites of the Central Interceptor Project are described in detail later in this report.

3.4 Truck Routes

The routes undertaken by construction trucks associated with the construction works will largely depend on the location of the sites and origin / destination of excavated materials. However, it is considered that the majority of trucks will travel to / from sites via the North-Western Motorway State Highway (SH) 16 and / or South-Western Motorway SH20.

A proposed truck route diagram has been developed for each of the construction sites and will be further discussed in later sections of this report. Truck routes to both SH16 and SH20 are displayed for some sites, with the possibilities that trucks may be directed to / from either the north or the south.

It is recommended that the trucks should generally follow the proposed truck routes as they have been chosen to avoid residential suburbs and uncontrolled right turns where possible. However, several construction sites are located in residential areas, in these instances, proposed truck routes generally follow arterial routes closest to the subject site, and right turns occur at either signalised intersections or roundabouts when available.

Truck tracking curves has been produced for the accesses of each site. The type of trucks used varies between sites, depending on the overall site layout and construction methodology.

4. Sites

The proposed sites and their associated site labels are listed below:

- Western Springs (WS1)
- Mount Albert War Memorial Reserve (AS1)
- Lyon Avenue (AS2)
- Haverstock Road (AS3)
- Walmsley Park (AS4)
- May Road (WS2)
- Keith Hay Park (AS5)
- PS23 (AS6)
- Kiwi Esplanade/Ambury Park (AS7)
- Mangere Pump Station (WS3)
- Motions Road (L1S1)
- Western Springs Depot (L1S2)
- Rawalpindi Reserve (L2S1)
- Norgrove Avenue (L2S2)
- PS25 (L3S1)
- Miranda Reserve (L3S2)
- Whitney Street (L3S3)
- Dundale Avenue (L3S4)
- Haycock Avenue (L3S5).

4.1 Western Springs (WS1)

4.1.1 Site Description

The proposed site location for the Western Springs (WS1) site is on the northern area in the Western Springs Park, Western Springs. Western Springs Park currently has access from Stadium Road (as does site L1S2 (Western Springs Depot) which will be discussed in Section 4.12) and from Bullock Track.

Western Springs Park has frontage on Great North Road, Stadium Road and Bullock Track. The subject site is currently a green field and several rugby pitches currently occupy the park. It is envisaged that these rugby pitches will remain in use during the construction period. The Museum of Transport and Technology (MOTAT) is located on the western side of Stadium Road and the Western Springs Stadium is located to the northwest of the site. Surrounding land uses to the north and east are typically residential.

4.1.2 Road Network

Great North Road is defined as a District Arterial Road in the Auckland City District Plan: Isthmus Section (Auckland City District Plan). It generally runs in a west-east direction, parallel to SH16 providing linkages between Avondale in the west and Central Auckland in the east. In the vicinity of the site, Great North Road has two traffic lanes in the westbound direction and one traffic lane in the eastbound direction separated by a flush median. Footpaths are provided on both sides.

Great North Road forms a signalised intersection with Stadium Road and SH16 eastbound on / off-ramps at Western Springs (MOTAT) to the western edge of the site, where Great North Road eastbound widens to a left and through shared lane, a through lane and two right turn lanes onto SH16 eastbound. In the westbound direction, Great North Road widens to a left turn slip lane, two through lanes and also providing a right turn bay on approach to the intersection.

Stadium Road is classified as a Local Road in the Auckland City District Plan. It runs in a north-west / south-east direction, and serves as a feeder road for the Western Springs Stadium parking area, as well as a parking area for MOTAT and the Western Springs playing fields. For the majority of its length, Stadium Road is a two-lane, two way street with marked parking spaces on either side of the carriageway. On approach to the intersection with Great North Road, Stadium Road widens to two lanes in each direction. There are also several road humps along Stadium Road, near the south-eastern end.

Great North Road forms a priority intersection with Bullock Track and Tuarangi Road to the eastern edge of the site. A left turn bay of approximately 70m is provided on Great North Road eastbound to provide a left turn access to Bullock Track.

Bullock Track is classified as a Collector Road in the Auckland City District Plan. It has one lane in each direction with a footpath provided on the western side of the road. Kerbside parking along both sides of Bullock Track is restricted by means of broken yellow lines. Bullock Track provides a connection between Great North Road in the south and Old Mill Road / Surrey Crescent in the north.

4.1.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Bullock Track, Great North Road and St Lukes Road. The Average Daily Traffic ("ADT") volumes vehicles per day ("vpd") and the vehicles per hour ("vph") in the peak period are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Bullock Track	Surrey to Sefton	Northbound	4037	3901	-	-	-	2008
		Southbound	3521	3519	-	-	-	2008
Great North Road	West of Bullock Track	Westbound	11741	11458	917	1170	1011	2008
		Eastbound	10783	10230	1257	790	830	2008
St Lukes Road	North of Morningside Drive	Northbound	16365	16126	1027	1579	1564	2005
		Southbound	14450	14134	1031	1136	1255	2005

Table 1: Traffic Volumes – Bullock Track, Great North Road and St Lukes Road

These traffic count data are typical of their road classifications.

Given that Western Springs (WS1) is a major scale site and its traffic generation is expected to be greater than the majority of the other sites, additional traffic surveys have been carried out. The following intersections are on route to the nearest motorway from site and are therefore of interest as part of the traffic investigation:

- Great North Road / Stadium Road / MOTAT on/off ramps
- Great North Road / Bullock Track / Tuarangi Road
- Great North Road / St Lukes Road
- St Lukes Road / St Lukes on/off ramps.

Existing traffic volumes of the above intersections were obtained from surveys undertaken by TDG on Tuesday 12 July 2011 7:00am - 9:00am and 3:00pm - 6:00pm and Saturday 16 July 2011 between 11:00pm and 2:00pm. The following tables summarise the surveyed peak hour volumes in vehicles per hour:

Approach	Movement	Morning Peak (7:45 – 8:45am)	Evening Peak (4:30 – 5:30pm)	Saturday Midday Peak (12:00 – 1:00pm)
Great North Road (eastbound)	Left	231	21	45
	Through	999	621	675
	Right (MOTAT On Ramp)	923	745	1107
Great North Road (westbound)	Left (MOTAT On Ramp)	504	215	191
	Through	454	927	655
	Right	15	20	19
Stadium Road	Left	10	17	28
	Through (MOTAT On Ramp)	205	15	13
	Right	8	32	26
MOTAT Off Ramp	Left	274	288	374
	Through	7	6	6
	Right	174	169	168

Table 2: TDG Surveyed traffic movements – Great North Road / Stadium Road / MOTAT on/off ramps

Approach	Movement	Morning Peak (7:45 – 8:45am)	Evening Peak (4:30 – 5:30pm)	Saturday Midday Peak (11:45 – 12:45pm)
Great North Road (eastbound)	Left	209	311	353
	Through	811	338	419
	Right (Tuarangi Road)	56	106	101
Great North Road (westbound)	Left (Tuarangi Road)	16	27	20
	Through	342	781	505
Bullock Track	Left	5	4	3
	Through (Tuarangi Road)	13	18	37
	Right	217	195	256
Tuarangi Road	Left	518	170	208
	Right	137	15	32

Table 3: TDG Surveyed traffic movements – Great North Road / Bullock Track / Tuarangi Road

Approach	Movement	Morning Peak (7:30 – 8:30am)	Evening Peak (4:45 – 5:45pm)	Saturday Midday Peak (11:30 – 12:30pm)
Great North Road (eastbound)	Through	233	210	298
	Right	1032	387	712
Great North Road (westbound)	Left	515	607	298
	Through	550	692	312
St Lukes Road	Left	165	353	442
	Right	1,199	781	1,032

Table 4: TDG Surveyed traffic movements – Great North Road / St Lukes Road

Approach	Movement	Morning Peak (8:00 – 9:00am)	Evening Peak (4:45 – 5:45pm)	Saturday Midday Peak (12:15 – 1:15pm)
St Lukes Road (Northbound)	Left	321	558	508
	Through	1076	984	1143
St Lukes Road (southbound)	Through	689	654	810
	Right	186	252	180
St Lukes off ramp	Left	482	1158	980
	Right	261	427	427

Table 5: TDG Surveyed traffic movements – St Lukes Road / St Lukes on/off ramps

The traffic effects of the proposed works on surrounding intersections will be examined and discussed later in this report.

4.1.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Stadium Road and the Stadium Road / Great North Road (Great North Road) / MOTAT On / Off Ramps intersection:

A total of 21 crashes including one serious injury crash and two minor injury crashes were found, with 20 crashes occurring at the intersection and one on Stadium Road.

- Rear-end type crashes appeared to be dominant with seven non-injury crashes on Great North Road (four eastbound and three westbound), and two non-injury crashes on MOTAT off-ramp.
- One serious injury crash took place on Great North Road westbound involving the vehicle failing to give way to a crossing pedestrian, and one minor injury crash when a vehicle ran through a red light and hit another vehicle at a right angle.
- Three crashes including one minor injury crash were caused by Great North Road westbound vehicles turning right into Stadium Road and failing to give way to through traffic.
- Two loss of control accidents occurred on MOTAT off–ramp when turning left.
- One crash occurred on Stadium Road approximately 100m north of the intersection when a vehicle hit a parked vehicle.
- Two accidents involved trucks – One was caused by a truck misjudging its speed when attempting to overtake a bus on Great North Road eastbound; - The remaining crash was due to a truck driver misjudging the position of an obstacle ahead and hitting a pole on MOTAT off-ramp.

Given the time period of the search and the high volumes on Great North Road it is considered that the number of crashes is typical for the scope of the search. There are no inherent specific safety issues within the study area.

Another search was carried out for the same time period for the intersection of Bullock Track / Great North Road and 100m along the length of Bullock Track from the intersection.

A total of 56 crashes including two with serious injuries and 19 with minor injuries were found, with all crashes occurring at the intersection.

- The majority of crashes had the same crash cause, (with 52 crashes including two crashes resulting in serious injuries and 19 crashes resulting in minor injuries) of failure to give way when turning right onto Great North Road from Bullock Track southbound.
- Three crashes were caused by vehicles from Great North Road turning right onto Bullock Track. A no right turn sign has been implemented for Great North Road to prohibit westbound vehicles from turning right onto Bullock Track.

There appears to be a safety issue with vehicles turning right onto Great North Road from Bullock Track southbound. As such, it is proposed that the subject site will only gain entry from Bullock Track (further discussed in the following section). All site traffic is likely to be travelling from Great North Road eastbound and turning left onto Bullock Track using the existing left turn slip lane (no right turns into Bullock Track are permitted). All site traffic will exit onto Stadium Road. It is therefore concluded that the proposed works will not have any additional adverse effects on the existing conditions at this intersection.

4.1.5 Proposed Works and Work Site Layout

The Western Springs (WS1) site is one of the three major-scale key connection points of the Central Interceptor project. Works will also involve a microtunnel connection to Western Springs Depot. The proposed location and site layout of both sites at Western Springs (WS1 and the CSO Collector Sewer site) can be referred to in the AEE Drawing Set. It is noted that the site arrangement will ultimately be the responsibility of the contractor and may be optimised.

The site will be located within the northern area of Western Springs Park, with separate site access and egress points. It is proposed that a one-way entry will be located on Bullock Track approximately 50m north of the intersection with Great North Road. A one-way access road is proposed through the site. Site traffic will exit the access road via an existing maintenance road north-west of the site which leads onto Stadium Road.

The worksite will be fully enclosed with fencing. A wheel wash is proposed to be located across the access road 10m before the site egress. On-site facilities for workers such as site offices and canteen are provided on the east side of the site. The site will also be able to accommodate the anticipated parking demand within its boundaries, minimising the effects on the immediate surrounding road network.

The secondary site is located on the southern side of Great North Road, adjacent to the existing Caltex service station. An existing access to this area is located on the northern side of the site. The drop shaft and the control chamber are located towards to the eastern side of this site and the remaining area will generally be used for vehicles to manoeuvre on-site.

4.1.6 Access and Sight Distance

4.1.6.1 Site Access

Site traffic is proposed to enter the site via a temporary access road from Bullock Track approximately 50m north of the intersection with Great North Road (at an existing access point). The gradient of the access is relatively flat and there is ample visibility to approaching pedestrians. All staff will be made aware, through on-site management, that the Bullock Track access is for entry movements only. Alternative access provisions (e.g. via Stadium Road) have not been considered due to the narrow width of the site access at this location which restricts movements to one-way only.

Observations suggest that adequate sight distances are provided both to the north and south of the access. It is recommended that all vehicle access be limited to left in only, thus minimising the impacts on the immediate road network. Figure 2 shows the swept path of the design truck using this access.

Photograph 1 below shows the proposed location of the site access:

Photograph 1: Proposed access location for site WS1

4.1.6.2 Site Egress

Site traffic will exit from the site onto an existing maintenance road north of the subject site which intersects with Stadium Road approximately 230m north of the intersection with Great North Road. Fencing is currently in place on this maintenance road separating the Stadium from the Park.

Observations suggest that adequate sight distance is provided both to the north and south of the access lane. It should be noted that the speed environment along Stadium Road is relatively low due to the presence of speed humps and the narrow width of the carriageway. It is recommended that heavy vehicle access be limited to left out only at the site exit onto Stadium Road, thus minimising the impacts on the immediate road network.

Photograph 2 below shows the proposed location of the site egress:

Photograph 2: Proposed egress location for site WS1

Given the level of pedestrian activity (especially school children) on Stadium Road, it is proposed to upgrade Stadium Road to ensure that school pedestrians that are dropped off travel safely to the MOTAT entrance on Stadium Road. In particular, this includes:

- a 2m footpath on the western side of Stadium Road
- bus drop-off area on the western kerb
- widening of Stadium Road on the eastern side by reducing the existing 4.5m footpath to 2.5m (thus resulting in no additional encroachment to the eastern trees).

4.1.7 Pedestrian Access

Pedestrian access to the Stadium and surrounding facilities is unlikely to be affected by the site. Footpaths are provided on Stadium Road and pedestrians will continue to utilise them to access the Stadium. The kerb around the Stadium building will remain and barriers will be positioned between the kerb and the temporary Depot access to ensure pedestrians' safety.

It is recommended that heavy vehicle movements be restricted during major events occurring at Western Springs Stadium.

4.1.7.1 Secondary site access

A secondary site is provided on the eastern side of the Caltex service station on Great North Road adjacent to the left turn slip lane from the SH16 Western Springs eastbound off-ramp. It is expected that works at this site will be minor and site traffic is anticipated to be low relative to the main site. Vehicles accessing the secondary site will be restricted to single-unit trucks due to its confined space. Access to and from the secondary site will also be limited to a left-in / left-out operation only as it is in close proximity to Great North Road and SH16 off-ramp. Trucks will be required to turn around on-site to ensure no reverse manoeuvring is required.

Due to the low number of traffic movements, and the left in/left out nature of the access, the access to the site can be safely managed.

4.1.8 Pedestrian Access

Footpaths are provided on both sides of Bullock Track, Stadium Road as well as Great North Road. As mentioned, the site will be enclosed in fencing and these footpaths will be functional as usual for pedestrians to travel around the site during construction. It is recommended that heavy vehicle movements be restricted during major events (such as Pacifica, music concerts etc) occurring at Western Springs Stadium. It is likely that major events will predominantly occur during the evening.

As noted, pedestrians will need to cross an existing access on the western side of Bullock Track approximately 50m north of Great North Road. As will be noted, the proposed traffic volumes are low and are not considered to generate any discernible impact in regards to pedestrian safety or amenity.

Pedestrian refuges are located on Bullock Track near the intersection with Great North Road and the signalised Stadium Road / Great North Road intersection provides signalised pedestrian crossing stages. The speed humps on Stadium Road will sustain the low operating speed on this road. It is considered that pedestrians will be able to travel safely around the site during construction.

The internal footpath on Western Springs Park located east of the site will remain open during the works and will join the existing vehicle access proposed for left turn entry movements. Pedestrians may be required to cross the site access to access the footpath. Notwithstanding this, it is considered that adequate sight distance is provided to make sure the access road is clear before crossing.

4.1.9 Traffic Generation

Trip generation information used for this assessment is as described in the AEE. The following table below summarises the trip generation information for Western Springs (WS1).

	Activity	Vehicle Type	Assumptions	Peak vehicles per Day	Peak Movements per Day
Stage 1 – Shaft Excavation and support	Shotcrete delivery	6m^3 concrete truck	Total volume of shotcrete at WS1 =120m^3	4	8
			Intermittent over 5 week period		
	Labour	Standard vehicle	Constant duration of project	7	14
	Site supervision	Standard vehicle	As needed	2	4
	Maintenance	3-axle truck		1	2
	Rock bolt, soil nail and steel delivery	Semi-trailer truck with flatbed	Intermittent over 18-20 week period and does not occur on the same day as concrete delivery	-	-
	Spoil removal	15m^3 spoil removal truck	Average excavation rate of 400m^3 per day	27	54
			6-day work week		
			Constant for 20 week period		
Stage 2 – Tunnel Excavation	Spoil removal	15m^3 spoil removal truck	Bulk spoil volume MT-1 and LS3 = 248,830m^3	42	84
			Average excavation rate of 16m per day		
			Constant for 58 week period		
	Segment delivery	Semi-trailer truck with flatbed	Average TBM advance rate of 16m/day	8	16
			Constant for duration of stage 2		
	Material delivery	Semi-trailer truck with flatbed	Materials for TBM	1	2
	Labour	Standard vehicle	Constant duration of stage 2	20	40
	Site supervision	Standard vehicle	Constant duration of stage 2	10	20
	Other	3-axle truck	As needed	1	2

Table 6: Traffic Generation – WS1

Based on the table above, it is estimated that the site will generate the following trips per day and per hour during the peak construction season (assuming 30% of light vehicles trips occurring during the peak hour):

Approximate traffic generation for Stage One:

- 18 standard vehicle movements per day (six vehicle movements during peak hour).
- 64 heavy vehicle movements per day (average of six heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation for Stage Two:

- 60 standard vehicle movements per day (18 vehicle movements during peak hour).
- 104 heavy vehicle movements per day (average of nine heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed works will generate a peak of around 164 vehicle movements per day, with 27 vehicle movements during the peak hour.

4.1.10 Traffic Distribution

In terms of the inbound and outbound distribution of vehicle movements, the light vehicle movements are likely to be tidal due to staff arrivals and departures (predominantly inbound in the morning and outbound during the evening) while the heavy-vehicle movements will be relatively even throughout the day. In terms of the distribution; we have assumed the following:

- 80% inbound / 20% outbound distribution for light vehicles during the morning peak hour and vice versa during the evening peak hour.
- 50% inbound / 50% outbound distribution for heavy vehicles during both peak hours.
- 50% inbound / 50% outbound distribution for both light and heavy vehicle during the Saturday midday peak.

It is assumed that all site entries will be coming from SH16 motorway via St Lukes off ramp, St Lukes Road, Great North Road onto Bullock Track. All site exits will be via Stadium Road towards SH16 via the on-ramps.

It is considered that the traffic distribution assumptions may change depending on which road provides the quickest route, generally providing a less congested network overall.

4.1.11 Construction Traffic Truck Routes

The Western Springs (WS1) site is proposed to be a major scale construction site, with a significant number of truck movements expected to access the site throughout the construction duration. This site will be one of the three major sites across the Central Interceptor project, which will be used as a main base for constructing the main tunnel.

It is assumed that truck tracking curves for large semi-trailer trucks will be run for the proposed access by the contractor once exact details are known.

Figure 3 shows the recommended routes for heavy vehicles travelling to site from the nearest Motorway and in the reverse direction. Trucks will be able to access the site from SH16 via the westbound off ramps, St Lukes Road, Great North Road and Bullock Track. Trucks will be able to leave the site and access the motorway via Stadium Road and SH16 on-ramps.

4.1.12 Impacts on Local Road network - SIDRA Intersection Modelling

The traffic effects of the proposed works on the surrounding intersections have been modelled using SIDRA, an industry standard tool for assessing the performance characteristics of intersections. Assessments of the existing weekday AM and PM and Saturday midday peak hours were carried out.

The results presented in this report include the 95th percentile queue length, average delay, and level of service (LOS). LOS is measured as a function of delay. According to the SIDRA manual LOS A and B are very good and indicative of free-flow conditions; C is good; D is acceptable; and E and F are indicative of congestion. The intersection results presented below give the worst 95th percentile queue, while the average delay and LOS presented is the average of all the vehicles.

The information provided indicates that the second stage of the Central Interceptor project will generate a greater volume of vehicle movements (as shown in Section 4.1.9). Therefore, only the second stage has been modelled. This will present a worst case scenario. All vehicles will enter the site via Bullock Track and leave via Stadium Road, and two scenarios have been modelled. It has been assumed that vehicles will:

a) all come to / from the motorway (travelling east of the site), or

b) all come to / from St Lukes Road (travelling south).

4.1.12.1 Great North Road / Stadium Road / MOTAT on/off ramps

The SIDRA results for the Great North Road / Stadium Road / MOTAT on/off ramps intersection during the three peak hours modelled are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
MOTAT on / off ramp	28.2	C	39.2	36.3	D	49.3	38.1	D	61.8
Great North Road WB	32.5	C	115.4	69.7	E	302.6	73.4	E	222.7
Stadium Road	60.0	E	68.2	63.4	E	20.4	68.6	E	19.4
Great North Road EB	35.6	D	199.3	47.6	D	197.8	44.6	D	285.2
Intersection	**35.4**	**D**	**199.3**	**54.6**	**D**	**302.6**	**51.5**	**D**	**285.2**

Table 7: Model Results for Great North Road / Stadium Road / MOTAT On/Off ramps – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
MOTAT on / off ramp	29.6	C	44.4	40.9	D	58.2	38.5	D	65.8
Great North Road WB	32.5	C	115.4	69.9	E	313.5	72.3	E	217.6
Stadium Road	60.2	E	70.7	65.3	E	33.6	66.4	E	26.8
Great North Road EB	36.0	D	199.3	45.9	D	186.6	48.2	D	296.3
Intersection	**35.8**	**D**	**199.3**	**54.7**	**D**	**313.5**	**53.2**	**D**	**296.3**

Table 8: Model Results for Great North Road / Stadium Road / MOTAT On/Off ramps – Future conditions

It can be seen from these results that the Great North Road / Stadium Road / MOTAT On/Off ramp intersection currently experiences some congestion during the peak periods particularly on the Great North Road approaches. However it can be seen that the impact on the intersection's operation as a result of the proposed works is minimal with a maximum increase in delay of 1.4 seconds, 4.6 seconds and 3.6 seconds in the AM peak, PM peak and Saturday midday peak respectively and a maximum increase in queue length of 5.2m (one vehicle), 13.2m (two vehicles) and 11.1m (two vehicles) in the AM peak, PM peak and Saturday midday peak respectively. There is no change in Level of Service for any movement as a result of the additional vehicle movements and as such the impact can be considered less than minor.

4.1.12.2 Great North Road / Bullock Track / Tuarangi Road

The SIDRA results for the Great North Road / Bullock Track / Tuarangi Road intersection during the three peak hours modelled are shown in the tables below.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Great North Road WB	0.3	N/A	0.2	0.3	N/A	3.0	0.3	N/A	1.9
Great North Road EB	1.7	N/A	1.7	4.3	N/A	5.2	3.7	N/A	3.5
Bullock Track	291.4	F	274.3	297.9	F	260.5	304.8	F	360.9
Tuarangi Road	18.0	C	47.3	16.4	C	13.2	13.3	B	12.5
Intersection	**35.5**	**N/A**	**274.3**	**36.4**	**N/A**	**260.5**	**50.2**	**N/A**	**360.9**

Table 9: Model Results for Great North Road / Bullock Track / Tuarangi Road – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Great North Road WB	0.3	N/A	1.2	0.3	N/A	3.0	0.3	N/A	1.9
Great North Road EB	1.8	N/A	1.7	4.4	N/A	5.2	3.7	N/A	3.5
Bullock Track	313.5	F	290.3	308.7	F	267.8	318.3	F	372.8
Tuarangi Road	17.9	D	47.1	17.1	C	13.8	13.3	B	12.5
Intersection	**37.5**	**N/A**	**290.3**	**37.6**	**N/A**	**267.8**	**51.9**	**N/A**	**372.8**

Table 10: Model Results for Great North Road / Bullock Track / Tuarangi Road – Future conditions

It can be seen from these results that at the Great North Road / Bullock Track / Tuarangi Road intersection, the Bullock Track approach to the intersection with Great North Road currently experiences significant congestion during the peak periods. From the model, it can be seen that the impact on the intersections operation as a result of the proposed works will induce a maximum increase in delay of 22 seconds, 10.8 seconds and 13.5 seconds in the AM peak, PM peak and Saturday midday peak respectively and a maximum increase in queue length of 16m (three vehicle), 7.8m (two vehicles) and 11.9m (two vehicles) in the AM peak, PM peak and Saturday midday peak respectively. Realistically, the proposed works will not result in any additional vehicle movements to the Bullock Track approach therefore it is considered that the impact on the intersection will be minor.

4.1.12.3 Great North Road / St Lukes Road

The SIDRA results for the Great North Road / St Lukes Road intersection during the three peak hours modelled are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road	30.4	C	195	26.6	C	110.8	23.8	C	149
Great North Road WB	26.6	C	105.4	20.7	C	108.8	23.1	C	51.4
Great North Road EB	9.0	A	83.4	13.4	B	57.6	13.3	B	99.7
Intersection	**22.0**	**C**	**195**	**21.5**	**C**	**110.8**	**20.2**	**C**	**149**

Table 11: Model Results for Great North Road / St Lukes Road – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road	29.3	C	203	26.9	C	113.5	24.4	C	151.2
Great North Road WB	27.1	C	111	20.5	C	108.8	21.2	C	48.1
Great North Road EB	10.5	B	95.9	13.9	B	57.6	13.3	B	97.8
Intersection	**22.3**	**C**	**203**	**21.6**	**C**	**113.5**	**20.2**	**C**	**151.2**

Table 12: Model Results for Great North Road / St Lukes Road – Future conditions via SH16

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road	29.3	C	203	26.9	C	113.5	24.4	C	151.2
Great North Road WB	27.2	C	111	20.7	C	108.8	21.6	C	48.1
Great North Road EB	10.5	B	95.9	13.4	B	57.6	13.3	B	97.8
Intersection	**22.3**	**C**	**203**	**21.6**	**C**	**113.5**	**20.2**	**C**	**151.2**

Table 13: Model Results for Great North Road / St Lukes Road – Future conditions via St Lukes Road

It can be seen from these results that the Great North Road / St Lukes Road intersection currently experiences some congestion during the peak periods particularly during the morning peak period. However it can be seen that the impact on the intersections operation as a result of the proposed works is minor with a maximum increase in delay of 1.5 seconds, 0.5 seconds and 0.6 seconds in the AM peak, PM peak and Saturday midday peak respectively and a maximum increase in queue length of 12.5m (two vehicles), 0.5m (less than one vehicle) and 2.2m (less than one vehicle) in the AM peak, PM peak and Saturday midday peak respectively. There is no change in Level of Service for any movement except for Great North Road eastbound where the LOS changes from LOS A to LOS B during the AM peak period. As such the impact of the proposed works on the intersection can be considered less than minor.

4.1.12.4 St Lukes Road / Western Springs on/off ramps

The SIDRA results for the Saint Lukes Road / Western Springs on/off ramps intersection during the three peak hours modelled are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road NB	20.1	C	134.2	25.9	C	152.6	23.8	C	166.1
Western Springs off ramp	16.1	B	68.5	16.7	B	135.0	18.1	B	135.0
St Lukes Road SB	16.6	B	112.7	20.7	C	111.7	21.8	C	173.0
Intersection	**18.1**	**B**	**134.2**	**21.1**	**C**	**152.6**	**21.3**	**C**	**173.0**

Table 14: Model Results for GNR / Stadium Road / MOTAT On/Off ramps – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road NB	20.1	C	134.2	25.8	C	152.6	23.5	C	166.1
Western Springs off ramp	17.2	B	77.3	16.7	B	135.0	18.1	B	135.0
St Lukes Road SB	16.6	B	112.7	20.7	C	111.7	21.8	C	173.0
Intersection	**18.4**	**B**	**134.2**	**21.1**	**C**	**152.6**	**21.3**	**C**	**173.0**

Table 15: Model Results for GNR / St Lukes Road / Western Springs Off ramps – Future conditions via SH16

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
St Lukes Road NB	20.9	C	140.7	28.3	C	164.5	25.1	C	174.1
Western Springs off ramp	16.1	B	68.5	16.7	B	135.0	18.1	B	135.0
St Lukes Road SB	16.6	B	115.6	20.7	C	114.7	22.6	C	183.2
Intersection	**18.5**	**B**	**140.7**	**22.1**	**C**	**164.5**	**22.1**	**C**	**183.2**

Table 16: Model Results for St Lukes Road / Western Springs Off ramps – Future conditions via St Lukes Road

Model results show that this intersection currently provides a good LOS. It can be seen that the impact on the intersections operation as a result of the proposed works is minimal with a maximum increase in delay of 1.1 seconds, 2.4 seconds and 1.6 seconds in the AM peak, PM peak and Saturday midday peak respectively and a maximum increase in queue length of 6.5m (one vehicle), 11.9m (two vehicles) and 10.2m (two vehicles) in the AM peak, PM peak and Saturday midday peak respectively. There is no change in Level of Service for any movement as a result of the additional vehicle movements and as such the impact can be considered less than minor.

Overall, the traffic modelling testing indicates that the proposed works at WS1 site will have a minor impact on the operation of the local road network.

4.1.13 Traffic Generation during Normal Operation

This site will provide long-term maintenance access to the tunnel and as such maintenance access to part of Western Springs Park is required by Watercare for the long term. The temporary 25m by 15m ellipse shaft will be reduced to a permanent 7m ID access shaft. The temporary site facilities and access path will be removed and the land will be reinstated. A possible air treatment facility is proposed to be located to the east of the drop shaft on the northern end of the site.

The traffic generation post construction will be limited to regular maintenance. It is estimated that traffic generated by the site will normally be one vehicle per week.

Given that the anticipated traffic volume post construction is relatively low and a maintenance road onto Stadium Road already exists, it is recommended that maintenance access to the site is gained at the proposed site egress via the maintenance road.

4.2 Mount Albert War Memorial Reserve (AS1)

4.2.1 Site Description

The proposed site location for the Mount Albert War Memorial Reserve (AS1) site is in the north-western part of the Mount Albert War Memorial Reserve, Mount Albert. Existing pedestrian access to the site is through a car park on the southern side of the site. The car park has two access roads onto Wairere Avenue (one via Councillor Drive). It is proposed that site access will be gained via the northern car park access road.

At present, the site is generally an open green space and it does not have any street frontages. Surrounding properties are largely residential in nature. The Mount Albert Community and Recreation Centre and associated car park are located to the east of the site.

4.2.2 Road Network

Wairere Avenue is classified as a Local Road in the Auckland City District Plan: Isthmus Section (District Plan). It runs in a northwest – south east direction, connecting Asquith Avenue in the north with New North Road in the south. Wairere Avenue has a posted speed limit of 50kph and is a two-lane, two way street with marked parking spaces on either side of the carriageway. There are also three speed humps situated along the length of Wairere Avenue.

Wairere Avenue intersects with New North Road and Kitenui Avenue approximately 170m southeast of the site. Traffic from Wairere Avenue and Kitenui Avenue is controlled by “Stop” signage and associated markings at the cross intersection. Right turn bays are provided for turning traffic on New North Road at the intersection.

Councillors Drive is a two-lane two-way internal road within the Mount Albert Community and Recreation Centre. It provides access to all parking areas for the Recreation Centre and the reserve, and connects Wairere Avenue in the southwest to New North Road in the southeast.

4.2.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Council Traffic Flow Database was obtained for Wairere Avenue. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Wairere Avenue	Asquith Ave to Councillors Dr	Northbound	1279	1168	190	172	84	2010
		Southbound	1469	1469	176	183	98	2010

Table 17: Traffic Volumes – Wairere Avenue

The traffic flows on Wairere Avenue are typical of a Local Road.

Existing traffic volumes on Wairere Avenue at the intersections with the parking area access and Councillors Drive were obtained from surveys undertaken by TDG on Thursday 14 July 2011 7:00am - 9:00am and 3:00pm - 6:00pm. The tables below summarise the surveyed peak hour volumes:

Approach	Movement	Morning Peak (8:00 – 9:00am)	Evening Peak (3:00 – 4:00pm)	Saturday Midday Peak (11:00am - 12:00pm)
Wairere Avenue (eastbound)	Left	2	6	0
	Through	192	151	139
Wairere Avenue (westbound)	Through	169	143	91
	Right	1	1	1
Car Park (Proposed access)	Left	0	1	11
	Right	2	2	3

Table 18: TDG Surveyed traffic movements – Wairere Avenue / Car Park Access

Approach	Movement	Morning Peak (7:45 - 8:45am)	Evening Peak (3:00 – 4:00pm)	Saturday Midday Peak (11:00am - 12:00pm)
Wairere Avenue (eastbound)	Left	3	11	10
	Through	189	141	140
Wairere Avenue (westbound)	Through	168	134	93
	Right	7	34	26
Councillors Drive	Left	2	22	38
	Right	2	10	6

Table 19: TDG Surveyed traffic movements – Wairere Avenue / Councillors Drive

The tables above show that traffic volumes on Wairere Avenue during the peak hours are relatively low. The survey results show that negligible traffic utilises the car park access (proposed site access) during the commuters' peak, suggesting that restricting the car park access road to exit only or temporarily closing the access road for the public should result in minimal effects during weekdays.

There is a slight increase in vehicles turning left from both the car park access and Councillors Drive onto Wairere Avenue during the weekend peak period. However, the overall traffic volumes at the car park access are generally low. Should the car park access be closed for public during construction, the additional traffic expected to use Councillors Drive will be up to 15 vehicles during the peak period which is expected to generate negligible traffic effects.

A parking survey of the car park has been carried out during the weekend peak period to observe the parking demand. This survey was carried out on a fine spring Saturday (10 September 2011 between 10:30am - 2:15pm. The survey showed that while the main capacity areas are well utilised, the parallel spaces along the northern car park access road (subject access) were rarely used with no vehicles recorded parking in these areas over the entire survey period. This survey was repeated on Saturday 9 June 2012, which showed a similar if not slightly less use of the car park during winter. Observations of the site show the carpark is predominantly used by YMCA and community centre visitors. Use of the carpark is not expected to be significantly different between seasons.

Further, of the 10 spaces available immediately adjacent to the construction site, a maximum of two spaces were occupied over this time. Overall, it appears that the spaces on the access and adjacent to the construction site are generally the last carparks to be used at the reserve. As such, temporarily removing these carparks is not considered to generate any adverse effects. In the rare instances that parking supply may be exceeded, there is ample on-street parking on Wairere Avenue to accommodate spill over parking demand.

4.2.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Wairere Avenue and all crashes related to the Wairere Avenue / New North Road / Kitenui Avenue intersection:

A total of 17 crashes including three minor injury crashes were found, with 14 crashes occurring at the intersection and three crashes occurring on Wairere Avenue.

- The major crash type at the intersection was failure to give way when turning right from Wairere Avenue on to New North Road westbound, with four crashes including one minor injury crash.
- The remaining crashes that occurred at the intersection had varying crash types, with no patterns apparent.
- The three crashes that took place on Wairere Avenue also had varying crash types, of which none were related to driveways near the subject site.

Given the time period of the search, it is considered that the number of crashes occurred is typical for the scope of the search. As a precaution to prevent additional incidents caused by right turning vehicles from Wairere Avenue, it is recommended that heavy vehicles be restricted to a left turn only from Wairere Avenue onto New North Road eastbound when leaving site. This is reinforced in the proposed truck route as discussed in Section 4.2.10.

4.2.5 Proposed Works and Work Site Layout

The AS1 site is a key connection location of the Central Interceptor project for construction of LS1 and the main tunnel with connections between the tunnel and Watercare's Branch 8 sewer. The Mount Albert War Memorial Reserve (AS1) site will be located within the north-western area of

the Mount Albert War Memorial Reserve. It is proposed that a two-way access be located over the existing western-most car parking entrance on Wairere Avenue, 170m west of the intersection with New North Road.

The proposed access path forms a loop within the site and operates as a clockwise motion only.

As the subject site is located within a well utilised reserve and is immediately surrounded by residential properties along its southern and western edges, noise walls will be erected around the worksite. A wheel wash is to be located across the entrance to the reserve adjacent to a water treatment plant. On-site facilities for workers such as site offices will be located on the north-eastern side of the site. Fencing surrounding the site and access road will be installed to fully isolate the site from pedestrians.

A temporary site access onto Wairere Avenue is proposed over the ingress lane and associated parallel parking spaces of the existing western car park access. Adjustments to the kerb line may be necessary in order for trucks to enter safely. Traffic movements for the public on this access will be restricted to exit only during the construction period. Temporary removal of 14 parking spaces will be required during the works.

4.2.6 Access and Sight Distance

Access to the site is proposed to be through the north-western corner of the parking area, via a car park access road from Wairere Avenue. There is currently a formed access onto the reserve, which at the time of observation had a yellow-hatched “No Parking” area marked on the parking area in front of the access. In order for this area to be used as an access path, two parking spaces to the south of the access are proposed to be temporarily removed. Photograph 3 below shows the entrance to the reserve:

Photograph 3: Proposed site entrance for site AS1

The proposed site access by means of an existing car park access road from Wairere Avenue is shown below in Photograph 4. The access currently serves the north-western parking area. There is considered to be adequate sight distance in both directions from the access to the parking area.

Photograph 4: Proposed access location for site AS1

The site access may be established in two possible ways. This access can be temporarily restricted to an exit only for public car park traffic during construction and all traffic wishing to access the car park will utilise Councillor Drive, 60m east of the proposed site access along Wairere Avenue. The 12 parallel parking spaces along the car park entrance will be temporarily removed during construction. Site vehicles are likely to enter / exit site in the right in / left out manner.

Alternatively the access road could be entirely closed for public traffic. This will allow more space for heavy vehicles to manoeuvre to and from the site more safely and prevent any conflict between site vehicles and car park users. Car park users will be able to access the car park via Councillors Drive from Wairere Avenue or New North Road.

During a site inspection, it was observed that there is a low parking demand during the weekdays within the car park. Even on weekends there is very low demand for the parallel parking spaces on the access road and in the parking area southeast of the site. On-street parking on Wairere Avenue is also readily available. Temporary removal of 14 car parking spaces (12 parallel parking spaces and two spaces before the site entry) to establish a temporary site access is therefore expected to have only a minor effect on the overall parking capacity in the area on weekdays.

Overall, given the low existing use of the accessway and the good alternative (via Councillors Drive), it is recommended that the option of closing this access for public traffic be implemented. Figure 4 shows the swept path of the design truck using this access.

4.2.7 Pedestrian Access

Footpaths are provided on both sides of Wairere Avenue and similarly on surrounding roads. These footpaths will remain fully functional during the works. Users of the car park can traverse to the southeast to surrounding buildings or utilise the footpath on Councillors Drive to gain access onto Wairere Avenue.

A pedestrian footpath is located to the east of the site within the reserve and connects with Asquith Avenue. Pedestrian access to this footpath will be retained and will be fully separated from the site with fencing to protect pedestrians.

It is recognised that Wairere Avenue can carry moderate levels of pedestrians (particularly relating to school, Baldwin Avenue train station). There is however, no particular additional mitigation considered necessary relating to these existing pedestrians due to:

- new access / truck crossing will be created and thus no new conflict area will be created for pedestrians.
- the presence of speed humps and the nature of Wairere Avenue means truck speeds will be low.
- only the eastern end of Wairere Avenue will be used for truck access, and
- adequate pedestrian footpaths exist on Wairere Avenue which will not be altered in any way by the proposal.

4.2.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the AS1 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS1 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.2.9 Traffic Distribution

It is assumed that all site entries will be via Wairere Avenue and New North Road and vice versa for site exits.

4.2.10 Construction Traffic Truck Routes

The AS1 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout thes construction duration.

Figure 5 displays the recommended truck routes between the site and the nearest motorway. Trucks will be able to access SH16 by means of New North Road and St Lukes Road to the east of the site. Trucks travelling south can also access SH20 also via New North Road, St Lukes Road and Sandringham Road / Sandringham Road Extension.

Light vehicles are likely to use a number of routes to access the site. Some vehicles may cross the western rail line however the proposed peak of four additional traffic movements on the road network is considered to have negligible traffic effects.

4.2.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the tunnel and as such long-term access to part of Mount Albert War Memorial Reserve is required by Watercare. The 6.5m ID temporary shaft will be diminished to a 2.4m ID access shaft. The temporary site facilities and access path will be removed and the land will be reinstated.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.3 Lyon Avenue (AS2)

4.3.1 Site Description

The proposed site location for the Lyon Avenue (AS2) site is in a small park (Roy Clements Treeway) to the south of the end of Morning Star Place, Mount Albert. The site is to be accessed by means of a temporary access proposed at the western end of Morning Star Place.

Morning Star Place mainly serves residential apartment buildings. To the east and south of the site are car parking areas for the retail complex accessed from Wagener Place. To the east of the site are Mt Albert Grammar School sport fields.

4.3.2 Road Network

Morning Star Place is a private road servicing a number of residential properties. It runs in a southwest – northeast direction, connecting with St. Lukes Road in the northeast and is a cul-de-sac in the southwest. The road is a two-lane, two way street with angled parking spaces on both sides of the road along the majority of its length. There are also two speed humps situated along the length of Morning Star Place.

St Lukes Road is classified as a Regional Arterial Road in the Auckland City District Plan. It connects Balmoral Road to the east and Great North Road to the west of Morning Star Place, typically with two traffic lanes in each direction. Between New North Road and Great North Road, one traffic lane and one cycle lane are provided in each direction with additional lanes at all major intersections. No parking is permitted along its entire length.

The St Lukes Road / Morning Star Place / Morningside Drive intersection is a signalised intersection.

4.3.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for St Lukes Road. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
St Lukes Road	North of Morningside Drive	Northbound	16365	16126	1027	1579	1564	2005
		Southbound	14450	14134	1031	1136	1255	2005

Table 20: Traffic Volumes – St Lukes Road

The traffic volumes obtained on St Lukes Road are typical of a Regional Arterial Road. The high Saturday volumes relates to the close proximity of the St Lukes Shopping Centre.

Existing traffic volumes for the St Lukes Road / Morning Star Place / Morningside Drive intersection were obtained from surveys undertaken by TDG on Thursday 31 March 2011 between 3:30pm and 6:30pm and Saturday 2 April 2011 between 11:00pm and 2:00pm. Note that the weekday evening peak period is considered to be more critical than the morning peak period due to the location of the St Lukes Shopping Centre which is a major traffic generator in the area and generates minimal traffic in the morning peak.

The following table summarises the surveyed peak hour volumes:

Approach	Movement	Evening Peak (4:55 – 5:55pm)	Saturday Midday Peak (11:50am – 12:50pm)
St Lukes Road (southbound)	Left	350	429
	Through	864	861
	Right	22	25
St Lukes Road (northbound)	Left	35	15
	Through	1,043	1,034
	Right	353	414
Morning Star Place	Left	23	23
	Through	7	10
	Right	16	23
Morning Star Drive	Left	434	393
	Through	10	5
	Right	363	398

Table 21: TDG Surveyed traffic movements

Data obtained from the traffic surveys shows traffic volumes on St Lukes Road are relatively consistent with the data obtained from Council and low traffic volumes on Morning Star Place reflect the nature of this road.

4.3.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Morning Star Place and all crashes related to the St Lukes Road / Morningside Drive / Morning Star Place intersection:

A total of 31 crashes occurred at the St Lukes Road / Morningside Drive / Morning Star Place intersection including two serious injury crashes and seven minor injury crashes. No crash took place on the length of Morning Star Place.

- The major crash type at the intersection was rear end type crashes on St Lukes Road eastbound, with eight non-injury crashes.
- The two crashes resulting in serious injuries took place on St Lukes Road northbound and their causes were failure to look behind when performing a U-turn, and loss of control of vehicle of which alcohol was a factor.
- The remaining crashes that occurred at the intersection had varying crash types with no patterns apparent.

Given the time period of the search and the high traffic volumes on St Lukes Road, it is considered that the number of crashes is typical for the scope of the search. The variety of search types therefore concluded that there are no inherent safety issues within the study area. None of the crashes were related to vehicles entering / exiting Morning Star Place. The proposed works will therefore not result in any significant changes to the road safety in the vicinity.

4.3.5 Proposed Works

The AS2 site is an intermediate sized site of the Central Interceptor project. The Lyon Avenue (AS2) site will be located within a small reserve south of the end of Morning Star Place. A temporary site access onto Morning Star Place (which is a private road), is proposed to be located approximately 50m south of the turn off to the complex at 27 Morning Star Place. The site access will branch off a visitor carpark access near the pedestrian access to Roy Clements Treeway.

It is proposed that a two-way access be located over the existing car parking spaces immediately in front of the site on the western side of Morning Star Place.

4.3.6 Access and Sight Distance

Access to the site is proposed to be from an existing visitor carpark access as shown below in Photograph 5.

Photograph 5: Proposed access location for site AS2

Figure 6 shows the swept path of the design trucks entering and exiting the site.

Given the low speed nature of Morning Star Place due to the presence of speed humps and the geometry of the street, it is considered that there is adequate sight distance in both directions.

4.3.7 Pedestrian Access

Given the low traffic volumes, low traffic speeds and low pedestrian volumes, these features are considered to be satisfactory. The proposed construction site does however lie in a busy portion of the Roy Clements Treeway which has pedestrian connections to both the St Lukes Mega Centre and a private access onto Morning Star Place. As such, a temporary pedestrian diversion will be established to provide alternatives to these existing pedestrian links.

4.3.8 Traffic Generation

Trip generation information used for this assessment is as described in the AEE. The following table below summarises the trip generation information for Lyon Avenue (AS2) as a worst case scenario for all small and intermediate sites.

	Activity	Vehicle Type	Assumptions	Peak vehicles per Day
Stage 1 – Diaphragm Wall Construction	Shotcrete delivery	6m3 concrete truck	Total volume of shotcrete at AS2 = 1,280m3	16
			Intermittent over 2-3 week period	
	Labour	Standard vehicle	Constant duration of project	5
	Site supervision	Standard vehicle	As needed	2
	Maintenance	3-axle truck		1
	Steel delivery	Semi-trailer truck with flatbed	Intermittent over 2-3 week period and does not occur on the same day as concrete delivery	
Stage 2 – Shaft Excavation	Spoil removal	15m3 spoil removal truck	Bulk spoil volume AS2 = 9,000m3	27
			Average excavation rate of 16m per day	
			Constant for 58 week period	
	Labour	Standard vehicle	Constant duration of stage 2	4
	Site supervision	Standard vehicle	Constant duration of stage 2	2
	Other	3-axle truck	As needed	1

Table 22: Traffic Generation – AS2

Based on the table above, it is estimated that the site will generate the following trips per day and per hour during the peak construction season (assume 30% of light vehicles trips occurring during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS2 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected. Of note the internal roads within Morningside Place gave been designed to accommodates single unit trucks for servicing the local apartments. Accordingly the existing environment can cater for the expected temporary truck movements associated with the works.

4.3.9 Traffic Distribution

It is assumed that inbound and outbound traffic will be distributed evenly between the north and the south of the site via the St Lukes Road / Morningside Drive / Morningside Place intersection.

4.3.10 Construction Traffic Truck Routes

The AS2 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 7 displays the recommended truck routes between the site and the nearest motorway. Trucks will be able to access SH16 by means of St Lukes Road / Western Springs (by way of traffic signals) on and off-ramps to the north. SH20 is accessible via St Lukes Road and Sandringham Road / Sandringham Road Extension.

4.3.11 Traffic Generation during Normal Operation

This site is proposed to provide long-term maintenance access to the tunnel and as such full maintenance access to part of these properties is required. The temporary site facilities and access path will be removed and the land will be reinstated.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month. It is proposed to have a permanent maintenance access in the same location as the temporary access with a lockable gate. Maintenance vehicles will park on-site. The access design will be negotiated with landowners at detailed design stage.

4.4 Haverstock Road (AS3)

4.4.1 Site Description

The proposed site location for the AS3 site is on the southern side of Haverstock Road, Sandringham.

The site is located at 118-120 Mt Albert Road, on open land owned by the Crown Research Institute Plant & Food Research. The site does not have any street frontage. Land uses on Haverstock Road and surrounding roads are largely residential in nature. The Mt Albert Science Centre (MASC) is located on the same property to the west of the site with access from Hampstead Road.

The site is proposed to be accessed by one of the three following temporary access options: via Haverstock Road, via Hampstead Road or via Camden Road.

4.4.2 Road Network

Haverstock Road is classified as a Local Road in the Auckland City District Plan. It runs in a northwest – southeast direction in the vicinity of the site, and forms a loop road off Fowlds Avenue. Haverstock Road is a two-lane, two way street with on-street parking available on both sides of the road along its entirety.

Haverstock Road forms a priority-controlled intersection with Sandringham Road in the southeast, with traffic on Sandringham Road having priority. Traffic on Haverstock Road is controlled by “Give Way” signage and associated markings. A right turn bay is provided for right-turning traffic on Sandringham Road onto Haverstock Road. To the northwest, Haverstock Road becomes Hazelmere Road at its intersection with Kerr Street.

Camden Road is defined as a Local Road in the Auckland City District Plan. It is a two-way unmarked cul-de-sac road of approximately 6.1m wide and 105m in length. It is intended to provide primarily for property access. Footpaths are provided on both sides of the road separated by wide berms and kerbside parking is permitted on the southern side of the road for some 60m. Parking is restricted for the remainder of the road by means of dotted yellow lines.

Hampstead Road is defined as a Local Road in the Auckland City District Plan. It is a two-way unmarked cul-de-sac road of approximately 7.5m wide and 130m in length. It is intended to provide primarily for property access including the main access to the MASC located at the cul-de-sac. Footpaths separated by wide berms and unmarked on-street parking are provided on both sides of the road.

4.4.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Haverstock Road. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below:

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Haverstock Road	Sandringham Rd to Duncan Ave	Eastbound	1150	1130	93	108	109	2009
		Westbound	950	950	121	88	67	2009

Table 23: Traffic Volumes- Haverstock Road

Data obtained shows that traffic volumes on Haverstock Road are typical of a Local Road.

There is no available data for Camden Road or Hampstead Road.

4.4.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along Haverstock Road from the intersection with Sandringham Road to 200m west of the site access, the full length of Camden Road and Hampstead Road, and Euston Road for 100m past these side roads.

The search included all crashes related to the intersections with Haverstock Road within the search area:

A total of 40 crashes including eight minor injury crashes were found in the search, but no crashes took place within 100m of the proposed site access.

- A major cause of crashes on Haverstock Road were vehicles entering Haverstock Road from Duncan Avenue failing to give way to through traffic, with 14 crashes including four minor injury crashes.
- Eight non-injury crashes involved vehicles on Haverstock Road hitting a parked vehicle (four crashes in each direction). Alcohol or speed was a factor in six of the eight crashes.
- Three rear end type crashes occurred on Sandringham Road northbound due to following too closely.

- There were no historic crashes on Camden Road or Hampstead Road, one crash occurred on Euston Road when an oncoming vehicle collided with the opened door of a stationary vehicle.

The proposed truck route to / from site will be directly along Haverstock Road onto Sandringham Road. If site access is gained from Camden Road or Hampstead Road, trucks will be advised to travel via Euston Road, Mount Albert Road and onto Sandringham Road / Sandringham Road Extension. It is unlikely that site traffic will access Haverstock Road from Duncan Avenue. It is therefore considered unlikely that the site traffic will have any adverse effects on the existing safety condition of surrounding roads. The proposed truck route will reinforce this.

4.4.5 Proposed Works and Work Site Layout

The AS3 site is a key connection location of the Central Interceptor project with connections between the main tunnel corridor and Watercare's CSO at Haverstock Road. The site layout of the Haverstock Road (AS3) site can be referred to within the AEE Drawing Set. The site will be fully enclosed by fencing. Facilities such as an office and a workshop will be located within the site perimeters. A wheel wash is intended to be located across the access road approximately 50m from the egress onto Haverstock Road.

An internal path will be formed within the site circulating the works and is proposes to operate in an anti-clockwise direction.

Three possible site access locations have been investigated and they are as follows:

- a two-way access located over a section between 96 and 98 Haverstock Road.
- a two-way access to be formed at the cul-de-sac of Camden Road.
- a two-way access using the existing formed MASC access from the end of Hampstead Road.

Each of these access options will be discussed in the following sections of this report.

4.4.6 Access and Sight Distance

4.4.6.1 Access via Haverstock Road

A possible two-way access to the site may be gained through the eastern side of a section (currently unoccupied) between 96 and 98 Haverstock Road. The proposed access is shown below in Photograph 6.

Photograph 6: Access location for site AS3 – Haverstock Road option

Due to the narrow nature of Haverstock Road in the vicinity of the proposed site, it is suggested that temporary parking restrictions be installed to the east of the proposed access to allow for trucks to enter and exit the site as shown in Figure 8 attached. It is also recommended that kerb-side car parking spaces on the southern-side of Haverstock Road within 50m of Sandringham Road be temporarily removed during the works. Figure 8 shows the swept path of the design truck using the Haverstock access.

Sight distance is satisfactory in both directions given the speed environment (40 - 50 kph).

4.4.6.2 Access via Camden Road

The possibility to access the site from Camden Road has been investigated. Access to the site may be gained from the end of the cul-de-sac on Camden Road directly across from the carriageway. The proposed access is shown below in Photograph 7.

Photograph 7: Access location for site AS3 – Camden Road option

Camden Road is narrow in nature with on-street parking already restricted on the northern side of the road. With parked vehicles on-street, the carriageway is unlikely to be wide enough for two-way movement and opposing traffic will therefore have to give way to each other.

If Camden Road is used to access the site, the existing kerbside parking will also need to be removed. Advanced signage or notice should be provided for local residents to reduce on-street parking where possible. However, some on-street parking should be maintained for local residents. Indented parking utilising the existing wide berms on either side of the road may need to be considered.

Site vehicles must exit onto Camden Road in a forward manner.

Sight distance is satisfactory in both directions given the speed environment (40 - 50 kph).

4.4.6.3 Access via Hampstead Road

The possibility to access the site from Hampstead Road has been investigated. Access to the site would utilise the existing access to MASC at the cul-de-sac on Hampstead Road directly across from the carriageway. The proposed access is shown below in Photograph 8.

Photograph 8: Access location for site AS3 – Hampstead Road option

A site access from Hampstead Road will require a longer traveling distance along the southern side of the Crown Research land than the other options.

Hampstead Road is also horizontally restricted with its narrow width and on-street parking on both sides of the road. On-site observations suggest that demand for kerbside parking on Hampstead Road can be high. With parked vehicles on both sides of the road, the carriageway is only wide enough for one-way movement and opposing traffic therefore has to give way to each other. If site access is gained from Hampstead Road, it is recommended that kerbside parking be removed on one side of the road.

Sight distance is considered to be adequate in both directions given the speed environment (40 - 50 kph).

4.4.6.4 Preferred Access

Site access via Haverstock Road would be the most direct hence the preferable access option for the AS3 site. Should Haverstock Road become unavailable both Hampstead Road and Camden Road are available (subject to localised on-street parking restrictions).

4.4.7 Pedestrian Access

Footpaths are provided on both sides of Haverstock Road, Camden Road and Hampstead Road as well as other roads in the surrounding areas. They will remain fully functional during the works.

4.4.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the AS3 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS3 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. While heavy vehicle movements are proposed to be controlled via compulsory truck routes, light vehicles will travel on a number of routes to and from the site. The peak hour light vehicle movement for both stages only add an additional four movements and therefore any safety or delay effects as a result of these additional vehicles are considered to be indiscernible. Minimal effects on the surrounding road network are therefore expected.

4.4.9 Traffic Distribution

It is assumed that inbound and outbound traffic will be distributed evenly between the north and the south of the site. All site entries will be via Haverstock Road and Sandringham Road northbound or southbound depending on the origin of site vehicles. Site exits travelling northward are assumed to travel via Haverstock Road and Sandringham Road northbound. While site exits travelling southward will be recommended to take Euston Road and Mount Albert Road before turning right into Sandringham Road Extension at a signalised intersection.

4.4.10 Construction Traffic Truck Routes

The AS3 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 9 displays the recommended truck routes between the site (Haverstock Road access) and the nearest motorway. Trucks will be able to access SH16 by means of Sandringham Road and St Lukes Road, or access SH20 via Sandringham Road/Sandringham Road extension. Vehicles travelling towards SH20 will be required to perform an opposed right turn onto Sandringham Road. As such, it is recommended that these vehicles use Euston Road to travel to Mt Albert Road (turning left) and then turn right into Sandringham Road Extension at the signalised intersection.

It is noted that kerb-side parking is permitted on both sides of the road on Haverstock Road and the aisle width near the intersection with Sandringham Road can be restricted by the parked cars. It is recommended that temporary parking restrictions should be in place on Haverstock Road near this intersection to ensure heavy vehicles can manoeuvre safely. It is recommended that for a distance of approximately 50m from Sandringham Road, the parking on the southern side of Haverstock Road be temporarily removed. Due to driveways and existing angled parking (which will not be removed), the removal of on-street parking is equivalent to approximately four cars. This is not considered significant and parking demand will be simply shifted west along Haverstock Road.

The preferred truck routes for the Hampstead Road and Camden Road accesses will be similar to the truck route previously discussed, where vehicles will travel to the site via Sandringham Road and Euston Road onto the side roads and leave the site via Euston Road and Mount Albert Road before reaching Sandringham Road / Sandringham Road Extension.

4.4.11 Traffic Generation during Normal Operation

This site is proposed to provide long-term maintenance access to the tunnel and as such full maintenance access to part of these properties is required. The site access road is proposed to be retained for long-term maintenance access. The temporary site facilities will be removed and the land will be reinstated.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.5 Walmsley Park (AS4)

4.5.1 Site Description

The proposed site location for the AS4 site is in the southern corner of Walmsley Park, situated to the west of Sandringham Road Extension, Mount Roskill. The proposed site access is by means of a temporary access road to the northeast of the site over the stream, onto Sandringham Road Extension just north of the intersection with Gilford Avenue.

The site has frontage on Sandringham Road Extension. The site is bordered by the existing stream to the northeast. Walmsley Park continues to the north of the site and residential properties border the south-western boundary.

4.5.2 Road Network

Sandringham Road Extension is classified as a District Arterial Road in the Auckland City District Plan. It runs in a north – south direction in the vicinity of the site, linking Mount Albert Road with Stoddard Road. Sandringham Road Extension has a posted speed limit of 50kph and is a two-

lane, two way street in the vicinity of the site. A pedestrian crossing is located along the site frontage. On-street parking is generally available on both sides of Sandringham Road, except on either side of the pedestrian crossing and the eastern side of Sandringham Road where it intersects with Gilford Avenue.

4.5.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Sandringham Road Extension. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Sandringham Road Extension	Mt Albert Rd to Sheppard Ave	Northbound	7654	7392	736	467	494	2009
		Southbound	7673	7673	433	696	491	2009

Table 24: Traffic Volumes – Sandringham Road Extension

The traffic volumes obtained on Sandringham Road Extension are typical of a District Arterial Road. The slightly higher weekday daily and peak hour volumes suggest that it is a major commuter route.

4.5.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along Sandringham Road extending 100m from the subject site in each direction. The search included all crashes related to the intersections of Gilford Avenue and O'Donnell Avenue with Sandringham Road Extension:

A total of 14 crashes including 3 with minor injuries were found in the search.

- Four non-injury crashes were rear-end type crashes on Sandringham Road Extension, caused by vehicles following too closely.
- Two of the three minor injury crashes were a result of vehicles turning right onto Sandringham Road Extension northbound failing to give way to southbound through traffic.
- Five rear-end crashes took place on O'Donnell Avenue eastbound approaching the intersection with Sandringham Road Extension.
- The remaining crashes occurred on Sandringham Road Extension with varying causes, no apparent patterns can be drawn.

Given the high traffic volumes on Sandringham Road Extension, it is considered that the number of crashes is typical for the scope of the search. The variety of search types therefore indicates that there are no inherent safety issues within the study area. The location of the proposed access is of a reasonable distance from the existing pedestrian crossing and it is therefore considered that the proposed works will not have any significant effects on the existing safety conditions of the area.

4.5.5 Proposed Works and Work Site Layout

The AS4 site is a key connection location of the Central Interceptor project with connections between the preferred tunnel corridor and Watercare's Branch 9 Trunk sewer. The proposed location and site layout of AS4 can be referred to within the AEE Drawing Set. The site will be located within the southern corner of Walmsley Park. A two-way access road is proposed to be constructed to provide site access from Sandringham Road Extension opposite Gilford Avenue.

The access road will cross the stream via a temporary access bridge and join Sandringham Road Extension on the west side of the existing pedestrian path in the park. The access road will form a loop within the site that circles the access shaft and drop shaft. It operates in a clockwise motion only to enable entry and exit manoeuvres from the site to be carried out in a forward direction.

Temporary removal of some kerb-side parking may be required adjacent to the proposed site access to enable safe manoeuvring in and out of the site by heavy vehicles.

4.5.6 Access and Sight Distance

The proposed access leading to the site is shown below in Photograph 9.

Photograph 9: Proposed access location for site AS4

It is suggested that temporary yellow "no-parking" lines be painted on the western side of Sandringham Road Extension (10m from either side of the entrance) immediately adjacent to the site access to enable safe manoeuvring in and out of the site by heavy vehicles. Figure 10 shows the swept path of a design truck using the proposed access.

Observations from on-site show that sight distance is satisfactory in both directions. Given Sandringham Road Extension is a District Arterial Road with relatively high traffic volumes, it is recommended that site access be limited to left-in / left-out only. The access has been designed to be at least 30m to the north of the existing pedestrian crossing. The access location is considered to be an appropriate solution due to the following:

- the access is left in/ left out only
- the access will only generate nine traffic movements during the peak hour

- the access is remote from the pedestrian crossing on Sandringham Road
- the access is designed as a driveway i.e. pedestrian priority
- any traffic control required during school times can be determined at detailed design stage.

4.5.7 Pedestrian Access

Footpaths are provided on both sides of Sandringham Road Extension and on roads within the surrounding network which provide adequate pedestrian accessibility around the site. Where any sections of footpaths within Walmsley Park are affected by construction, appropriate fencing and signage will be in place to redirect foot traffic within the Park to maintain access.

4.5.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the AS4 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS4 will generate a peak of no more than 68 vehicle movements, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.5.9 Traffic Distribution

It is assumed that inbound and outbound traffic will be distributed evenly between the north and the south of the site via Sandringham Road Extension for standard vehicles. For heavy vehicles, all site entries are assumed to be travelling from SH20 to the south via Maioro Street interchange. Heavy vehicles exit the site and travel on Sandringham Road Extension northbound, onto Mount Albert Road and Dominion Road and access SH20 via Dominion Road interchange.

4.5.10 Construction Traffic Truck Routes

The AS4 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 11 displays the recommended truck routes between the site and the nearest motorway. Trucks will be able to access the motorway network via the Sandringham Road Extension interchange with SH20 to the south. Upon leaving the site, it is recommended that heavy vehicles be restricted to a left out only due to the considerably high traffic volumes on Sandringham Road Extension.

4.5.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the tunnel and as such long-term access to part of Walmsley Park is required by Watercare. The site layout post construction can be found within the AEE Drawing Set.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month. The temporary site facilities will be removed and the land will be reinstated. The access bridge over the stream is proposed to remain post construction.

4.6 May Road (WS2)

4.6.1 Site Description

The proposed site location for the WS2 site is in a vacant piece of land between Roma Road and Marion Avenue, Mount Roskill. The site has no frontages on these roads. It is proposed that the site will be accessed via an existing driveway onto Roma Road.

The subject site is zoned Business Activity 4. At present, the subject site is vacant. Land uses are mainly residential to the south and west of the site. Roma Road is occupied by a large food bulk store (Gilmours) and some office facilities.

4.6.2 Road Network

May Road is classified as a Collector Road in the Auckland City District Plan. It runs in a south-west / north-east direction, linking Mount Albert Road in the north with Richardson Road in the south. May Road has a posted speed limit of 50kph and is a two-lane, two-way street in the vicinity of the site. On-street parking is available on both sides of the road.

Roma Road is classified as a Local Road in the Auckland City District Plan. It is a cul-de-sac road that runs in a north-west / south-east direction, connecting with May Road at the south-eastern end. Roma Road is a two-lane, two way street with parking available on both sides of the carriageway along its length. At the time of site inspection, Roma Road was undergoing upgrades; however the configuration of the carriageway is expected to remain.

The May Road / Roma Road intersection is a priority-controlled intersection. Traffic on Roma Road is controlled by “Give Way” signage with associated markings. A right-turn bay onto Roma Road is provided on May Road.

4.6.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for May Road. The ADT in vehicles per day (vpd) and the peak period volumes in vehicles per hour (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
May Road	Roma Rd to Glynn St	Northbound	5599	5296	692	303	345	2009
		Southbound	5547	5547	247	729	339	2009

Table 25: Traffic Volumes- May Road

The traffic volumes observed on May Road are typical of a Collector Road. The higher peak hour volumes show that May Road operates as a commuter route.

There is no Council data available for traffic flows along Roma Road.

Given that WS2 is a major scale site and its traffic generation is expected to be greater than the majority of the other sites, additional traffic surveys have been carried out. The following intersections are on route to the nearest motorway from site and are therefore of interest as part of the traffic investigation:

- May Road / Roma Road
- May Road / Stoddard Road / Denbigh Avenue
- Denbigh Avenue / Dominion Road
- Dominion Road / SH20.

Traffic surveys for the above intersections have been undertaken by TDG on Wednesday 3 August 2011 7:00am - 9:00am and 3:00pm - 6:00pm, and Saturday 6 August 2011 between 11:00pm and 2:00pm. The following tables summarise the surveyed peak hour volumes:

Approach	Movement	Morning Peak (7:45 - 8:45am)	Evening Peak (4:45 – 5:45pm)	Saturday Midday Peak (11:30am - 12:30pm)
May Road (northbound)	Left	38	5	4
	Through	758	423	573
May Road (southbound)	Through	232	928	478
	Right	162	31	59
Roma Road	Left	29	163	58
	Right	6	44	4

Table 26: TDG Surveyed traffic movements – May Road / Roma Road

Approach	Movement	Morning Peak (7:45 - 8:45am)	Evening Peak (4:45 – 5:45pm)	Saturday Midday Peak (11:30am - 12:30pm)
Denbigh Avenue (northbound)	Left	152	195	143
	Through	215	328	283
	Right	37	13	46
Denbigh Avenue (southbound)	Left	98	123	143
	Through	248	115	221
	Right	116	149	169
Dominion Road (eastbound)	Left	195	580	178
	Through	509	511	502
	Right	162	30	53
Dominion Road (westbound)	Left	17	7	28
	Through	422	516	448
	Right	30	100	96

Table 27: TDG Surveyed traffic movements – Dominion Road / Denbigh Avenue

Approach	Movement	Morning Peak (7:45 - 8:45am)	Evening Peak (4:45 – 5:45pm)	Saturday Midday Peak (11:30am - 12:30pm)
May Road (northbound)	Left	79	130	72
	Through	509	261	305
	Right	316	274	275
May Road (southbound)	Left	16	8	34
	Through	212	496	338
	Right	85	159	141
Stoddard Road	Left	33	34	183
	Through	185	157	369
	Right	111	245	98
Denbigh Avenue	Left	161	444	123
	Through	172	479	304
	Right	42	72	63

Table 28: TDG Surveyed traffic movements – May Road / Denbigh Avenue

Approach	Movement	Morning Peak (7:45 - 8:45am)	Evening Peak (4:45 – 5:45pm)	Saturday Midday Peak (11:30am - 12:30pm)
Dominion Road (northbound)	Left	32	9	36
	Through	996	765	1220
	Right	725	348	328
Dominion Road (southbound)	Left	559	367	429
	Through	218	449	671
	Right	12	11	0
SH20 eastbound	Left	9	4	12
	Through	0	0	0
	Right	31	44	51
SH20 westbound	Left	246	755	292
	Through	0	0	0
	Right	397	953	377

Table 29: TDG Surveyed traffic movements – Dominion Road / SH20

The traffic effects of the proposed works on surrounding intersections will be examined and discussed later in this report.

4.6.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Roma Road and May Road extending 100m in each direction from the proposed May Road access.

A total of nine crashes including three with minor injuries were found in the search, with seven crashes occurring at the Roma Road / May Road intersection and two crashes occurring on May Road.

- Three crashes involved failure to give way when turning right into / out of Roma Road from / to May Road (includes one truck failing to give way).
- Two loss of control crashes occurred on May Road midblock.

It is considered that the number of crashes within the area of the search is low given the extent and time period of the search. There are no inherent safety issues within the study area.

4.6.5 Proposed Works and Work Site Layout

The May Road (WS2) site is one of the three major scale sites of the Central Interceptor project required for launch / retrieval of the TBM for construction of the main tunnel. The proposed location and site layout of WS2 can be referred to within the AEE Drawing Set. The subject site is located within the western side of a vacant piece of land between Roma Road and Marion Avenue.

A site access onto Roma Road is proposed over a narrow strip of land between 44-52 Roma Road and 54-60 Roma Road. Temporary removal of some kerb-side parking on the southern side of Roma Road at and adjacent to the proposed site access may be required. It is proposed that this access will remain as a two-way access post construction during normal operation.

An internal access road will form a loop within the site around the ellipse temporary shaft. It will operate in a clockwise motion before reaching the site egress onto Roma Road.

4.6.6 Access and Sight Distance

All truck and light vehicle movements are proposed to occur via Roma Road. The proposed location for the Roma Road access road is shown below in Photograph 10. The access road is proposed to run parallel to the neighbouring building on the east side for some 80m before reaching Roma Road, in the same general direction as May Road to the east. Figure 12 shows the swept paths of the design trucks using the Roma Road access. As can be seen, a total of approximately 10m of on-street parking will be required to be removed to accommodate the swept paths of trucks to and from the site.

Observations of the site show parking at the northern end of Roma Road is well utilised mainly as a result of staff parking at the Foodstuffs distribution centre. Despite this however, there is considered to be ample room to accommodate any displaced parking further south along Roma Road.

Observations from on-site indicate that there is satisfactory sight distance in both directions.

Photograph 10: Proposed Roma Road access location for site WS2

4.6.7 Pedestrian Access

Footpaths are provided on both sides of May Road and Roma Road and they will continue to serve pedestrians during construction. It is considered that adequate sight distance is provided to make sure the access road is free of traffic before crossing.

4.6.8 Traffic Generation

The expected trip generation at this site is as per the trip generation information used for WS1. The WS2 site will be assessed as a potential launching or receiving site for the Central Interceptor main tunnel TBM. Based on the information provided in section 4.1.9, it is estimated that the site will generate the following trips per day and per hour during the peak construction season (assuming 30% of light vehicles trips occurring during the peak hour):

Approximate traffic generation for Stage One (Shaft Wall construction):

- 18 standard vehicle movements per day (six vehicle movements during peak hour).
- 64 heavy vehicle movements per day (average of six heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation for Stage Two (Shaft excavation and support):

- 60 standard vehicle movements per day (18 vehicle movements during peak hour).
- 104 heavy vehicle movements per day (average of nine heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed works will generate a peak of around 164 vehicle movements per day, with 27 vehicle movements during the peak hour.

4.6.9 Traffic Distribution

In terms of the inbound and outbound distribution of vehicle movements, the light vehicle movements are likely to be tidal due to staff arrivals and departures (predominantly inbound in the morning and outbound during the evening) while the heavy-vehicle movements will be relatively even throughout the day. In terms of the distribution, we have assumed the following:

- 80% inbound / 20% outbound distribution for light vehicles during the morning peak hour and vice versa during the evening peak hour.
- 50% inbound / 50% outbound distribution for heavy vehicles during both peak hours.
- 50% inbound / 50% outbound distribution for light and heavy vehicles during the Saturday peak hour.

It is assumed that all site entries will be coming from SH20 motorway via Dominion Road off ramp, Dominion Road, Denbigh Avenue, May Road and Roma Road, and vice versa for all site exits.

It is considered that these assumptions may change depending on which road provides the quickest route, generally providing a less congested network overall.

4.6.10 Construction Traffic Truck Routes

The WS2 site is proposed to be a major scale construction site, with a significant number of truck volumes expected to access the site throughout the construction duration. This site will be a major tunnelling site with proposed connections to three other sites as well as a potential TBM launch site.

Figure 13 displays the recommended truck routes between the site and the nearest motorway. Trucks will be able to access SH20 by means of Denbigh Avenue to the north and the Dominion Road interchange and as such it is considered an ideal site from a traffic engineering point of view.

It is assumed that truck tracking curves for large semi-trailer trucks will be run for the proposed access when detailed design is undertaken by the contractor.

4.6.11 Impacts on Local Road network - SIDRA Intersection Modelling

The traffic effects of the proposed works on the surrounding intersections have been modelled using SIDRA, an industry standard tool for assessing the performance characteristics of intersections. Assessments of the existing weekday AM and PM and Saturday midday peak hours were carried out.

The results presented in this report include the 95th percentile queue length, average delay, and level of service (LOS). LOS is measured as a function of delay; according to the SIDRA manual LOS A and B are very good and indicative of free-flow conditions; C is good; D is acceptable; and E and F are indicative of congestion. The intersection results presented below give the worst 95th percentile queue, while the average delay and LOS presented is the average of all the vehicles.

The information provided indicates that the second stage will generate a greater volume of heavy vehicle movements (as shown in Section 4.1.9). Therefore, only the second stage has been modelled. This will present a worst case scenario.

4.6.11.1 May Road / Roma Road

The SIDRA results for the May Road / Roma Road intersection during the three peak hours modelled are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
May Road NB	1.6	A	29.5	0.2	A	10.8	0.4	A	16.9
May Road SB	6.2	A	11.5	0.3	A	1.0	1.2	B	2.8
Roma Road	49.4	E	12.3	20.6	C	22.5	12.7	B	3.6
Intersection	**4.5**	**NA**	**29.5**	**3.0**	**NA**	**22.5**	**1.4**	**NA**	**16.9**

Table 30: Model Results for May Road / Roma Road – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
May Road North	1.8	A	30.2	0.3	A	10.9	0.5	A	17.1
May Road South	7.0	C	14.4	0.4	A	1.5	1.5	B	3.7
Roma Road	52.3	F	16.6	21.0	C	26.0	13.5	B	5.0
Intersection	**5.4**	**NA**	**30.2**	**3.3**	**NA**	**26.0**	**1.8**	**NA**	**17.1**

Table 31: Model Results for May Road / Roma Road – Future conditions

It can be seen from these results that the Roma Road approach currently experiences some congestion during the morning peak period. Roma Road LOS will drop from E to F with the proposed traffic generation. However, it can be seen that the impact on Roma Road and the intersection operation as a result of the proposed works is minimal with a maximum increase in delay of 2.9 seconds, 0.4 and 0.8 second in the AM peak, PM peak and Saturday midday peak respectively and a maximum increase in queue length of 3.5m (one vehicle) in the PM peak. As such, the impact can be considered less than minor.

Due to the low number of additional movements (maximum of 27 additional movements during Stage 2), and the direction of travel for trucks (right in, left out), there is not considered to be any discernible impact on safety or efficiency of the surrounding intersections.

4.6.11.2 May Road / Denbigh Avenue / Stoddard Road

The SIDRA results for the May Road / Denbigh Avenue / Stoddard Road intersection during the three peak hours modelled are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
May Road NB	32.1	C	163	74.2	E	205.6	49.0	D	127.6
May Road SB	39.6	D	62.5	76.8	E	251.4	46.2	D	115.7
Denbigh Avenue	36.7	D	86	58.3	E	339.5	41.2	D	133.0
Stoddard Road	50.7	D	65	72.5	E	134.5	63.1	E	242.5
Intersection	**37.4**	**D**	**163**	**68.8**	**E**	**339.5**	**50.7**	**D**	**242.5**

Table 32: Model Results for May Road / Denbigh Avenue / Stoddard Road – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
May Road NB	32.8	C	170.9	70.7	E	217.2	60.4	E	160.6
May Road SB	39.6	D	62.5	80.4	F	261.9	46.2	D	115.7
Denbigh Avenue	35.1	D	85.2	63.5	E	363.6	41.0	D	135.4
Stoddard Road	50.7	D	65	87.1	F	155.4	63.6	E	242.5
Intersection	**37.4**	**D**	**170.9**	**73.0**	**E**	**363.6**	**54.0**	**D**	**242.5**

Table 33: Model Results for May Road / Denbigh Avenue / Stoddard Road – Future conditions

It can be seen from these results that at present, this signalised intersection already experiences some congestion during the afternoon peak with a LOS of E for most approaches. Model results show that the proposed traffic generation will change the LOS during the peak PM period for the May Road southbound approach and Stoddard Road approach from a LOS E to LOS F. During the weekend midday peak period, the May Road northbound approach will also change from a LOS D to LOS E. The maximum increases in delay are 0.7 seconds, 14.6 seconds and 11.4 seconds in the AM peak, PM peak and Saturday midday peak respectively and a maximum increase in queue length of 24.1m (four vehicles) in the PM peak. As such, the impact can be considered no more than minor.

4.6.11.3 Denbigh Avenue / Dominion Road

The SIDRA results for the Dominion Road / Denbigh Avenue intersection during the three peak hours modelled are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Denbigh Road EB	12.4	B	30.7	10.2	B	16.4	10.9	B	28.5
Denbigh Road WB	9.1	A	14.7	12.2	B	31.4	11.1	B	26.2
Dominion Road NB	8	A	37.1	10.6	B	48.3	8.9	A	36.7
Dominion Road SB	8.8	A	29.9	7.4	A	33.5	9.1	A	37.6
Intersection	**9.3**	**A**	**37.1**	**10.1**	**B**	**48.3**	**9.9**	**A**	**37.6**

Table 34: Model Results for Denbigh Avenue / Dominion Road – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Denbigh Road EB	12.8	B	32.7	10.7	B	18.1	11.2	B	30.9
Denbigh Road WB	9.2	A	14.9	12.8	B	33.0	11.4	B	27.2
Dominion Road NB	8.0	A	37.1	10.7	B	48.7	8.9	A	36.9
Dominion Road SB	9.0	A	30.8	7.4	A	34.5	9.4	A	39.1
Intersection	**9.5**	**A**	**37.1**	**10.3**	**B**	**48.7**	**10.1**	**B**	**39.1**

Table 35: Model Results for Denbigh Avenue / Dominion Road – Future conditions

Model results show that this intersection currently provides a very good LOS. The overall intersection will have a LOS B from a LOS A during the weekend midday peak period with the proposed traffic generation. However, it can be seen that the impact on the intersections operation as a result of the proposed works is minimal with a maximum increase in delay of 0.6 seconds during the peak periods and a maximum increase in queue length of 1.5m (less than one vehicle). Overall, the impact can be considered less than minor.

4.6.11.4 Dominion Road / SH20

The Dominion Road / SH20 intersection has been modelled as two intersections – Dominion Road / SH20 WBD and Dominion Road / SH20 EBD. Their SIDRA results for the three peak hours are shown in the following tables.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Dominion Road NB	29.7	C	140.6	25.7	C	43.1	24.4	C	50.8
Dominion Road SB	15.0	B	24.9	16.3	B	61.1	12.7	B	33.5
SH20 WB off-ramp	25.9	C	41.3	21.4	C	85.0	20.3	C	28.9
Intersection	**27.0**	**C**	**140.6**	**21.2**	**C**	**85.0**	**20.1**	**C**	**50.8**

Table 36: Model Results for Dominion Road / SH20 WBD Off-ramp – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Dominion Road NB	29.7	C	140.6	27.4	C	45.0	24.2	C	50.8
Dominion Road SB	15.0	B	24.9	17.2	B	62.6	12.7	B	33.5
SH20 WB off-ramp	26.0	C	43.7	20.6	C	83.8	20.4	C	30.3
Intersection	**27.1**	**C**	**140.6**	**21.2**	**C**	**83.8**	**20.1**	**C**	**50.8**

Table 37: Model Results for Dominion Road / SH20 WBD Off-ramp – Future conditions

Model results show that the Dominion Road / SH20 westbound off-ramp intersection currently operates at an excellent LOS. Traffic impact caused by the proposed works is expected to be minimal with negligible increase in delay of 0.9 seconds during the peak periods and a maximum increase in queue length of 2.4m (less than one vehicle). Less than minor effects are therefore anticipated and any additional traffic can be absorbed by the capacity of the intersection.

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Dominion Road NB	19.7	B	249.1	19.9	B	237.2	17.6	B	131.4
Dominion Road SB	36.1	D	73.2	32.2	C	111.2	24.6	C	57.5
SH 20 EB off-ramp	33.5	C	4.3	36.4	D	5.8	24.7	C	5.1
Intersection	**25.0**	**C**	**249.1**	**25.2**	**C**	**237.2**	**20.7**	**C**	**131.4**

Table 38: Model Results for Dominion Road / SH20 EBD Off-ramp – Existing conditions

Approach	Weekday AM Peak			Weekday PM Peak			Weekend Midday Peak		
	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)	Average Delay (s)	LOS	95th % Queue (m)
Dominion Road NB	21.0	C	265.7	20.4	C	243.1	17.8	B	135.8
Dominion Road SB	36.2	D	75.7	32.0	C	111.2	24.4	C	57.5
SH 20 EB off-ramp	33.6	C	4.3	36.4	D	5.8	24.8	C	5.1
Intersection	**25.8**	**C**	**265.7**	**25.4**	**C**	**243.1**	**20.7**	**C**	**135.8**

Table 39: Model Results for Dominion Road / SH20 EBD Off-ramp – Future conditions

It can be seen that the Dominion Road / SH20 eastbound off-ramp intersection experiences slight congestion during the morning and evening peak periods and reasonably long queuing distance for the Dominion Road northbound approach. Model results show that although the proposed traffic generation changes the LOS of Dominion Road northbound approaches from LOS B to LOS C during the weekday peak periods, a maximum increase in delay of 1.3 seconds and a maximum increase in queue length of 16.6m (three vehicles) in the morning peak. As such, the impact can be considered no more than minor.

4.6.12 Traffic Generation during Normal Operation

Post construction, the WS2 site will provide long-term maintenance access to the tunnel and an air treatment facility will be established. As such a two-way site maintenance access is proposed over the construction egress onto Roma Road. The site layout post construction can be found within the AEE Drawing Set.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per week.

4.7 Keith Hay Park (AS5)

4.7.1 Site Description

The Keith Hay Park (AS5) site is proposed to be located at No. 20/22 Gregory Place as well as within Keith Hay Park on the north-eastern side of the Cameron Pool Leisure Centre (Cameron Pool) at 53 Arundel Street, Mount Roskill. The subject site will be served through No. 49 and 51 Arundel Street as well as an existing pedestrian / cycling track along the property boundary of Keith Hay Park parallel to the creek onto Rainford Street (for micro tunnelling only).

The subject site is zoned both Open Space 3 and Residential 5 and 6a under the Auckland City District Plan. Apart from the Cameron Pool immediately to the south of the site, surrounding areas are generally occupied by residential properties, as the Keith Hay Park itself.

4.7.2 Road Network

Rainford Street, Arundel Street and Gregory Place are all classified as a Local Road in the Auckland City District Plan.

Rainford Street is a two-lane, two-way cul-de-sac road of approximately 120m in length with on-street parking available on the north-eastern side of the carriageway only. Rainford Street provides vehicular access mainly to residential properties and to the public car parking area for park users on the southern side of street.

Rainford Street forms a priority-controlled intersection with Stamford Park Road in the east, with traffic on Rainford Road controlled by “Give Way” signage and associated marking. A timber bridge of 17.5m in length and 4.2m wide is located at the western end of Rainford Street, currently providing pedestrian and cyclist access to Keith Hay Park over the creek. It is anticipated that this bridge will be used as a temporary access for this site, for the micro tunnelling.

Arundel Street is a two-lane, two-way cul-de-sac road of approximately 450m in length with on-street parking available on both sides of the road. Arundel Street is approximately 10.75m wide and provides vehicular access to both residential properties as well as the Keith Hay Park / Cameron Pools and gymnasium.

Gregory Place is a two-lane, two-way cul-de-sac road of approximately 140m in length with on-street parking on both sides of the road. Gregory Place provides vehicular access to residential properties and is 6m in width.

4.7.3 Existing Traffic Volumes

There is no available traffic volume data for Rainford Street or Gregory Place. It is believed that flows on these streets are relatively low.

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Stamford Park Road and Arundel Street. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Midday	
Stamford Park Road	Melrose Rd to Rainford St	Northbound	928	1,009	49	126	49	2009
		Southbound	1,306	1,306	176	130	76	2009
Arundel Street	West of Rogan St	Eastbound	1,199	-	170	242	173	2005
		Westbound	1,151	-	363	209	196	2005

Table 40: Traffic Volumes – Stamford Park Road

The traffic volumes obtained on Stamford Park Road and Arundel Street are typical of a Local Road.

4.7.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the length of Rainford Street, Stamford Park Road within 100m in both directions from the intersection with Rainford Street, Gregory Street and Arundel Street.

There were no historic crashes found in the search, representing an excellent safety record in the vicinity of the site.

4.7.5 Proposed Works and Work Site Layout

The AS5 site is a key connection access shaft site of the Central Interceptor project providing permanent access to the Main Tunnel. The proposed location and site layout of AS5 can be referred to within the AEE Drawing Set. The site will be located within the southern corner of Keith Hay Park and within No's 20 and 22 Gregory Place. A 900mm ID micro tunnel is proposed approximately parallel to the creek, providing connections to Branch 9B MH03 on the north side of SH20. A two-way access road is proposed via No's 49 and 51 Arundel Street and over the

existing pedestrian / cyclist pavement along the south-eastern boundary of Keith Hay Park, providing site access from Rainford Street via a bridge over the creek some 260m north of the site (the latter access for micro tunnelling use only).

At the end of the access road, it forms a loop within the site around the Connection and Stop Log Chamber to enable entry and exit manoeuvres from the site to be carried out in a forward direction.

4.7.6 Access and Sight Distance

4.7.6.1 Arundel Street

The main access to the site is via 49/51 Arundel Street

Observations from the site entrance indicate that sight distance is adequate from the access, especially given the slow speed generated by the speed bump at the entrance to the nearby Keith Hay Park gymnasium/Cameron Pools. Figure 14 shows the swept path of the design trucks using the Arundel Street access.

Photograph 11 below shows Arundel Street with access located at an area currently gated/fenced off:

Photograph 11: Proposed access location for site AS5

4.7.6.2 Rainford Street

Access to the site for micro tunnelling may also occur via an over bridge onto Keith Hay Park from the western end of Rainford Street. The entrance to the bridge is shown below in Photograph 12. This timber bridge with a length of 17.5m has a total width of 4.2m between the railings and an aisle width of 3.5m. Strengthening and widening works of the bridge will be required in order to cater for trucks and trailers to enter and exit the site safely.

Observations from the site entrance indicate that sight distance is adequate from the bridge. Observations were also made on Rainford Street at its intersection with Stamford Park Road and sight distances are considered sufficient in both directions. Figure 14 shows the swept path of the design trucks using the Rainford Street access.

Photograph 12: Proposed access location for site AS5 (micro tunnel)

Photograph 13 below shows the proposed access road of some 260m from the Rainford Street Bridge to site. It is an existing pedestrian / cyclist pavement through Keith Hay Park to the northern side of Cameron Pool. The pavement has a width of 3.5 – 3.6m.

Photograph 13: Proposed access location for site AS5 (micro tunnel)

In order for the bridge and pedestrian / cyclist path to provide two-way temporary site access, widening of the bridge and the path to a width of at least 6m will be required. Alternatively, given the confinement of the path by the creek to the east and trees to the west, as well as the need to maintain pedestrian access, it would also be considered acceptable to have a one-way access road and install temporary traffic lights on both ends of the access road on Rainford Street before the Bridge, and within the site before the wheel wash.

4.7.7 Pedestrian Access

The existing timber bridge at the end of Rainford Street provides access to Keith Hay Park from Rainford Street and the current pedestrian / cyclist route along Keith Hay Park connects Cameron Pool in the south to Mount Roskill Grammar School in the north over SH20. Pedestrian access

will be maintained between Rainford Street and Keith Hay Park and this may take the form of a sharing of the existing access between trucks and pedestrians (due to low truck volumes) and implementing traffic controls, or establishing a temporary pedestrian and cycle bridge).

During construction (particularly for micro tunnelling), pedestrian and cycle access to Keith Hay Park will need to be retained. Alternatives for temporary pedestrian and cycle access would be determined in consultation with Auckland Council. A possible solution is to construct a temporary footbridge north of the existing timber bridge providing connections to Keith Hay Park. A temporary walking / cycling route should be provided on the western side of site access to maintain connection between the Cameron Pool and Mount Roskill Grammar School.

Footpaths are provided on both sides of Rainford Street and Arundel Street, and streets in the surrounding network. Pedestrians are able to travel around the vicinity of the site using the existing footpaths and access to Cameron Pool can be gained via Arundel Street.

4.7.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the AS5 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS5 will generate no more than 48 vehicle movements per day during stage one, with seven vehicle movements during the peak hour. During stage two works, no more than 68 vehicle movements per day are anticipated with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.7.9 Traffic Distribution

It is assumed that all site entries will be coming from SH20 motorway via Hillsborough Road off ramp, Hillsborough Road, Carr Road, Hayr Road, Melrose Road, Oakdale Road and onto Arundel Street. All site traffic leaving the site will be vice versa from Arundel Street towards SH20.

4.7.10 Construction Traffic Truck Routes

The AS5 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 15 shows the recommended preferred truck route from Arundel Street by means of Oakdale Road to the east, Melrose Road, Hayr Road, Carr Road and Hillsborough Road before reaching SH20 via the Hillsborough interchange.

4.7.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the tunnel and as such long-term access to parts of Keith Hay Park is required by Watercare. The site layout post construction can be found within the AEE Drawing Set.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month. The temporary site facilities and access path will be removed and the land will be reinstated.

Given the low expected site traffic volume post construction, it is recommended that the long-term maintenance access is established from Gregory Place to allow the pedestrian / cycle route to be reinstated, and properties at 49 and 51 Arundel Street to be reinstated.

4.8 PS23 (AS6)

4.8.1 Site Description

The PS23 (AS6) site is located at 39 Frederick Street, Hillsborough. The subject site will be served by an existing access road onto the southern side of Frederick Street.

The subject site is currently occupied by the PS23 Pumping Station and has frontages onto Hillsborough Bay (Manukau Harbour). The proposed work site will consist of the existing land area as well as a temporary construction platform. Areas surrounding the site are mainly residential properties.

4.8.2 Road Network

Frederick Street is classified as a Local Road in the Auckland City District Plan. It runs in a southwest – east direction in the vicinity of the site, linking Hoskins Avenue in the south with Carlton Street in the east. Frederick Street is a two-lane, two way roads with on-street parking available on both sides of the carriageway. There is a speed hump directly south of the existing access.

The Frederick Street / Carlton Street intersection is a priority-controlled intersection. Traffic on Frederick Street is controlled by “Stop” signage and associated markings.

4.8.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Frederick Street. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Frederick Street	Pallister Dr to Belfast St	Northbound	912	868	180	63	49	2009
		Southbound	905	908	46	186	62	2009

Table 41: Traffic Volumes – Frederick Street

The traffic volumes obtained on Frederick Street are typical of a Local Road. The tidal nature of the peak hour volumes suggests that it is a commuter route.

4.8.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the length of Frederick Street between Belfast St and Carlton Street.

A total of five non-injury crashes were found in the search.

- Four crashes occurred at the Frederick Street / Carlton Street intersection, with varying crash causes including two rear-end, one loss of control, and one head-on type crash. No apparent patterns can be established.
- One loss of control type crash took place on Frederick Street northbound over the right hand bend north of Pallister Road.

It is considered that the number of crashes within the area of the search is typical given the time period of the search. Thus there are no inherent safety issues within the study area.

4.8.5 Proposed Works and Work Site Layout

The AS6 site is a key connection location of the Central Interceptor project with connections to the Main Tunnel and the existing Onehunga Branch Sewer. The proposed site layout plan can be found on within the AEE Drawing Set. A temporary working platform will be created in Hillsborough Bay to provide space for construction.

The subject site is located on the southern side of Frederick Street. The existing access road to 39 Frederick Street will be used to serve the site. An internal access road is proposed forming a loop around PS23 building. It will operate in an anti-clockwise motion to enable entry and exit manoeuvres from the site to be carried out in a forward direction.

Temporary restriction on some kerb-side parking may be required adjacent to the proposed site access to enable safe manoeuvring in and out of the site by heavy vehicles.

4.8.6 Access and Sight Distance

Access to the site is proposed to be through the existing access to 39 Frederick Street. The access leading to the site is shown below in Photograph 14.

Photograph 14: Proposed access location for site AS6

It is suggested that temporary restriction on some kerb-side parking will be required (6 m either side of the driveway) adjacent to the proposed site access to enable safe manoeuvring in and out of the site by heavy vehicles. As a neighbouring driveway is located immediately to the east of the proposed driveway, the reduction in on-street parking is equivalent to the loss of one parking space. Any parking demand for this space can be easily accommodated elsewhere on Frederick Street. Figure 16 shows the swept path of the design truck turning to and from the Frederick Street access.

It is noted that the existing access road from Frederick Street is both steep and narrow. As such, truck access should be carefully managed throughout construction to ensure simultaneous movements do not occur near the proposed access. This generally could be achieved by adequately staging truck entry / exit and temporarily removing on-street parking before the entrance to enable entering vehicles to wait on Frederick Street for exiting vehicles to leave. Due to driveway locations, the best truck waiting area is considered to be immediately in front of Pallister Drive. This location enables good visibility from Pallister Drive and for vehicles approaching along Frederick Street. Temporary speed limits of 30km/hr are recommended during work hours to further slow traffic while passing any trucks parked on-street. The level of traffic travelling along both Frederick Street and Pallister Drive is considered to be low and it is considered that construction works can be undertaken in a safe manner. Figure 16 shows the location of this temporary waiting area.

Observations from on-site indicate that sight distance is satisfactory in both directions.

4.8.7 Pedestrian Access

Footpaths are provided on both sides of Frederick Street in the vicinity of the site and a footpath is provided on the westbound side of the road north of its intersection with Pallister Drive. Pedestrians will be able to travel past the site using the existing footpaths. Adequate sight distances are provided from the site access for site traffic to see any pedestrian crossing the access.

4.8.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the AS6 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS6 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.8.9 Traffic Distribution

It is assumed that all site entries will be coming from SH20 motorway via Queenstown Road off ramp, Queenstown Road and Frederick Street. All site traffic leaving the site will be vice versa from Frederick Street towards SH20.

4.8.10 Construction Traffic Truck Routes

The AS6 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 17 shows the recommended truck route with access to SH20 via Queenstown Road and the Queenstown interchange to the east.

4.8.11 Traffic Generation during Normal Operation

This site is an existing Watercare site. It is proposed to provide permanent access for operations and maintenance to the tunnel. The site layout post construction can be found on within the AEE Drawing Set. The temporary site facilities and construction platform will be removed.

The traffic generation post construction will be for regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per week.

4.9 Kiwi Esplanade or Ambury Park (AS7)

4.9.1 Site Description

This site has two alternative locations at either Kiwi Esplanade or Ambury Park. The Kiwi Esplanade (AS7) site is proposed to be located at the western end of Kiwi Esplanade, Mangere Bridge. It is located north of the WWTP. A temporary site access is proposed to be located on the northern side of Kiwi Esplanade, directly opposite Andes Avenue.

The subject site is currently a grassed reserve, as are areas to the east and the west. To the north of the site is the Manukau Harbour. Land uses on the southern side of Kiwi Esplanade are generally residential properties.

The Ambury Park (AS7) site is proposed to be located within the Ambury Reserve with access from Ambury Road, Mangere Bridge. The site is located on a narrow unsealed road at the western end of Ambury Road.

The subject site is currently a farm reserve comprising paddocks and access roads. Neighbouring land uses are similar with residential property further afield along Muir Ave and Kiwi Esplanade.

4.9.2 Road Network

Kiwi Esplanade and Ambury Road are classified as Local Roads in the vicinity of the site in the Manukau District Plan. Both roads run in a general east – west direction with Kiwi Esplanade further north along the southern edge of the Manukau Harbour, connecting with Waterfront Road to the east of the site and Ambury Road further south within the Ambury Reserve. Both roads are two-lane, two way streets with parking available on both sides of the carriageway along its length. Ambury Road is more rural in nature with no kerb and channel and large grass berms.

4.9.3 Existing Traffic Volumes

There is no Council data available for traffic flows along Kiwi Esplanade.

Traffic Loop counters were set up on Kiwi Esplanade to record the traffic flow for the week between 11 July 2011 and 18 July 2011. The table below summarises the daily and peak flows on this road.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Kiwi Esplanade	Seaforth Ave – House Ave	Eastbound	575	590	77	53	63	2011
		Westbound	642	660	39	87	89	2011

Table 42: Traffic Volumes – Kiwi Esplanade

The relatively low traffic volumes on Kiwi Esplanade are typical of a Local Road. Ambury Road would have similar, if not lower, traffic volumes.

4.9.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the length of Kiwi Esplanade from its western end to the intersection with Boyd Avenue, along the full length of Boyd Avenue, and all crashes related to the Boyd Avenue / Wallace Road and the Wallace Road / Church Road / Short Avenue intersections.

A total of 11 crashes including one serious injury crash and three minor injury crashes were found in the search.

- There are no historic accidents that occurred in the immediate vicinity of the site.
- Two crashes took place when vehicles on Kiwi Esplanade eastbound lost control turning right onto Seaforth Avenue.
- The crash that resulted in serious injuries was caused by speeding vehicle on Boyd Avenue westbound colliding with a vehicle manoeuvring onto the road from a driveway. Alcohol was a factor in this crash.
- The remaining crashes had varying causes and largely took place at intersections (Kiwi Esplanade / Boyd Avenue – two crashes, Boyd Avenue / Sullivan Avenue – two crashes, and Boyd Avenue / Wallace Road / Church Road – four crashes).

Given the large scope of the search area, it is considered that the number of crashes is typical given the time period of the search. The variety of accident types therefore indicates that there are no inherent safety issues within the study area.

A similar search was also undertaken on Ambury Road to the west of Muir Ave. One crash was identified and occurred at the western extent of Ambury Road near the proposed site access. A vehicle travelling northbound lost control on the bend. There were no injuries as a result of this crash.

Given the low speed nature of the road environment at the end of Ambury Road, this crash is considered to be driver error rather than any deficiency in the design of the road. On-site observations of the site access revealed a low-speed road with no discernible safety issues.

4.9.5 Proposed Works and Work Site Layout

The AS7 site is a key connection location of the Central Interceptor project with connections to the Main Tunnel and the existing wastewater system. The proposed location and site layout of the AS7 sites can be referred to within the AEE Drawing Set.

The Kiwi Esplanade site is located at the western end of Kiwi Esplanade, on the northern side of the road over parts of an existing grass field. The proposed site is located some 50m back from the street frontage of Kiwi Esplanade, with its western and northern edges parallel to an existing footpath. A single two-way temporary site access is proposed directly opposite Andes Avenue. The access road forms a loop within the site and it operates in a clockwise manner to enable entry and exit manoeuvres from the site to be carried out in a forward direction.

The Ambury Park site is located at the western end of Ambury Road on an existing unsealed access road that links to Kiwi Esplanade to the north. The proposed site is located some 100m north of Ambury Road, on vacant parkland.

A sealed two-way access is proposed from Ambury Road. A turning head will be located just south of the site to enable trucks to turn around and exit the site in a forward direction.

In addition to the works described above, a pipeline (LS4) is proposed to be trenched between the AS7 site and the existing wastewater network near Witla Court.

4.9.6 Access and Sight Distance

Photograph 15 below shows the proposed temporary access location to the site at the western end of Kiwi Esplanade. Approximately two on-street parking spaces on Kiwi Esplanade will be removed to establish this access. This is expected to have negligible effects on Kiwi Esplanade as ample kerbside parking spaces will remain available for any events that take place at the Ambury Regional Park such as the Ambury Park Day. Figures 18a and 18b show the swept path of the design vehicles using both the Kiwi Esplanade and Ambury Park sites.

Observations from on-site indicate that sight distance is adequate in both directions.

Photograph 15: Proposed access location for Kiwi Esplanade site (AS7)

Photograph 16 below shows the temporary access for the Ambury Park site at the western end of Ambury Road. The access is existing however, it will need to be widened to accommodate two-way traffic flow and sealed to prevent debris from construction transferring onto the surrounding roads.

Photograph 16: Proposed access location for Ambury Park site (AS7)

No parking will be removed to accommodate the access as no parking is currently provided at this location.

4.9.7 Pedestrians and Cyclists

At the Kiwi Esplanade site, a footpath is provided along the southern side of Kiwi Esplanade. A walking track continues at the western end of the road to the north along water banks towards to Manukau Yacht and Motor Boat Club and an access road at the western end connects to Ambury Road. For the Kiwi Esplanade site, the track is outside of the site boundaries and will be unaffected by the works. Adequate pedestrian accessibility around the site will be maintained.

For the Ambury Road site, the aforementioned access road between Kiwi Esplanade and Ambury Road will be affected by the proposed site. A temporary pedestrian diversion around the site will be established to at least the standard of the current access road to cater for pedestrian demands.

Although there are no specific cyclists provisions Kiwi Esplanade, Andes Road and Ambury Road are identified as a quiet route recommended by cyclists on the Auckland Transport southern cycle map. There are a number of off-road shared pedestrian and cyclist links which travel along the waterfront Reserve and through Ambury Regional Park.

4.9.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the AS7 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at AS7 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.9.9 Traffic Distribution

It is assumed that all site traffic travelling to and from the north will access site from SH20 motorway via Mahunga Drive interchange, Rimu Road, Church Road, Boyd Avenue and onto Kiwi Esplanade and/or Muir Ave. All site traffic travelling to / from south can travel via Boyd Avenue, Church Road, Coronation Road, McKenzie Road, Kirkbride Road, Ascot Road and Greenwood onto Island Road.

4.9.10 Construction Traffic Truck Routes

The AS7 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 19 shows the recommended truck route from the site to the SH20 via Coronation Road and Rimu Road to the east.

4.9.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the tunnel and as such long-term site access is required. The site layout post construction can be found within the AEE Drawing Set.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.9.12 Witla Court LS4

4.9.12.1 Proposed Works

In addition to the proposed works described in Section 4.9.5 above, a pipeline (LS4) is proposed to be trenched from this site to Witla Court and connect to the existing western interceptor. Connections to the existing western interceptor will be via a new stop gate chamber located east

of Witla Court. The course at the pipeline will vary depending if Kiwi Esplanade or Ambury Park is chosen as the site for AS7. Each route is discussed as follows:

Kiwi Esplanade

The proposed pipeline is approximately 700m in length overall. The course of the pipeline will connect to the drop shaft within the AS7 site in the west, it will continue across the reserve in an eastward direction for some 230m. Trenching will then continue in a southeast direction parallel to Kiwi Esplanade until opposite Yorkton Rise. The pipeline is then proposed to be trenched across Kiwi Esplanade and southward along the full length of Yorkton Rise until reaching Muir Avenue. Trenching will continue westward along the carriageway of Muir Avenue up to Witla Court, then continue along the length of Witla Court for some 50m before connecting to the western interceptor approximately 35m from the eastern side of the road.

Ambury Park

The proposed pipeline is approximately 700m in length overall. The source of the pipeline will connect to the drop shaft within the AS7 site, link to Ambury Road in an eastward direction to Muir Avenue. Trenching will then travel northwards on Muir Avenue to Witla Court, then continue along the length of Witla Court for some 50m before connecting to the Western interceptor approximately 35m from the eastern side of the road.

A corridor of approximately 5m wide will be required along the entire length of the pipeline to provide construction access. Construction works over a carriageway will generally require either the closure of one lane of traffic or reduction in lane widths along the construction route. The trenches will be dug on one side of the road at a time to enable at least one lane of traffic to operate. Where the pipeline route crosses a carriageway or over an intersection, trenching will need to be carried out over one lane width at a time to maintain all traffic movements. A stop-go operation is likely to be established in order to retain two-way traffic flows.

Existing traffic volumes for Muir Avenue have been obtained from Auckland Transport. Muir Avenue has a 7-day ADT volume of 1,736vpd (recorded in February 2009), while Ambury Road has a 7-day ADT volume of 208 vpd (recorded in July 2006 between Warden Place and Muir Avenue. There is no data available for Yorkton Rise and Ambury Road, and Witla Court. However, these roads are side roads to Kiwi Esplanade / Muir Avenue and generally provide access to private properties / Ambury Park only. The traffic flows on these roads are therefore expected to be very low.

The traffic volumes of these roads have been assessed against the general design guidelines contained in Section C15.4 of CoPTTM. Due to their expected low daily and peak hourly traffic volume, delays in excess of five minutes are not expected. It is assumed that the road will be subject to a 30km/hr speed restriction at all times of construction activity. As such the minimum lane width permitted by CoPTTM is 2.75m with an additional 0.3m shy line when adjacent to a barrier.

During construction, access to nearby properties including the Manukau Yacht and Motor Boat Club will be maintained. Where possible, trench works should be restricted during any major events at Ambury Regional Park to minimise traffic disturbance.

All road crossing locations are located in residential areas and all proposed traffic management measures will need to be designed to maintain pedestrian a footpath on one side of the road at all times. Where pedestrians are required to use footpath on the other side of the road, sufficient crossing sight distance (“CSD”) will be provided to ensure pedestrians can cross the road safely.

All temporary traffic management on-site will be set out and removed by a Site Traffic Management Supervisor (STMS) having the appropriate STMS qualifications from New Zealand Transport Agency (NZTA).

The pipeline route will be reinstated to its former condition (eg: road, berm etc) as the trenching works progress.

4.10 Motions Road (L1S1)

4.10.1 Site Description

The proposed site location for the Motions Road (L1S1) site is a small reserve on the western side of Motions Road. There is currently no formed access from the site onto Motions Road.

The site is located south of the Auckland Performing Arts Centre (TAPAC) and Western Springs College. The Auckland Zoo is directly across from the site. The Pasadena Intermediate School is situated in the south separated from the site by a small stream.

4.10.2 Surrounding Road Network

Motions Road is classified as a Collector Road in the Auckland City District Plan. It runs in a north-south direction at the site location, linking Old Mill Road in the north with Great North Road in the south. Motions Road is a two-lane, two way street with a posted speed limit of 50kph. Marked on-street parking is generally provided on both sides of the carriageway. However, on-street parking along the site frontage is prohibited by means of broken yellow lines.

A signalised pedestrian crossing is also located immediately north of the subject site which enables the MOTAT / Zoo tram to cross Motions Road. With Western Springs College in close proximity to the site, Motions Road experiences significant pedestrian volumes both before and after school hours. A footbridge is situated on the western side of the subject site providing pedestrian access across the stream.

4.10.3 Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Motions Road. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Motions Road	Old Mill Rd to Great North Rd	Northbound	2543	2554	137	301	307	2008
		Southbound	2739	2559	655	203	296	2008

Table 43: Traffic Volumes – Motions Road

The traffic volumes obtained on Motions Road are slightly high for a Local Road. The slightly higher peak hours volumes suggest that it is a commuter route.

4.10.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Motions Road and all crashed related to the intersection of Motions Road with Great North Road.

A total of 16 crashes including six with minor injuries were found in the search.

- A total of nine crashes including five minor injury crashes involved right turning movements from Motions Road onto Great North Road. Eight of these crashes were due to right turning vehicles failing to give way, and one crash involved loss of control of vehicle when turning.
- Two rear end type crashes took place on Motions Road on approach to the intersection with Great North Road.

Given the high traffic volumes on Great North Road, it is considered that the number of crashes is reasonable for the scope of the search. There seems to be an existing pattern of crashes caused by right turning movements from Motions Road to Great North Road. It is therefore recommended that all heavy vehicles generated by the site should be restricted to a left turn out only onto Great North Road.

This safety measure has been incorporated in the proposed truck route as discussed in the truck routes that follow.

4.10.5 Proposed Works and Work Site Layout

The L1S1 site is an intermediate scale site of the Central Interceptor project with connections to a micro tunnel to convey flow to the Main tunnel at WS1, and to the Orakei Main Sewer. The proposed location and site layout of L1S1 can be referred to within the AEE Drawing Set. The subject site is located at a small reserve on the western side of Motions road.

A single two-way temporary site access is proposed onto Motions Road some 50m south of the pedestrian crossing. The access road of approximately 30m runs in a west–east direction and ends in a Y-shape to allow site vehicles to turn around and exit the site in a forward motion.

The L1S1 site is also required to extend over the north-eastern access of an existing footbridge west of the site. A diversion is therefore proposed to be constructed over the eastern end of the pedestrian footbridge to the west of the site in order to enable works while maintaining foot traffic between Motion Road and the playing fields.

4.10.6 Access and Sight Distance

A singular access is proposed to serve as both an entry and an exit point for the site. Photograph 19 below shows the proposed location of the site access. Figure 20 shows the swept path of the design truck using the access.

Observations from the approximate location of the proposed access way indicate that there is sufficient sight distance to both the north and south. It is noted that parked vehicles on Motions Road may limit visibility, however, since parking is already prohibited along the site frontage and the majority of vehicles using the access will be trucks, this is not considered a significant issue.

Photograph 17: Proposed access location for site L1S1

4.10.7 Pedestrian Access

Given the nature of the amenities surrounding the site mentioned previously, there may be a high number of pedestrians particularly children travelling on Motions Road. Additional surveys have therefore been carried out focussing around school opening and closing hours.

Existing pedestrian volumes on Motions Road and the footbridge connecting the playing fields to Motions Road were obtained from surveys undertaken by TDG on Tuesday 12 July 2011 from 7:00am – 9:00am and 3:00pm – 6:00pm. The following tables summarise the surveyed peak hour volumes:

Approach	Movement	AM Peak (8:00-9:00am)	Evening Peak (3:00-4:00pm)
Motions Road	Eastern side	7	12
	Western side	31	164

Table 44: TDG Surveyed pedestrian movements – Motions Road Footpath

Approach	Movement	AM Peak (8:00-9:00am)	Evening Peak (3:00-4:00pm)
Pedestrian Crossing	Eastbound (towards Zoo side)	1	67
	Westbound (from Zoo side)	6	13

Table 45: TDG Surveyed pedestrian movements – Pedestrian Crossing on Motions Road

Approach	Movement	AM Peak (8:00-9:00am)	Evening Peak (3:00-4:00pm)
Footbridge	Eastbound (towards Motions Road)	8	100
	Westbound (from Motions Road)	8	15

Table 46: TDG Surveyed pedestrian movements – Footbridge between Motions Road and Playing Field

Footpaths are provided on both sides of Motions Road and a signalised pedestrian crossing is positioned about 50m north of the subject site. These facilities will be unaffected during the works. It is considered that adequate sight distances in both directions are provided to make sure that the site access is clear before crossing.

It can be seen from the surveys that a large volume of pedestrians utilises the footbridge between Motions Road and the Playing Fields. As such, the proposed temporary diversion of the north-eastern end of the footbridge will maintain pedestrian flows across this bridge and therefore will not cause any adverse effects.

It is also proposed to limit traffic movements during school peak times. The construction duration will therefore be extended accordingly to avoid these peak times.

4.10.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L1S1 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L1S1 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected. In terms of effects on the Great North Road / Motions Road intersection, the peak of nine additional movements is considered to generate negligible traffic effects particularly when a large proportion of traffic (all trucks) will turn left from Motions Road into Great North Road.

4.10.9 Traffic Distribution

It is assumed that all site entries will be coming from SH16 motorway via St Lukes off ramp, St Lukes Road, Great North Road onto Motion Road. All site exits will be via Motions Road towards SH16 via MOTAT on-ramps.

4.10.10 Construction Traffic Truck Routes

The L1S1 site is proposed to be an intermediate scale construction site, with medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 21 displays the recommended truck routes between the site and the nearest motorway. Trucks will be able to access SH16 by means of Motions Road, Great North Road and the MOTAT on / off-ramps, and as such it enjoys excellent access to the wider road network.

Note that heavy vehicles will be restricted to and only require a left turn out of Motions Road onto Great North Road.

4.10.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the micro tunnel and as such long-term access is to be obtained by Watercare. The site layout post construction can be found within the AEE Drawing Set. The temporary site facilities and access path will be removed and the land will be reinstated.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.11 Western Springs Depot (L1S2)

4.11.1 Site Description

The proposed site location for the L1S2 site is within the council depot area behind the Western Springs Stadium (Stadium), Western Springs. The site is currently accessed through a parking area with 90 degree angled parking on both sides of the aisle, currently separated from Stadium Road by semi-permanent fencing.

The site is mostly surrounded by grassed parks. The stadium is located to the north and to the northwest of the site is the Western Springs Depot (Depot) which is accessed via the same parking area of the subject site.

4.11.2 Road Network

The L1S2 site is located in close proximity to WS1 and both sites utilise Stadium Road as part of the site access and / or egress route.

Stadium Road is classified as a Local Road in the Auckland City District Plan. It runs in a north-west / south-east direction, and serves as a feeder road for the Stadium parking area, as well as a parking area for MOTAT and the Western Springs playing fields. For the majority of its length, Stadium Road is a two-laned, two way street with marked parking spaces on either side of the carriageway. On approach to the intersection with Great North Road, Stadium Road widens to two lanes in each direction. There are also several road humps along Stadium Road, near the south-eastern end.

Great North Road forms a signalised intersection with Stadium Road and SH16 eastbound on / off-ramps at Western Springs (MOTAT) to the western edge of the site, where Great North Road eastbound widens to a left and through shared lane, a through lane and two right turn lanes onto

SH16 eastbound. In the westbound direction, Great North Road widens to a left turn slip lane, two through lanes and also providing a right turn bay on approach to the intersection.

4.11.3 Traffic Volumes

Existing traffic volumes of Stadium Road were obtained from surveys undertaken by TDG on Thursday 21 July 2011 7:00am - 9:00am and 3:00pm - 6:00pm and Saturday 23 July 2011 between 11:00pm and 2:00pm. The following tables summarise the surveyed peak hour volumes in vehicles per hour (vph):

Approach	Movement	Morning Peak (vph)	Evening Peak (vph)	Saturday Midday Peak (vph)
Stadium Road	Left	10	17	28
	Through (MOTAT On Ramp)	205	15	13
	Right	8	32	26

Table 47: TDG Surveyed traffic movements – Great North Road / Stadium Road / MOTAT on/off ramps

The traffic flows on Stadium Road are generally quite low with the exception that 205 through vehicles travelled on Stadium Road during the morning peak, implying that traffic on Great North Road turns into Stadium Road with an attempt of shortcutting onto the motorway.

4.11.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Stadium Road.

There was only one crash that occurred on the length of Stadium Road found in the search.

- One non-injury crash occurred on Stadium Road approximately 100m north of the intersection when a vehicle hit a parked vehicle while manoeuvring.

It is considered that Stadium Road has an excellent accident record and does not have any inherent safety issues.

4.11.5 Proposed Works and Work Site Layout

The L1S2 site is a small-scale link sewer shaft site of the Central Interceptor project. The construction site is located within the area behind the Council works depot building at Western Springs.

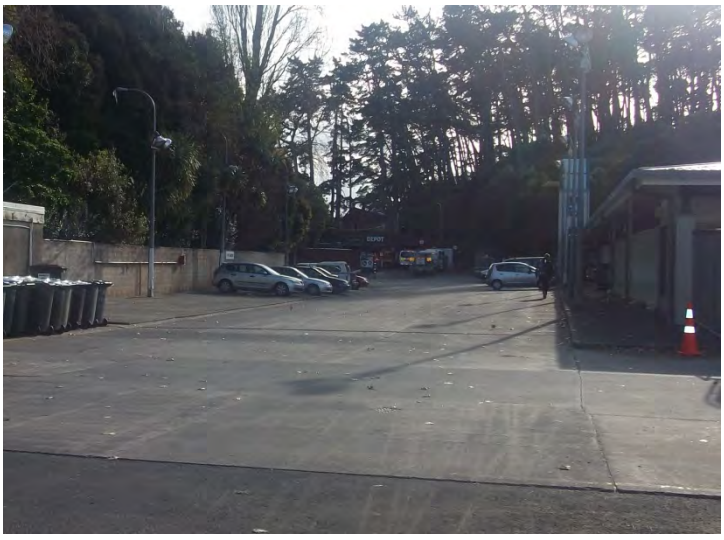
The proposed location and site layout of L1S2 can be found in the AEE Drawing Set. A single two-way temporary site access is proposed.

4.11.6 Access and Sight Distance

Site vehicles will gain access via the existing access road into the Stadium car park at the end of Stadium Road. Photograph 20 shows the proposed access into site L1S2:

Photograph 18: Proposed access location from Stadium Drive for site L1S2

Upon entering the Stadium car park, a single accessway is proposed to serve as both an entry and exit point for the site. The construction site is located at the western end of the Depot. Figure 22 shows the swept path of the design truck using the site access and turning around on-site. As the access path to the Depot will be restricted to one lane only, traffic controls need to be implemented to direct opposing traffic. Devices such as a convex mirror should be installed to ensure traffic exiting the site does not conflict with traffic leaving the depot. Photograph 21 shows the access to the subject site location:



Photograph 19: Proposed site location of the site entrance for site L1S2

4.11.7 Effects on the operation of the Stadium

No parking will be removed at the Depot and therefore there are considered to be no issues during normal operation times. It is recommended however, that all vehicle movements are restricted during major events occurring at Western Springs Stadium.

4.11.8 Pedestrian Access

Pedestrian access to the Stadium and surrounding facilities is unlikely to be affected by the site. Footpaths are provided on Stadium Road and pedestrians will continue to utilise them to access the Stadium. The kerb around the Stadium building will remain and barriers will be positioned between the kerb and the temporary Depot access to ensure pedestrians' safety.

It is recommended that heavy vehicle movements be restricted during major events occurring at Western Springs Stadium.

Given the level of pedestrian activity (especially school children) on Stadium Road, it is proposed to upgrade Stadium Road to ensure that school pedestrians that are dropped off and travel safely to the MOTAT entrance on Stadium Road. In particular, this includes:

- a 2m footpath on the western side of Stadium Road
- bus drop-off area on the western kerb
- widening of Stadium Road on the eastern side by reducing the existing 4.5m footpath to 2.5m (thus resulting in no additional encroachment to the eastern trees).

4.11.9 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L1S2 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L1S2 will generate a peak of no more than 68 vehicle movements per day, nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.11.10 Traffic Distribution

It is assumed that all site entries will be coming from SH16 motorway via St Lukes off ramp, St Lukes Road, Great North Road onto Stadium Road. All site exits will be via Stadium Road towards SH16 via MOTAT on-ramps.

4.11.11 Construction Traffic Truck Routes

The L1S2 site is proposed to be a small scale construction site, with low truck volumes expected to be accessing the site throughout the construction duration.

Figure 23 shows the recommended routes for heavy vehicles travelling to site from the nearest Motorway and in the reversed direction. Trucks will be able to access the site from SH16 via the westbound MOTAT off ramp, St Lukes Road, Great North Road and Stadium Road. Tracks will be able to leave the site and access the motorway via Stadium Road, and the eastbound Western Springs on ramp.

4.11.12 Impact on Road Network

Both the Western Springs (WS1) site and the Western Springs Depot (L1S2) site require access from Stadium Road. While the WS1 site will have construction duration of three to five years, construction at the L1S2 site is only expected to last between six to eight months. In order to assess any cumulative effects of the two sites under construction concurrently, the Stadium Road / Great North Road / MOTAT on/off ramps intersection has been modelled using SIDRA with the estimated traffic generation of both sites.

Model results show the impact on the intersection's operation as a result of the proposed works at both the WS1 and L1S2 sites. There is no change in Level of Service for any movement as a result of the additional vehicle movements and as such the impact can be considered less than minor.

4.11.13 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for maintenance to the LS1 tunnel and as such long-term access is required by Watercare. The site layout post construction can be found in the AEE Drawing Set. The temporary site facilities and access path will be removed and the car park will be reinstated.

The traffic generation post construction will be very infrequent and will be limited to maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle every five years.

4.12 Rawalpindi Reserve (L2S1)

4.12.1 Site Description

The Rawalpindi Reserve (L2S1) site is proposed to be located within the Rawalpindi Reserve, off Rawalpindi Street, Mount Albert. There is currently an existing formed access into the reserve, located on the eastern side of Rawalpindi Street slightly south of Segar Avenue.

These traffic volumes are low and typical of a urban local road in Auckland. Rawalpindi Reserve continues to the north and the Chamberlain Park Golf Course is located to the east of the site. A children's playground is situated immediately south of the site. Surrounding land uses are generally residential.

4.12.2 Road Network

Rawalpindi Street is a no-exit road of approximately 280m, and is classified as a Local Road in the Auckland City District Plan. It runs in a north-south direction, and connects with Fontenoy Street at the southern end. The road is a two-laned, two way street with on-street parking available on both sides of the carriageway.

4.12.3 Traffic Volumes

There is no Council data available for traffic flows along Rawalpindi Street.

Tube counts were thus set up on Rawalpindi Street for the week between 12 July 2011 and 19 July 2011. Table below summarises the daily and peak flows on this road.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Rawalpindi Street	South of Segar Ave	Northbound	373	344	61	55	33	2011
		Southbound	323	306	33	51	34	2011

Table 48: Traffic Volumes – Rawalpindi Street

These recorded volumes confirm the Local Road status of Rawalpindi Street.

4.12.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Rawalpindi Street inclusive of its intersections with Segar Avenue and Fontenoy Street.

Two minor injury crashes were found at the Rawalpindi Street / Fontenoy Street intersection.

- One loss of control crash was found near the intersection of Rawalpindi Street and Fontenoy Street. Fatigue was the cause of the crash.
- One rear end crash took place on Fontenoy Street eastbound on approach to the intersection with Rawalpindi Street, due to an inexperienced driver following too closely.

An extended search was carried out for the full length of Segar Avenue and Fontenoy Street, and their intersections with Carrington Road as these are the possible truck routes to the nearest motorway.

- A total of nine crashes including one minor injury crash were found. Four crashes were found on the length of Segar Avenue and three on the length of Fontenoy Street. One rear end crash took place on Carrington Road northbound at its intersection with Fontenoy

Street and one minor injury crash was caused by a vehicle turning right onto Carrington Road from Segar Avenue failing to give way.

These crashes took place at different sections of the road and all had varying causes which implied that there are no inherent safety issues within the search area.

4.12.5 Proposed Works and Work Site Layout

The L2S1 site is an intermediate scale site of the Central Interceptor project with connections to a micro tunnel to convey flow to the main tunnel at AS1, and to the Orakei Main Sewer. The proposed location and site layout of L2S1 can be referred to within the AEE Drawing Set. A single two-way site access road is proposed utilising the existing access from Rawalpindi Street into the Reserve. This access road of approximately 50m runs in a west-east direction and meets the proposed internal access path to the north.

The proposed access path forms a one-way loop within the site and operates in a clockwise only access enabling entry and exit manoeuvres from the site to be carried out in a forward direction.

4.12.6 Access and Sight Distance

A single accessway is proposed to serve the site as both an entry and exit point for the site. Currently there is an existing accessway to Rawalpindi Reserve on the eastern side of Rawalpindi Street as shown below in Photograph 22. Figure 24 shows the swept path of the design truck using the site access and turning around on-site.

A children's playground is located south of the subject site. It is proposed that during construction, a pedestrian access to the playground is retained parallel to the site access road. If required, the site access road may be offset to the north to accommodate this pedestrian access.

Observations from the location of the access indicate that there is sufficient sight distance to both the north and the south. The observed speed environment of Rawalpindi Street has been observed to be less than 50 kph due to the geometry of the street and therefore it is considered that sight distance is sufficient.

Photograph 20: Proposed access location for site L2S1

4.12.7 Pedestrian Access

It is proposed that a pedestrian access will be retained parallel to the site access road during construction to provide access to a children's playground. Footpaths are provided on both sides of Rawalpindi Street and footpaths are provided on at least one side of the roads in the surrounding network.

4.12.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L2S1 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L2S1 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.12.9 Traffic Distribution

It is assumed that all site traffic will access site from SH16 by means of Segar Avenue, Carrington Road to the west and the Waterview on / off ramps. Vehicles can also access SH20 via Carrington Road and Sandringham Road Extension.

4.12.10 Construction Traffic Truck Routes

The L2S1 site is proposed to be an intermediate scale construction site, with low / medium truck volumes expected to be accessing the site throughout the construction duration.

Figure 25 displays the recommended truck routes between the site and the nearest motorway. Trucks will be able to access SH16 by means of Carrington Road to the west and the Waterview on / off ramps. Vehicles can also access SH20 via Carrington Road and Sandringham Road Extension.

4.12.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for maintenance to the LS2 tunnel and as such long-term access is required by Watercare. The site layout post construction can be found in the AEE Drawing Set.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month. The temporary site facilities and access path will be removed and the land will be reinstated.

4.13 Norgrove Avenue (L2S2)

4.13.1 Site Description

The proposed site location for L2S2 site is at the northern end of Norgrove Avenue, Mount Albert. The site is proposed to be on the road carriageway itself and the adjacent berm to the east of the carriageway, at the northern end of Norgrove Avenue where the cul-de-sac is located.

Surrounding areas are residential in nature and the Chamberlain Park Golf Course is located to the north of the subject site.

4.13.2 Road Network

Norgrove Avenue is classified as a Local Road in the Auckland City District Plan. It runs in a southwest – northeast direction with a cul-de-sac at the north-eastern end of the road. The road is an unmarked two-laned, two way street with on-street parking available on both sides of the carriageway. Verona Avenue intersects with Norgrove Avenue approximately 50m south of the cul-de-sac.

4.13.3 Existing Traffic Volumes

There is no Council data available for traffic flows along Norgrove Avenue however, on-site observations indicated traffic volume is very low (less than 50 movements per day).

4.13.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Norgrove Avenue as well as the surrounding local roads as possible truck routes.

- No crashes were found within Norgrove Avenue, Verona Avenue and Chatham Avenue.
- Two crashes including one minor-injury crash took place at the Chatham Avenue / Martin Avenue intersection and three non-injury crashes occurred at the Rossgrove Terrace / Asquith Avenue intersection. All crashes had varying causes and any apparent patterns cannot be determined.

4.13.5 Given the wide scope of the search, it is considered that there are no inherent safety issue within the vicinity of the site.Proposed Works and Work Site Layout

The L2S2 site is a small scale link sewer site of the Central Interceptor project. The proposed location and site layout of L2S2 can be referred to within the AEE Drawing Set. Works will occur within the road reserve. Limited space is available for this site.

A single access is proposed to serve as an entrance / exit to the site approximately 25m before the northern end of Norgrove Avenue. Any reverse manoeuvring should be undertaken with the aid of an on-site spotter to ensure pedestrian/vehicle safety is maintained.

Kerb-side parking is proposed to be restricted on both sides of the northern leg of Norgrove Avenue. This is necessary to enable temporary access to adjacent private properties as well as allowing safe manoeuvres by site vehicles.

4.13.6 Access and Sight Distance

Due to the limited site area available on Norgrove Avenue, the western leg of Norgrove Avenue may be used to assist with truck reversing into the site when accessing from Verona Avenue, to allow for forward-exiting vehicles as it is unlikely that trucks will be able to turn around on Norgrove Avenue. Figure 26 shows the swept path of the design truck manoeuvring near the site.

There is adequate sight distance looking south-west along Norgrove Avenue, and similarly there is sufficient sight distance along Verona Avenue to the south-east at the Norgrove Avenue / Verona Avenue intersection. The cul-de-sac at the north-eastern end of Norgrove Avenue is shown below in Photograph 23:

Photograph 21: Proposed site and access location for site L2S2

Due to the proposed layout of the site, it will be necessary to relocate the access to existing properties at No.14 and No.16 Norgrove Avenue at the north-western end on the street. Figure 26 shows an indicative access arrangement whereby vehicles at No. 14 and No.16 Norgrove Avenue could use a temporary access driveway over the existing berm.

4.13.7 Pedestrian Access

Footpaths are provided on the northern side of Norgrove Avenue and both sides of other roads in the surrounding area. The footpath on the north-eastern leg of Norgrove Avenue maybe temporarily altered or limited for the purpose of providing temporary vehicular access to the affected properties. Given that the eastern end of Norgrove Avenue is a cul-de-sac with access only to private properties, the proposed works are considered acceptable provided alternative arrangements are made to provide access to the private residential properties.

Access to the remaining footpaths will be maintained and pedestrian travelling around the site is unlikely to be affected except for the eastern leg of Norgrove Avenue.

4.13.8 Construction Traffic Management Plan (CTMP)

A draft construction traffic management plan has been developed at this stage given the limited space available for construction as shown in Figure 27.

It is proposed that during the construction at the L2S2 site, the last 40m of carriageway and footpath on the northern end of Norgrove Avenue will be closed off as part of the construction site.

The northern end of Norgrove Avenue is a cul-de-sac thus no through traffic will be blocked by the proposed works. Access to the private properties at No.14 and 16 Norgrove Avenue will be limited and detailed traffic management for these accesses will be required once the exact layout is known. Kerb-side parking on both sides of Norgrove Avenue will be removed during the construction period. However, on-street parking on the remaining sections of Norgrove Avenue and nearby roads is readily available.

Overall, minimal effects on the surrounding network are expected.

4.13.8.1 Temporary Signage

The proposed signage that will be installed for the draft temporary traffic management plan is displayed in Figure 27.

4.13.9 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L2S2 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L2S2 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.13.10 Traffic Distribution

It is assumed that site traffic coming from SH16 motorway will travel via St Lukes off ramp, St Lukes Road, New North Road, Wairere Avenue, Rossgrove Terrace, Verona Avenue onto Norgrove Avenue; and vice versa for all site traffic travelling towards SH16.

It is assumed that all site vehicles will travel to and from site immediately via Verona Avenue and Rossgrove Terrace, from here, vehicles can access SH16 via Wairere Avenue, New North Road, St Lukes Road and the St Lukes interchange. Alternatively vehicles can travel on Asquith Avenue onto Carrington Road, where site traffic can access SH16 to the north via the Waterview interchange or SH20 to the south via Mt Albert Road and Sandringham Road Extension.

4.13.11 Construction Traffic Truck Routes

The L2S2 site is proposed to be a small scale construction site, with low truck volumes expected to be accessing the site throughout the construction duration.

Figure 28 displays the recommended truck routes between the site and the nearest motorway. Inbound trucks from SH16 will be able to access the site via a controlled right turn from St Lukes Road into New North Road, Wairere Avenue, Asquith Avenue, Rossgrove Terrace and Verona Road. Outbound trucks however will be able to access the SH16 motorway by means of Verona Avenue, Linwood Ave and St. Lukes Road. Alternatively, vehicles can travel to and from site via Verona Avenue, Rossgrove Terrace and Asquith Avenue onto Carrington Road. From Carrington Road, site traffic can access SH16 to the north via the Waterview interchange or SH20 to the south via Mt Albert Road and Sandringham Road Extension.

Given the location of the site, these routes are generally through residential streets and as such advance planning of large trucks travelling through these areas will be required.

4.13.12 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for maintenance to the LS2 tunnel and as such long-term access is required by Watercare. The site layout post construction can be found in the AEE Drawing Set. The temporary site facilities will be removed and the affected land will be reinstated.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.14 PS25 (L3S1)

4.14.1 Site Description

The proposed site location for L3S1 site is at the existing Watercare pump station on Miranda Street, Avondale. It is proposed to use the existing access onto Miranda Street.

Surrounding land uses are generally residential in nature, with some commercial and retail complexes to the north on Wolverton Street.

4.14.2 Road Network

Miranda Street is classified as a Local Road in the Auckland City District Plan and is intended to provide primarily for property access. It runs in a northwest – east direction, linking Wolverton Street and Blockhouse Bay Road. Miranda Street has a posted speed limit of 50kph and is a two-lane, two-way unmarked street with on-street parking available on both sides of the carriageway.

4.14.3 Existing Traffic Volumes

There is no Council data available for traffic flows along Miranda Street.

Tube counts were set up on Miranda Street for the week between 12 July 2011 and 19 July 2011. Table below summarises the daily and peak flows on this road.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Miranda Street	Between Ruahine St	Westbound	1753	1706	182	185	163	2011
		Eastbound	1500	1471	135	143	148	2011

Table 49: Traffic Volumes – Miranda Street

The traffic volumes on Miranda Street are typical of a Local Road and appear to be consistent between the morning and evening peak periods.

4.14.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Miranda Street inclusive of its intersections with Wolverton Street and Blockhouse Bay Road.

A total of 19 crashes were found in the search and can be summarised as follows:

- Six non-injury crashes took place on the length of Miranda Street including two loss of control type crashes, two crashes caused by drivers' misjudgements and hit parked vehicles, one crash caused by driver inattention when reversing onto Miranda Street from a driveway, and one crash due to vehicle on Miranda Street westbound cutting corner when turning and collide with oncoming vehicle head on.

- Seven crashes occurred at the Wolverton Street / Miranda Street intersection. Four crashes including one with minor injuries were caused by vehicles on Miranda Street failing to give way to through traffic when turning right onto Wolverton Street. Two rear-end and one loss of control type crashes also took place on Wolverton Road at this intersection.
- Five crashes took place at the Blockhouse Bay Road / Miranda Street. Three minor-injury crashes involved vehicles on Blockhouse Bay Northbound travelling too fast or following too closely on approach to the pedestrian crossing or vehicles slowing for the crossing, of which one of the crashes involved hitting a pedestrian and another involved hitting the rear of a left turning vehicle from Miranda Street. Two crashes were caused by right turning vehicles from Miranda Street onto Blockhouse Bay Road southbound failing to give way.

There are no apparent safety issues that arose from the crash history for the length of Miranda Street. However, there appears to be a pattern involving right turning movements onto Wolverton Street from Miranda Street. As such, this manoeuvre (right turn exit from Miranda Street to Wolverton Street) has been avoided in the truck routes as discussed in the following sections.

4.14.5 Proposed Works and Work Site Layout

The L3S1 site is a key connection site of the Central Interceptor project with connection to the Western Interceptor at Watercare's existing Pump Station 25. The proposed location and site layout of L3S1 can be referred within the AEE Drawing Set. A single two-way site access road is proposed utilising the existing access road of 6m wide to the Watercare Pump Station from Miranda Street. A "T" shaped turn-around area is located north west of the site to allow vehicles to leave site in a forward motion.

Temporary restrictions of some kerb-side parking may be required adjacent to the proposed site access to enable safe manoeuvring in and out of the site by heavy vehicles.

4.14.6 Access and Sight Distance

Access to the site is proposed to be through the existing access road of 6m wide on Miranda Street. This access is shown below in Photograph 24. It is considered that this access is appropriate and upgrades will not be required.

Sight distance is over 100m in both directions, and is more than adequate for a speed environment of 50kph on a local road.

Photograph 22: Proposed access location for site L3S1

Figure 29 shows the swept path of the design truck using the Miranda Street access. The existing access is designed for truck access and therefore no on-street parking is required to be removed.

4.14.7 Pedestrian Access

Footpaths are provided on both sides of Miranda Street as well as other roads in the surrounding areas. They will remain fully functional during the works for pedestrians to travel around the site.

An internal recreational footpath runs parallel to Miranda Street and connects east side of the site to Blockhouse Bay Road through Miranda Reserve. Fencing will be installed to separate the construction site from the reserve and the footpath. Access to this path from Miranda Street between properties No. 14 and 16 will remain accessible for pedestrians. As the existing pedestrian link between No.14 and No.16 is not an all-weather surface, it is recommended that a permanent concrete footpath be established between the recreational path and Miranda Street.

4.14.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L3S1 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L3S1 will generate a peak of no more than 68 vehicle movements, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.14.9 Traffic Distribution

It is assumed that all site entry traffic will travel to site from SH20 by means of Maioro Street, New Windsor Road, Tiverton Road and the Wolverton Street / Miranda Street intersection. All site exits will leave site via the Blockhouse Bay Road / Miranda Street intersection, Tiverton Road, New Windsor Road and Maioro Street onto SH20.

4.14.10 Construction Traffic Truck Routes

The L3S1 site is proposed to be an intermediate scale construction site, with medium level truck volumes expected to be accessing the site throughout the construction duration.

A recommended truck route is displayed in Figure 30. Trucks will be able to access site from SH20 via Maioro Street, New Windsor Road, Tiverton Road and Wolverton Street. In reverse, site exits towards SH20 from site via Blockhouse Bay Road, Tiverton Road, New Windsor Road and Maioro Street. This truck route is recommended so that uncontrolled right turns from Blockhouse Bay Road onto Miranda Street and from Miranda Street onto Wolverton Street are avoided.

Trucks will pass through a 40km/hr school zone on Blockhouse Bay Road during school hours. This is considered acceptable as trucks will simply adjust their speed accordingly. Blockhouse Bay Road already caters for buses and other large vehicles and the additional peak of five heavy vehicle movements per hour is not considered to present any significant adverse road operation or safety effects.

4.14.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the tunnel and existing sewers. As such long-term access is required. The site layout post construction can be found in the AEE Drawing Set. The temporary site facilities will be removed and the land will be reinstated. The existing site access road will be maintained.

The traffic generation post construction will be limited to regular maintenance of site facilities and access to an air treatment facility. It is estimated that traffic generated by the site will normally be one vehicle per week.

4.15 Miranda Reserve (L3S2)

4.15.1 Site Description

The proposed site location for the Miranda Reserve (L3S2) site is in the Miranda Reserve, located south of 337 Blockhouse Bay Road, Avondale. There is no current vehicular access available onto the subject site.

The site has frontage on Blockhouse Bay Road. The site is currently occupied by a children's playground and green field. Miranda Reserve extends to the west beyond the site, while surrounding land uses to the north, east and south are generally residential in nature.

4.15.2 Road Network

Blockhouse Bay Road is classified as a Collector Road in the Auckland City District Plan. It runs in a north – south direction across west Auckland, linking Great North Road in the north with Donovan Street in the south. Blockhouse Bay Road has a posted speed limit of 50kph and is a two-lane, two way street in the vicinity of the proposed site. On-street parking is available on both sides of the carriageway.

Blockhouse Bay Road intersects with Margate Road some 45m north of the subject site. Traffic on Margate Road is priority controlled by a "Stop" sign and associated markings.

Of note, there is an existing bus-stop and bus shelter located directly in front of the site, which would be required to be moved temporarily during construction in order for an access to be installed. There is adequate space on Blockhouse Bay Road to the south of the subject site where the bus stop can be relocated.

4.15.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Blockhouse Bay Road. The ADT volumes and the peak period volumes are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Blockhouse Bay Road	Matata St to Margate Road	Northbound	5351	5110	740	289	319	2009
		Southbound	5797	5797	285	805	326	2009

Table 50: Traffic Volumes - Blockhouse Bay Road

The traffic volumes observed on Blockhouse Bay Road are typical of a Collector road. The directionality of traffic during peak hours suggests that it is a major commuter route.

4.15.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along Blockhouse Bay Road within 100m from the site in each direction. The search includes all crashes at or related to the Blockhouse Bay Road / Margate Road intersection.

A total of five crashes were found in the search and they are as follows:

- Four crashes occurred at the intersection with Margate Road. There was one rear-end type crash caused by vehicle following too closely, one head-on crash due to vehicle cutting corner at intersection, one minor-injury crash as a result of failure to give way when turning right onto Blockhouse Bay Road, and one minor-injury crash caused by a pedestrian crossing road heedless of traffic.
- One non-injury crash occurred midblock about 50m south of the site when vehicle on Blockhouse Bay Road southbound lost control and hit a house. Fatigue was a crash factor.

It is considered that the number of crashes within the area of the search is typical given the time period of the search. The varying causes of crashes indicate that there are no inherent safety issues within the study area.

4.15.5 Proposed Works and Work Site Layout

The L3S2 site is a small scale site of the Central Interceptor project. The proposed location and site layout of L3S2 can be referred to in the AEE Drawing Set. A single two-way temporary site access road is proposed on Blockhouse Bay Road. The proposed access path forms a one-way loop around the temporary shaft within the site. It operates in an anti-clockwise motion to enable entry and exit manoeuvres from the site to be carried out in a forward direction.

The existing bus stop on Blockhouse Bay Road northbound will be temporarily relocated to the south, approximately 40m from its currently location.

4.15.6 Access and Sight Distance

Access to the site is proposed to be through a new access on Blockhouse Bay Road. The approximate location of this access is shown below in Photograph 25. As part of the bus stop relocation, it is proposed that the bus shelter immediately before the reserve will also be moved southward along Blockhouse Bay Road.

Observations from the approximate location of the proposed access indicate that sight distance is satisfactory in both directions.

Photograph 23: Proposed access location for site L3S2

Figure 31 shows the swept path of the design truck using the proposed Blockhouse Bay Road access, including the removal of approximately 16m of on-street parking.

4.15.7 Pedestrian Access

Footpaths are provided on both sides of Blockhouse Bay Road as well as other roads in the surrounding areas. They will remain functional during the works for pedestrians to travel around the site. Pedestrian may be required to cross the site access along the footpath on Blockhouse Bay Road. Notwithstanding this, it is considered that adequate sight distance is provided to make sure the access road is cleared before crossing.

An internal recreational footpath to the north of the site runs in an east – west direction, generally parallel to Miranda Street. This footpath provides pedestrian access through the reserve from Blockhouse Bay Road and Miranda Street and is linked to the PS25 (L3S1) site to the west. Both the L3S1 and L3S2 sites will be fully fenced off from the footpath and the reserve. As such, the recreational footpath will remain accessible by the public.

4.15.8 Proposed Bus stop relocation

An existing bus shelter on Blockhouse Bay Road northbound is located immediately in front of Miranda Reserve. It is proposed that during the works, the bus stop including the bus shelter will be relocated approximately 40m south of its existing location. All bus routes including school buses that utilise this stop are expected to utilise the relocated bus stop. Passengers will only be required to walk a maximum additional distance of 40m to get to the bus stop. It is anticipated that minimal effects will be caused to all bus services in terms of delays and functionality.

4.15.9 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L3S2 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L3S2 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Minimal effects on the surrounding road network are therefore expected.

4.15.10 Traffic Distribution

It is assumed that all site traffic will access site from SH20 motorway via Maioro Street, New Windsor Road, Tiverton Road and Blockhouse Bay Road. Similarly, in the reverse direction all site traffic to travel towards SH20 via these roads.

4.15.11 Construction Traffic Truck Routes

The L3S2 site is proposed to be a small scale construction site, with low truck volumes expected to be accessing the site throughout the construction duration.

Figure 32 shows the recommended truck route from the site to the nearest motorway. Trucks will be able to access SH20 by means of Tiverton Road in the north, New Windsor Road and Maioro Street.

Trucks will pass through a 40km/hr school zone on Blockhouse Bay Road during school hours. This is considered acceptable as trucks will simply adjust their speed accordingly. Blockhouse Bay Road already caters for buses and other large vehicles and the additional peak of five heavy vehicle movements per hour is not considered to present any significant adverse road operation or safety effects.

4.15.12 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for operations and maintenance to the micro tunnel and as such long-term access to parts of the reserve is required by Watercare. The site layout post construction can be found in the AEE Drawing Set. The temporary site facilities and access path will be removed, and the playground area will be reinstated in consultation with Auckland Council.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.16 Whitney Street (L3S3)

4.16.1 Site Description

The subject site is located on the corner of Whitney Street and Mulgan Street, New Windsor. The proposed site location is outside private property at 120 - 124 Whitney Street and road reserve on Whitney Street.

The site area is confined and a temporary site access is proposed onto Whitney Street during construction. Residential properties and a local superette surround the subject site.

4.16.2 Road Network

Whitney Street is classified as a Local Road in the Auckland City District Plan. It runs in a north-south direction, linking Tiverton Street in the north with Donovan Street in the south. Whitney Street is a two-lane, two way street with a painted flush median in the vicinity of the proposed site.

Mulgan Street is classified as a Local Road in the Auckland City District Plan. It runs in an east-west direction, linking Whitney Street with New Windsor Road to the east. Mulgan Street is a two-lane, two way street, with parking available on both sides of the carriageway.

The Whitney Street / Mulgan Street intersection is a recently upgraded roundabout-controlled intersection. Kerb-side parking is restricted by means of broken yellow lines on all legs for at least 30m from the intersection. Pedestrian refuges (as part of the roundabout) are located on Mulgan Street and Margate Road, and on the southern leg of Whitney Street. Three angled parking spaces are located on Whitney Street outside the superette.

4.16.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Whitney Street and Mulgan Street. The average daily traffic volumes (ADT) in vpd and the peak period volumes in vph are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Whitney Street	Tiverton Rd to Margate Rd	Northbound	1712	1647	270	111	84	2008
		Southbound	1700	1662	141	224	99	2008
Mulgan Street	Pasteur Pl to New Windsor Rd	Eastbound	754	713	141	52	41	2008
		Westbound	605	581	34	99	36	2008

Table 51: Traffic Volumes – Whitney Street and Mulgan Street

The traffic volumes on Whitney Street and Mulgan Street are typical of Local Roads. The slightly higher daily weekday volumes and peak hours occurring on both roads show that they are commuter routes.

Existing traffic volumes of the above intersections were obtained from surveys undertaken by TDG on Thursday 21 July 2011 7:00am - 9:00am and 4:00pm - 6:00pm. The following tables summarise the surveyed peak hour volumes:

Approach	Movement	Morning Peak (vph)	Evening Peak (vph)
Whitney Street (Northbound)	Left	79	93
	Through	155	56
	Right	44	14
Whitney Street (Southbound)	Left	23	14
	Through	64	112
	Right	27	46
Mulgan Street	Left	7	16
	Through	83	276
	Right	18	11
Margate Road	Left	57	13
	Through	192	93
	Right	82	45

Table 52: TDG Surveyed traffic movements – Whitney Street / Mulgan Street / Margate Road

The traffic count data obtained are typical of Local Roads. Data shows that on Mulgan Street, commuters travel towards the east during the morning peak period and vice versa during the evening period.

4.16.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Mulgan Street and its intersections with Whitney Street and New Windsor Road.

A total of 12 crashes were found within the search and can be summarised as follows:

- Four non-injury crashes took place on Mulgan Street midblock including two loss-of-control crashes and two crashes involving hitting parking vehicles when manoeuvring.
- Five crashes including one minor injury crash occurred in the Whitney Street / Mulgan Street intersection. All were caused by traffic on Mulgan Street or Margate Road failed to stop at the stop sign and collided with through traffic on Whitney Road.
- Three crashes took place at the Mulgan Street / New Windsor Road intersection on New Windsor Road southbound, including one loss-of-control crash when overtaking resulting in minor injuries, and two non-injury crashes when through traffic hit rear-end of right turning vehicles.

The number of crashes occurred within the scope and time period of the search are considered typical. A slight pattern of through traffic on Whitney Street hitting vehicles crossing at right angle from the right is observed. The proposed works will require partial closure of Mulgan Street. Appropriate speed reduction and safety measures will be implemented and discussed in later sections in this report to ensure that the proposed works will not result in any significant changes to the road safety in the vicinity.

It is further noted that there has been a recent upgrade to the intersection (paint marking / kerb changes) to aid in safety in the area.

4.16.5 Proposed Works and Work Site Layout

The L3S3 site is a small scale key connection site of the Central Interceptor project. The proposed location and site layout of L3S3 can be referred to in the AEE Drawing Set. In order to undertake the proposed works, approximately 20m of the eastern footpath and the southbound lane on Whitney Street are proposed to be closed off as part of the site area. Access to the site will be gained from the western side of the site over the road section on Mulgan Street, where vehicles will travel along the southern side of the site to the site egress and onto Mulgan Street again. A one-way flow will be adopted through the site.

Site preparation will occur over the eastern half of Whitney Street in front of 124 Whitney Street. Two-way traffic flows on Whitney Street will be retained during construction by removing the existing painted flush median on Whitney Street to the north of Mulgan Street. A total carriageway width of 6.0m will be available for two-way traffic.

In addition to the construction of the Link Sewer 3 tunnel, connections to the existing wastewater network will also be provided at this site. Short term construction access is needed to construct the connection to the Avondale Diversion Sewer within the aforementioned construction area. The site will be fully enclosed in fencing and separated from the carriageway and the surrounding dwellings.

4.16.6 Access and Sight Distance

Access to the site is proposed via an on-street temporary access, which will be situated on the southbound lane on Whitney Street. Photograph 26 below shows the proposed location of the access and section of road proposed to be occupied for the duration of construction.

Photograph 24: Proposed access location for site L3S3

The proposed site access is parallel to the existing carriageway. It is recommended that vehicles access the site from Whitney Street north of the site and exit via Whitney Street south of the site. It is also likely that site vehicles will be directed in and out of the site to avoid conflict with passing traffic.

Observations from the approximate location of the proposed access indicate that sight distance is over 100m to the north (and reaches the intersection to the south) and is thus adequate for a local Road.

Figure 33 shows the swept path of the design truck using the proposed Whitney Street access.

4.16.7 Pedestrian Access / Carpark

Footpaths are currently provided on both sides of Whitney Street and Mulgan Street as well as other roads in the immediate road network. During the works, the footpath on the eastern side of Whitney Street will be closed and pedestrians will be required to use the footpath on the other side of Whitney Street. Appropriate signage detailed in the CTMP will be in place to direct the pedestrian's detour.

The existing three carparks serving the superette on Whtiney Street will remain unaffected by the works. The location of this space is such that they will be "protected" by the fencing surrounding the works, enabling easy access/egress for users of the spaces.

4.16.8 Construction Traffic Management Plan (CTMP)

4.16.8.1 Proposed Changes for Vehicular Movements

It is proposed that during the construction works at the L3S3 site, traffic lanes on Whitney Street for approximately 90m will be narrowed, whilst retaining a two-lane two-way road to accommodate all through traffic.

Traffic cones and barriers will be used to offset the traffic lanes to a minimum width of 2.75m each and divert traffic along Whitney Street.

Traffic will be required to reduce speed from 50kph to 30kph when travelling through the Whitney Street / Margate Road / Mulgan Street intersection and along Whitney Street for 130m during the entire works period. This is likely to result in some delays. However, it is considered that dedicated detour routes will not be required. Given the existing traffic flow on Whitney Street is relatively low, only minor effects to the surrounding road network are anticipated.

During construction of a connection between the main drop shaft and a manhole to the Avondale Diversion Sewer, Whitney Street will be required to be one-way. During this time, stop/go control will be required and it is recommended that this occurs outside peak hours of 7:00 – 9:00am and 4:00 – 6:00pm weekdays.

Figure 34 shows the indicative Construction Traffic Management Plan.

4.16.8.2 Proposed Changes for Pedestrian Movements

The eastern footpath on Whitney Street north from Mulgan Street for 40m will be closed during the works. Pedestrians will be directed to the footpath on the opposite side to traverse across Whitney Street. A temporary pedestrian refuge island will be constructed on Whitney Street to enable pedestrians to avoid the work site. These changes are considered sufficient to mitigate the temporary removal of the pedestrian refuge.

4.16.9 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L3S3 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L3S3 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Realistically, L3S3 is a small construction site and site traffic is expected to be reasonably lower than the assessed volumes. With the proposed temporary road layout on Whitney Street, minor effects on the surrounding road network are therefore expected.

4.16.10 Traffic Distribution

It is assumed that all site traffic will travel to site from SH20 motorway via Maioro Street, New Windsor Road, Tiverton Road, and Whitney Street and onto Mulgan Street. All site exits will travel on Mulgan Street eastbound onto New Windsor Road, Maioro Street and onto SH20.

4.16.11 Construction Traffic Truck Routes

The L3S3 site is proposed to be a small scale construction site, with low truck volumes expected to be accessing the site throughout the construction duration.

Figure 35 shows the recommended truck route from the site to the nearest motorway. Trucks will be able to access site from SH20 by means of Maioro Street, New Windsor Road, Tiverton Road and Whitney Street in order to turn left into site. Trucks from site will be able to access SH20 via Whitney Street (turning around at the roundablout), Tiverton Road, New Windsor Road and Maioro Street to the east of the site.

4.16.12 Traffic Generation during Normal Operation

This site is proposed to provide long-term maintenance access to the connection and as such long-term access to parts of the property at 128 Whitney Street is required. The site layout post construction can be found in the AEE Drawing Set. The temporary site facilities and access path will be removed and the land and affected road infrastructure, including the pedestrian refuge, will be reinstated.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

4.17 Dundale Avenue (L3S4)

4.17.1 Site Description

The proposed site location for the L3S4 site is in a small reserve on the northern side of Dundale Avenue, approximately 170m west of the Dundale Avenue / Boundary Road intersection in New Windsor. The site is proposed to be accessed via a temporary access onto Dundale Avenue.

The subject site is currently a green field with street frontage on Dundale Avenue. A small stream is situated to the north running parallel to the northern boundary of the site. The site is zoned as part of the road reserve under the Auckland City District Plan. Surrounding properties are mainly residential in nature. The Blockhouse Bay Christian Kindergarten is located to the northeast of the site. A small scale retail complex is located at the south-western corner of the Dundale Avenue / Boundary Road intersection.

4.17.2 Road Network

Dundale Avenue is classified as a Local Road in the Auckland City District Plan. It runs in an east-west direction, linking Whitney Street in the west with Boundary Road in the east. Dundale Avenue is a two-lane, two-way unmarked street with on-street parking available on both sides of the carriageway.

Approximately 170m to the east of the site, Dundale Avenue forms a priority Tee intersection with Boundary Road. Traffic on Dundale Avenue is controlled by "Stop" signage and associated markings. A left turn slip lane onto Dundale Avenue is provided for Boundary Road northbound.

4.17.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Dundale Avenue. The ADT volumes (vpd) and the peak period volumes (vph) are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Dundale Avenue	Whitney St to Boundary Rd	Eastbound	1022	951	191	70	44	2008
		Westbound	969	921	101	120	57	2008

Table 53: Traffic Volumes – Dundale Avenue

The traffic volumes observed on Dundale Avenue are typical of a Local Road. The slightly higher daily weekday and peak hour volumes occurring particularly on Dundale Avenue eastbound suggest that it is a commuter route.

Given the nature of the amenities surrounding the site as previously mentioned, there may be a high number of pedestrians particularly children travelling on Dundale Avenue. Vehicular and pedestrian surveys on Dundale Avenue have therefore been carried out.

Existing vehicle traffic and pedestrian traffic volumes of Dundale Avenue were obtained from surveys undertaken by TDG on Thursday 14 July 2011 7:00am - 9:00am and 3:00pm - 6:00pm. The following table summarise the surveyed peak hour volumes:

Approach	Movement	Morning Peak (8:00 – 9:00am)	Evening Peak (3:00 – 4:00pm)
Dundale Avenue (Eastbound)	Left	8	8
	Through	326	72
Dundale Avenue (Westbound)	Through	81	125
	Right	16	9
Driveway to Kindergarten east of site	Left	0	0
	Right	0	0

Table 54: TDG Surveyed traffic movements – Whitney Street / Mulgan Street / Margate Road

Approach	Movement	Morning Peak (8:00 – 9:00am)	Evening Peak (3:00 – 4:00pm)
Dundale Avenue	Along footpath	4	2
	Crossing Dundale Avenue	0	4

Table 55: TDG Surveyed pedestrian movements – Dundale Avenue

The survey results show that only a small number of vehicles utilise the kindergarten driveway and the number of pedestrians travelling on Dundale Avenue is minimal during the commuters' peak period.

4.17.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Dundale Avenue and its intersection with Boundary Road.

A total of six crashes were found within the search and can be summarised as follows:

- Four non-injury crashes took place on Dundale Avenue midblock with various causes which included two crashes hitting parked / parking vehicles, one loss-of-control crash when turning left, and one rear-end crash involving manoeuvres from private driveways.
- Two crashes including one minor injury crash occurred at the Dundale Avenue / Boundary Road intersection. One crash was caused by vehicle on Dundale Avenue failing to give way when turning right onto Boundary Road resulting in minor injuries, the other was a rear-end crash when through vehicle fail to notice right-turning vehicle slowing on Boundary Road southbound.

It is considered that the number of crashes occurred within the area of the search are typical given the time period of the search. Thus, there are no inherent safety issues within the study area.

4.17.5 Proposed Works and Work Site Layout

The L3S4 site is a small scale site of the Central Interceptor project. The proposed location and site layout of L3S4 can be referred to in the AEE Drawing Set. A single two-way temporary site access is proposed on Dundale Avenue. The proposed access path borders the temporary shaft and provides sufficient space for vehicles to turn around on-site before exiting in a forward direction. The driveways adjacent to the construction site will be fully separated from the site by fencing.

Temporary restrictions of some kerb-side parking may be required on the northern side of Dundale Avenue adjacent to the proposed site access.

4.17.6 Access and Sight Distance

Access to the site is proposed to be through a new temporary access on Dundale Avenue about 25m from the eastern site boundary. The approximate location of this proposed access is shown below in Photograph 27. The access is likely to be right-turn in / left-turn out due to the location of the site compared to the motorway.

The driveway adjacent to the eastern site boundary provides access to the Blockhouse Bay Christian Kindergarten. It is recommended that this site ceases to generate heavy vehicle traffic around the hours of opening sessions (9:00am Monday to Friday and 12:30pm Monday to Thursday) and closing sessions (12:00pm Monday to Friday and 3:30pm Monday to Thursday) of the kindergarten in order to eliminate potential safety issues associated with the children of the kindergarten. It is considered that the site access located 25m away from the Kindergarten's driveway is of an appropriate distance and provides sufficient separation.

Observations from the approximate location of the proposed access indicate that sight distance is satisfactory in both directions.

Photograph 25: Proposed access location for site L3S4

Figure 36 shows the swept path of the design truck using the Dundale Avenue access. In order to establish the access, it is recommended that 15m of on-street parking be removed temporarily to accommodate the driveway and truck swept paths. The loss of parking is not considered significant as there is ample off-street parking for the kindergarten and other community facilities.

4.17.7 Pedestrian Access

Footpaths are provided on both sides of Dundale Avenue. Pedestrian movements will be retained during the works. The proposed site access is located approximately 25m from the nearest driveway. It is considered that adequate separation is provided.

Pedestrians may be required to cross the site access along the footpath on the northern side of Dundale Avenue, notwithstanding this, it is considered that adequate sight distance is provided to make sure the access road is clear before crossing.

4.17.8 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L3S4 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L3S4 will generate a peak of no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

As noted, it is recommended that truck movements are restricted around the start of finish times of kindergarten sessions. Currently these sessions are from 9:00am to 12:00pm and 12:30pm to 3:30pm.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Realistically, L3S4 is a small construction site and site traffic is expected to be reasonably lower than the assessed volumes. Minimal effects on the surrounding road network are therefore expected.

4.17.9 Traffic Distribution

It is assumed that all site traffic will travel to site from SH20 motorway via Maioro Street and New Windsor Road / Boundary Road onto Dundale Avenue. All site exits will travel on Dundale Avenue eastbound onto Boundary Road / New Windsor Road, Maioro Street and onto SH20.

4.17.10 Construction Traffic Truck Routes

The L3S4 site is proposed to be a small scale construction site, with low truck volumes expected to be accessing the site throughout the construction duration.

Figure 37 shows the recommended truck route from the site to the nearest motorway. Trucks will be able to access SH20 by means of Boundary Road to the east, New Windsor Road and Maioro Street.

4.17.11 Traffic Generation during Normal Operation

This site is proposed to provide permanent access for maintenance to the micro tunnel and as such long-term access to parts of the reserve is required. The site layout post construction can be found in the AEE Drawing Set.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will be very infrequent and will normally be one vehicle every five years.

4.18 Haycock Avenue (L3S5)

4.18.1 Site Description

The proposed site location for the L3S5 site is on the section of land at 4 Haycock Avenue, Mount Roskill. The sites propose to use new access locations.

The subject site is rectangular in shape. It is currently occupied by two residential dwellings as are properties surrounding the site.

4.18.2 Road Network

Haycock Avenue is classified as a Local Road in the Auckland City District Plan. It runs in a general northwest – southeast direction, where it becomes John Davis Road in the north and links with White Swan Road in the south. Haycock Avenue is a two-lane, two way road with on-street parking available on both sides of the carriageway.

4.18.3 Existing Traffic Volumes

The latest two-way traffic volume data from Auckland Transport Traffic Flow Database was obtained for Haycock Avenue. The ADT volumes and the peak period volumes are summarised in the table below.

Road	Location	Direction	ADT (vpd)		Peak Hour Traffic Volume (vph)			Year
			5 day	7 day	Weekday AM	Weekday PM	Saturday	
Haycock Avenue	Battersby Ave to White Swan Rd	Northbound	645	644	80	62	43	2008
		Southbound	969	921	72	101	39	2008

Table 56: Traffic Volumes - Haycock Avenue

The low traffic volumes observed on Haycock Avenue are typical of a Local Road.

4.18.4 Road Safety Assessment

A search within the NZ Transport Agency's Crash Analysis System (CAS) has been undertaken for the five year period from 2006 to 2010, and all available data from 2011. The search was made for all reported injury and non-injury crashes along the full length of Haycock Avenue inclusive of its intersection with White Swan Road.

A total of two crashes were found in the search. One minor-injury crash took place on Haycock Avenue 130m north of the intersection with White Swan Road when a vehicle lost control on the curve. One non-injury crash occurred at the Haycock Avenue / White Swan Road intersection when the left-turning vehicle from Haycock Avenue failed to give way and collided with through traffic.

Given the low number of accidents that occurred within the scope and time frame of the search, it can be concluded that there are no inherent safety issues within the search area.

4.18.5 Proposed Works and Work Site Layout

The L3S5 site is a small scale connection site of the Central Interceptor project required for construction of LS3. Connections to the existing Western Interceptor and Lynfield Branch Sewer will also be provided in this site. The proposed location and site layout of L3S5 can be referred to in the AEE Drawing Set. Vehicles will enter/exit the site via a new driveway on the western boundary of No. 4 Haycock Avenue. Works will occur at 4 Haycock Avenue and over the carriageway of Haycock Avenue (for connection to the existing Western Interceptor).

The site will be enclosed in fencing and be fully separated from surrounding properties.

4.18.6 Access and Sight Distance

Access to the site is proposed via an on-street temporary access, which will be situated on Haycock Avenue. Photograph 28 below shows the proposed location of the access and section of road proposed to be occupied for the duration of construction of the Western Interceptor connection.

Photograph 26: Haycock Avenue access / site

Figure 38 shows the swept path of the design truck using the Haycock Avenue access.

4.18.7 Pedestrian Access

Footpaths are currently provided on both sides of Haycock Avenue as well as other roads in the immediate road network. During the works associated with the Western Interceptor connection, the footpath on the southern side of Haycock Avenue will be closed and pedestrians will be required to use the footpath on the other side of Haycock Avenue. Appropriate signage detailed in the CTMP will be in place to direct the pedestrian's detour.

4.18.8 Haycock Avenue lane closure - Construction Traffic Management Plan (CTMP)

4.18.8.1 Proposed Changes for Vehicular Movements

During the construction works associated with the Western Interceptor connection, Haycock Avenue may be narrowed to one operational lane only, whilst retaining two-way traffic flow to accommodate all through traffic on Haycock Avenue by means of the implementation of temporary traffic signals, as shown in Figure 39.

A pair of temporary traffic signals (or stop/go personnel) will be installed on Haycock Avenue westbound 35m from the intersection with White Swan Road, and on Haycock Avenue eastbound approximately 10m from the intersection with Battersby Avenue. Priority will be given to westbound traffic to prevent traffic from backing up to the intersection (i.e. signals will revert to green for westbound traffic when no vehicles present).

Through traffic in both directions on Haycock Avenue will be required to reduce speed from 50kph to 30kph when travelling on Haycock Avenue during the entire works period. This is likely to result in some delays. However, dedicated detour routes will not be required for this option. Given the existing traffic flow on Haycock Avenue is relatively low, only minor effects to the surrounding road network are anticipated.

4.18.8.2 Proposed Changes for Pedestrian Movements

The southern footpath on Haycock Avenue between White Swan Road and Battersby Avenue will be closed during the works associated with the Western Interceptor connection. Pedestrians will be directed to the footpath on the opposite side to traverse across Haycock Avenue.

4.18.9 Traffic Generation

The trip generation data for Lyon Avenue (AS2) (detailed in Section 4.3.9) has been used to assess all intermediate and small scale sites in this report, where vehicle movements are expected to be the highest out of all these sites and therefore representing a worst case scenario.

Based on this worst case scenario, it is anticipated that the L3S5 site will generate no more than the following trips per day and per hour during the peak construction season (assuming 30% of light vehicle trips occur during the peak hour):

Approximate traffic generation in Stage One:

- 14 standard vehicle movements per day (four vehicle movements during peak hour).
- 34 heavy vehicle movements per day (average of three heavy vehicles movements per hour over a 12 hour day).

Approximate traffic generation in Stage Two:

- 12 standard vehicle movements per day (four vehicle movements during peak hour).
- 56 heavy vehicle movements per day (average of five heavy vehicle movements per hour over a 12-hour day).

In total, it is estimated that the proposed development at L3S5 will generate no more than 68 vehicle movements per day, with nine vehicle movements during the peak hour.

The low additional traffic volumes are well within the capacity of the surrounding roads and are well within the typical hourly fluctuations of the nearby roads. Realistically, L3S5 is a small construction site and site traffic is expected to be reasonably lower than the assessed volumes. With the proposed temporary road layout on Haycock Avenue, the minor effects of the works on the surrounding road network are expected to be well accommodated.

4.18.10 Traffic Distribution

It is assumed that all site entries will originates from SH20 and travel via Dominion Road, Richardson Road, and White Swan Road onto Haycock Avenue. All site exits will travel along Haycock Avenue westbound onto John Davis Road, Richardson Road and Maioro Street onto SH20.

4.18.11 Construction Traffic Truck Routes

The L3S5 site is proposed to be a small scale construction site, with low truck volumes expected to be accessing the site throughout the construction duration.

Figure 40 shows the recommended truck route from the site to the nearest motorway. Trucks will be able to access site from SH20 by means of Dominion Road, Richardson Road and White Swan Road onto Haycock Avenue. Trucks from site will be able to access SH20 via Haycock Avenue westbound, John Davis Road, Maioro Street and onto SH20.

It is considered that these assumptions may change depending on which road provides the quickest route, generally providing a less congested network overall.

4.18.12 Traffic Generation during Normal Operation

This site is proposed to provide long-term maintenance access to LS3 and as such long-term access to this site is required. The site layout post construction can be found in the AEE Drawing Set. The temporary site facilities and access path will be removed.

The traffic generation post construction will be limited to regular maintenance of site facilities. It is estimated that traffic generated by the site will normally be one vehicle per month.

5. Cumulative Effects

There are a number of sites that will travel through the same intersection / interchanges. In particular, the Maioro Street interchange with SH20 will likely have up to five sites (Walmsley Park, L351, Miranda Reserve, Whitney Street and Dundale Avenue) which will, in some time, use the interchange. In this regard, it is highly unlikely that all five sites will be a peak operation at the same period. Further, the site routes have been chosen so they use high capacity interchanges (eg: Dominion Road/SH20, Hillsborough/SH20, Maioro Street/SH20, Western Springs interchange) to gain access to the arterial road network in Auckland. These intersections/interchanges are well designed for large trucks and can cater for the small increase in traffic expected from the construction works.

6. Construction Traffic Management Plans

In addition to the construction traffic management plans (CTMP) provided for Norgrove Avenue (L2S2), Whitney Street (L3S3) and Haycock Avenue (L3S5) previously discussed in this report, a CTMP is required for each site during the construction stage.

Each CTMP should generally detail appropriate signage and notifications to be erected and / or circulated well in advance of the works on and around each site, in order to give road users plenty of notice. Any affected parties (where applicable) in the area should also be notified in advance of the works, and at the three major sites, at least three months prior to commencement of work such as (but not limited to):

- Local residents.
- Local businesses.
- Schools.
- Local boards.
- Public transport companies.
- Emergency Services.
- Auckland Transport.

7. Conclusions

On the basis of this transport assessment it is concluded that all 19 sites can be established with no more than minor traffic effects on the operation of the surrounding road and pedestrian network during the works period, provided that the following mitigation measures are generally implemented at each site:

- Construction truck routes to avoid right turns and generally follow arterial routes as detailed in the Construction Truck Route Diagram for each site.
- Restrict site heavy vehicles to the largest allowable truck size as shown on the Vehicle Tracking Curve diagrams, and
- Production of a detailed Construction Traffic Management Plan.

In addition to the mitigation measures listed above, the following table summarises the mitigation measures to be in place for each individual site:

Site	Recommendations/ Comments	Estimated Traffic Effects
Western Springs (WS1)	■ All construction vehicles should enter / exit the site via left in / left out only. ■ Limit any vehicle movement during any major events at the Western Springs Stadium. ■ Upgrade Stadium Road to include footpath on both sides is maintained.	Minor (including surrounding intersections and SH16 interchange)
Mt Albert War Memorial Reserve (AS1)	■ Closure of the northern access for public vehicles during significant times of construction (ie: truck access route only).	Less than minor
Lyon Avenue (AS2)	■ maintain pedestrian access to Roy Clements Treeway.	Less than minor
Haverstock Road (AS3)	■ Removal of carparks both immediately near the site entrance and on the southern-side of Haverstock Road within 50m of Sandringham Road	Less than minor
Walmsley Park (AS4)	■ Site access be restrict to left in / left out only ■ Provision of parking restrictions 6m either side of the proposed access on Sandringham Road	Less than minor
May Road (WS2)	■ Provision of parking restriction 10m on Roma Road.	Minor (including surrounding intersections / interchanges).
Keith Hay Park (AS5)	■ Strengthening and/or widening of the access bridge at the end of Rainford Street (micro-tunnelling). ■ Widening of the proposed access road between the site and Rainford Street (currently an internal pedestrian / cyclist path in Keith Hay Park); or installation of the temporary traffic signals to direct site traffic (micro-tunnelling). ■ Temporary / Alternate pedestrian / cycle routes be established between Cameron Pool Leisure Centre and Mt. Roskill Grammar School (micro-tunnelling).	Minor
PS23 (AS6)	■ Production of a detailed Construction Traffic Management Plan which will include ways to ensure queuing of vehicles does not occur on Frederick Street such as providing a dedicated waiting area in place of existing parking to ensure vehicles do not restrict through traffic on Frederick Street.	Less than minor
Kiwi Esplanade / Ambury Park (AS7)	■ For the Ambury Road site, a temporary pedestrian diversion will be established to existing standards.	Less than minor

Site	Recommendations/ Comments	Estimated Traffic Effects
Mangere Pump Station (WS3).	■ Heavy vehicles should abide by existing heavy vehicle restrictions on Greenwood Road/Creamery Road. ■ Upgrading of the access road to ensure safe manoeuvres performances by site vehicles.	Minor
Motions Road (L1S1)	■ Temporary / Alternate pedestrian / cycle routes be established for both Motions Road and the nearby footbridge.	Minor
Western Springs Depot (L1S2)	■ Limit all vehicle movement during any major events at the Western Springs Stadium. ■ Upgrade Stadium Road to maintain footpath access.	Minor
Rawalpindi Reserve (L2S1)	■ Temporary / Alternate pedestrian path to playground to be established and fully fenced.	Less than minor
Norgrove Avenue (L2S2)	■ Arrangements with local residents regarding temporary access. ■ Production and implementation of a detailed CTMP generally as per Figure 27 of this report.	Minor
PS25 (L3S1)	N/A.	Less than minor
Miranda Reserve (L3S2)	■ The bus stop at 337 Blockhouse Bay Road relocated to 40m south of its existing location. ■ Provision of 16m of no stopping parking restrictions.	Minor
Whitney Street (L3S3)	■ Temporary / Alternate pedestrian route be established ■ Production and implementation of a detailed CTMP generally as per Figure 34 of this report.	Minor
Dundale Avenue (L3S4)	■ Truck movements to be limited around the opening and closing hours of the Blockhouse Bay Christian Kindergarten adjacent to the site, in order to eliminate potential safety issues associated with the children of the kindergarten. ■ Provision of parking restriction 15m on Dundale Avenue.	Less than minor
Haycock Avenue (L3S5)	■ Installation of the temporary traffic signals to direct site traffic or completed closure of Haycock Avenue (for Western Interceptor connection only). ■ Temporary / Alternate pedestrian routes be established. ■ Production and implementation of a detailed CTMP generally as per Figure 39 of this report.	Minor

Table 57: Overall Site Assessment issues

With the above measures in place it is considered that the Watercare Central Interceptor Project can occur with no more than minor effects to the surrounding roading network.

Traffic Design Group Ltd
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