Proposed Magnetite Processing Facility

Traffic Impact Assessment

Animal Plant Mineral Pty Ltd

20 January 2021
Ref: 201471

tonkin

Building exceptional
outcomes together

Document History and Status

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1 Introduction

Tonkin has been engaged by Animal Plant Mineral Pty Ltd to undertake a traffic impact assessment on behalf of TNG Limited, for a proposed magnetite processing facility located on Channel Island Road, Northern Territory.

It is understood that TNG proposes to construct and operate the Darwin Processing Facility on land within Lot 1817, Hundred of Ayers, Middle Arm. The site is located adjacent to the Elizabeth River and is approximately 507 ha. It is understood that the design life of the Processing Facility will be 40 years.

It is proposed that materials will be transported from Mount Peake Project, 1,400km south of Darwin shown in Figure 1 below, to the facility by rail. The material will be processed at the facility and then transported to Darwin's East Arm Wharf by rail.

The Processing Facility would process magnetite concentrate to produce:

- Vanadium pentoxide - for use in steel, non-ferrous alloys, chemicals, catalysts and energy storage (vanadium redox batteries).
- Titanium dioxide pigment - for use in paint, and coatings.
- Iron Oxide fines - for use in steel making.

The three products will be exported through the Port of Darwin's East Arm Wharf.

As part of the proposed facility, the following transport infrastructure will be required to be constructed:

- Road connection to/from the new intersection of Channel Island Road.
- A rail siding running parallel to the Adelaide-Darwin rail line.

This report presents a traffic impact assessment (TIA) for the proposed development, detailing the likely traffic impacts on the wider road network.

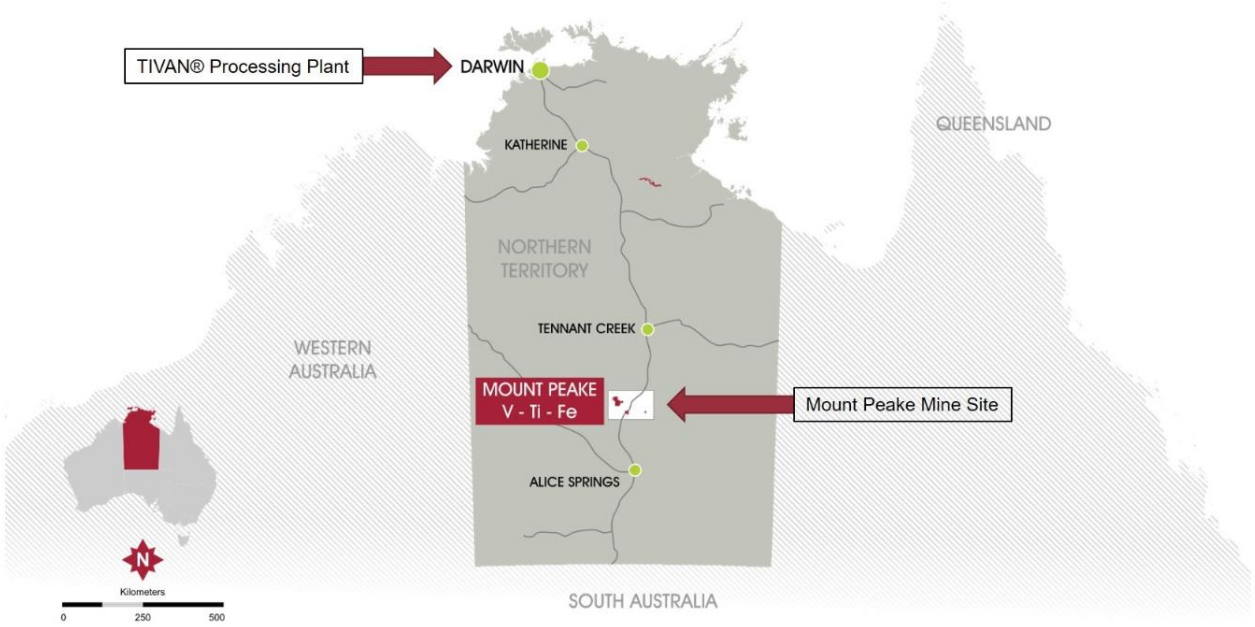

Figure 1 Locality Plan

2 Existing Conditions

2.1 Subject Site

The processing facility will be located on a site of approximately 507ha at Lot 1817, Hundreds of Ayers, Middle Arm Peninsula of Darwin Harbour. Access to the site is via Channel Island Road and is approximately 33 km by road from Darwin, 12 km from Palmerston and 22 km by road or rail from East Arm Wharf.

The site is currently leased from the NT government by private companies under extractive resources licence/s for quarrying activities. To facilitate these current uses, the site has the following access tracks entering from Channel Island Road:

- Approximately 550m south of the Elizabeth River Bridge
- Approximately 130m south of the level crossing
- Approximately 250m west of Jenkins Road
- Approximately 600m west of Jenkins Road

The access track 550 m south of the Elizabeth River Bridge will be upgraded for use as an emergency entry and exit point. It is understood that the other informal access tracks will be closed and all access to the site would be consolidated at a single site access junction.

The processing facility and associated access roads, supporting infrastructure and services comprise a development footprint of approximately 270.5 ha. The site is zoned future development.

The site is bounded to the north and west by mangrove forest which is zoned conservation.

The development will front Channel Island Road. However, no direct access will be adopted as the development will utilise the Kittyhawk access road junction which has recently been constructed further west on Channel Island Road.

The existing rail line is located between Channel Island Road and the site. It is proposed to provide a spur line within the site to provide connection to this rail line.

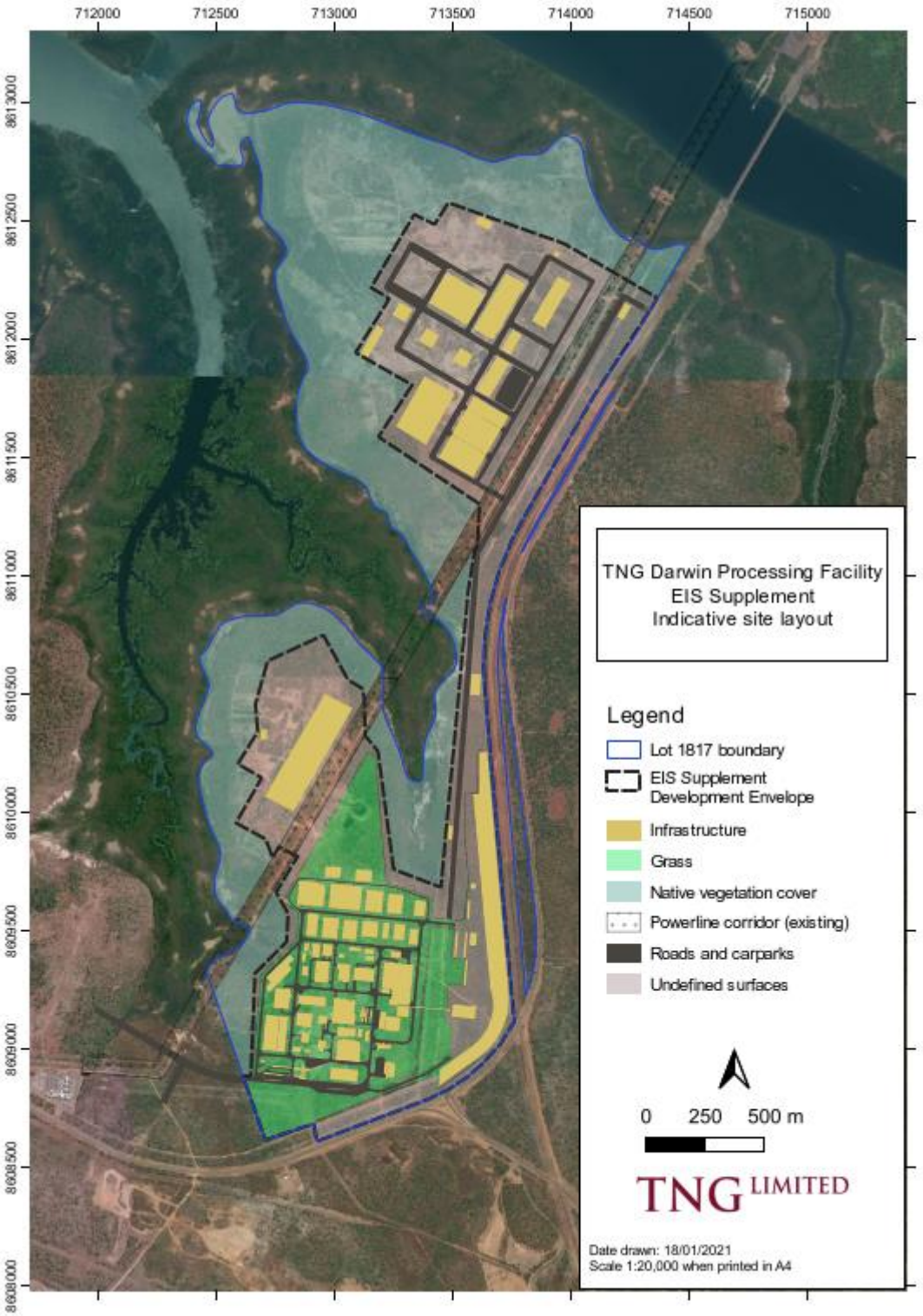

Figure 2 Proposed Site Arrangement

2.2 External Road Network

2.2.1 Adjoining Roads

2.2.1.1 Channel Island Road

Channel Island Road is a two lane sealed road under the care and control of the NT Government (Department of Infrastructure, Planning and Logistics). It consists of a single carriageway with one lane in each direction, the posted speed limit is 90km/h at the proposed location of the processing facility. The road consists of sealed and unsealed shoulders with a total sealed width of approximately 8m, lane widths are approximately 3.5m in each direction.

Channel Island Road extends from Palmerston to the north and Channel Island power Station to the south-west. Given the primarily industrial area to south-west of Channel Island Road, it is understood that most of the traffic utilising the road is generated by industry.

There is a level rail crossing on Channel Island Road, approximately 500m north-east of the intersection with Jenkins Road. The intersection with Jenkins Road has dedicated turn lanes provided.

To the north of the proposed site is the Elizabeth River bridge which spans approximately 500m.

Based on 2019 traffic data, Channel Island Road has an annual average daily traffic (AADT) of approximately 1,895 vehicles per day (vpd) with a commercial vehicle (CV) percentage of 12.33% (data from DIPL Annual Traffic Report, 2019).

It is noted that Channel Island Road had significantly higher traffic volumes (approximately 250% higher than the observed 2019 volumes) in the proceeding years when the construction of the Inpex project was underway.

2.2.1.2 Jenkins Road

Jenkins Road is a two-lane (1 lane in each direction) sealed road which connects Channel Island Road to the Stuart Highway south of the Arnhem Highway.

Each lane provided on Jenkins Road has a width of approximately 3.5m with sealed shoulders of approximately 1.5m provided.

2.2.2 Pedestrian and Cycling Infrastructure

There is no pedestrian or cycling infrastructure in the vicinity of the proposed site. Given the rural/industrial location of the site, pedestrians and cyclists are not expected to utilise Channel Island Road, and so the infrastructure is not considered to be required.

It is noted that the road reserves are typically large and if demand for pedestrian and cyclist facilities increases, there is a potential for the road authority to provide this infrastructure within the road reserve.

3 Development Proposal

3.1 Layout

The proposed site arrangement is shown in Figure 2 above. The proposed site will utilise the recently constructed access into the stage 1 Kittyhawk Estate. This access is located approximately 2.4km west of the intersection with Jenkins Road (Figure 3).

It is understood that this intersection has been designed and built to provide access to the future industrial subdivision; this and the connection of the proposed development site to the local road network of the Kittyhawk Estate has been confirmed by the Land Development Corporation (LDC).

As part of the proposed development, a rail siding will be constructed to allow for loading/unloading of goods from the site. The rail siding will be approximately 3.8 km long to allow for the full length of the train (1.36 km) on either side of the unloading station, which will be located midway along the siding. This is required to ensure that the train will have sufficient space on the siding to unload without interrupting the regular flow of traffic on the main rail.

The rail siding will be built on the Lot 1817 as close as possible to the Processing Facility, within the southern section of the site.

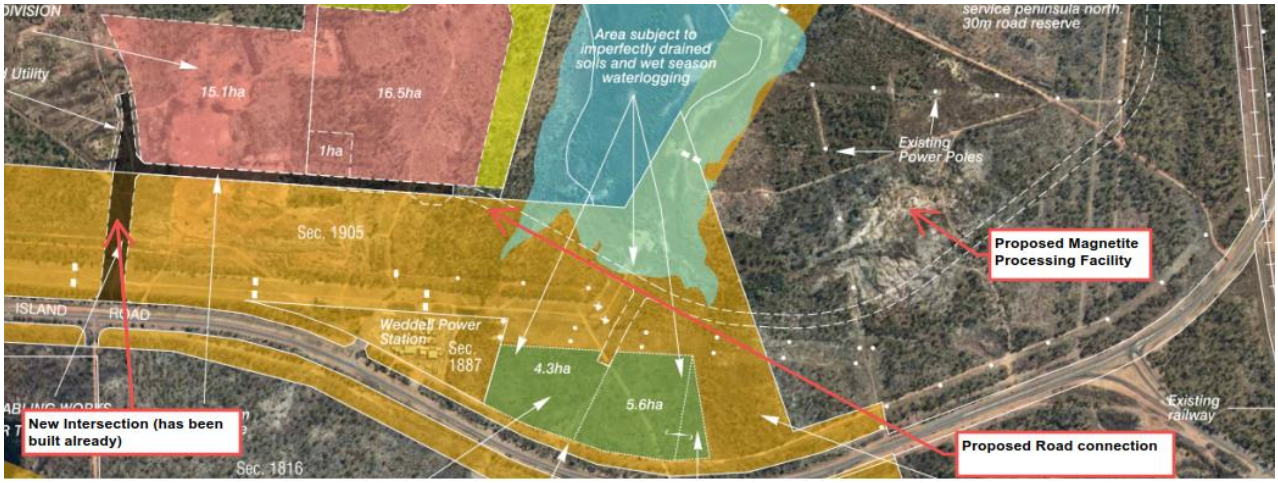

Figure 3 Approximate Road Connection Location

3.2 Site Usage

The site usage is divided into two phases:

- Construction/commissioning, and
- Operations/maintenance.

3.2.1 Construction/Commissioning

The construction phase is estimated to take approximately 30 months and will be undertaken over both the wet and dry season.

It is understood that there will be a laydown area which will securely house machinery and equipment, although this area is still under consideration and the location is not yet finalised, it is understood that this area is likely to be on the northern portion of the site.

Expected vehicle movements on Channel Island Road include:

- 38 maximum estimated trips per day (earthworks)
- 64 maximum estimated trips per day (civil works)
- 4 maximum estimated trips per day (structural steel)
- 2 maximum estimated trips per day (mechanical equipment)
- 1 maximum estimated trip per day (pipes and valves)
- 1 maximum estimated trip per day (Electrical and Instrumentation)
- 1 maximum estimated trip per day (Ad-hoc deliveries & visitors)
- 58 maximum estimated trips per day (light vehicles to transport workers from camp or local towns)
- 26 maximum estimated trips per day (buses to transport workers from construction camp)

While it is under construction, it is anticipated that the site will generate a maximum of 195 vehicle trips per day, although this is conservative as many of the vehicles in reality will not be utilised at the same time.

3.2.2 Operations/Maintenance

Upon completion of the construction phase, usage of the site will transition to operational and maintenance related traffic. Vehicle movements within the site will occur on purpose-built roads and have not been discussed further within this section. Due to the size of the site, any vehicle entering the site will be able to turn around and exit in a forward gear.

Daily vehicle movements external to the site (primarily between the site and the Darwin Port) will include:

- 4 isotainer truck movements
- 10 quad road train movements
- 2 flatbed truck movements
- 4 fuel/lubrication truck movements
- 16 light vehicle movements

It is identified that the above (36) movements would occur outside of the peak hours for staff movements.

In addition to the above, there will be light vehicle and/or bus movements associated with employees travelling to and from the site. It is anticipated that this would include traffic movements associated with approximately 300 roles across the following areas:

- Administration staff (8am to 4pm, 5 days per week) – 26 roles

- Operations staff (8am to 4pm, 5 days per week) – 31 roles
- Operations staff (8am to 6pm, 7 days a week) – 3roles
- Operations staff (8am to 6pm and 7pm to 7am, shift) – 240 roles

It is noted that the anticipated employment would be higher to ensure full coverage, with an expectation that approximately 850 personnel will be employed for the project during operations.

Based on the above roles, the total daily traffic movements for the operations/maintenance phase is approximately 636 vehicles per day, if all staff drive independently to and from the site (rather than any buses being adopted).

If it is assumed (worst case) that every staff member drives, the following hourly movements are anticipated:

- 7am – 120 movements away from the site
- 8am – 180 movements to the site
- 4pm – 58 movements away from the site
- 6pm –122 movements away from the site
- 7pm – 120 movements towards the site

It is assumed that the majority of staff movements will be to and from the north along Channel Island Road (as this provides access to the residential areas of Palmerston, Darwin and the rural area).

Based on a large coach capacity of 57 seats, a total of 6 buses would be required in the morning and evening, noting that the morning would be spread over a 2 hour window and the evening over a 3 hour window. That is, the actual number of buses per hour is likely to be at the most 4 buses.

3.3 Parking

Parking will be provided on site for construction and ongoing operations/maintenance. The site has sufficient space to provide adequate parking for the identified uses.

Based on the above staffing predictions, it is anticipated that a total provision of up to 50 car parking spaces should be provided for the construction period, it is noted that this estimate is based on 29 light vehicles, 13 buses and 8 other vehicles parking at the site.

For the ongoing operations/maintenance and assuming all staff will drive their own vehicle to and from site a total of 320 parking space would be required.

However, if buses are provided to transport workers to and from the site, this could be reduced to 26 parking bays.

3.4 Rail Movements

The site is proposed to be serviced with a rail spur that facilitates movement of materials to and from the Processing Facility. It is understood that there are proposed to be 6 cycles per week to and from the south and 7 cycles to and from East Arm per week. The proposed maximum train length is approximately 1,365m.

There are two level crossings nearby (Channel Island Road and Jenkins Road). Both level crossings currently have advance warning signage on the approaches to the level crossings. The operation of these level crossings will be impacted by the trains travelling to and from the south (ie total 6 movements per week).

4 Assessment

This section assesses the traffic impacts of the proposed development.

4.1 Traffic Generation

4.1.1 Background Growth

It is understood that there are significant areas of land within Middle Arm that NTG are seeking to develop for large scale industrial uses. It is noted that based on past traffic on the Channel Island Road with the construction of the Inpex Icthys, an increase in excess of 190vpd (during construction) or 636vpd (during operations) on current traffic volumes could be accommodated by the existing road and junctions.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Inbound (veh/day)	339	371	454	502	872	1,514	2,199	1,548	1,358	1,520	1,821	950
Outbound (veh/day)	339	372	439	496	674	1,442	2,388	1,812	1,566	1,535	1,810	944
Two-Way (veh/day)	678	743	893	998	1,546	2,956	4,587	3,360	2,924	3,055	3,631	1,894

Figure 4 NTG Traffic Counts (2008-2019)

4.1.2 Construction Phase

It is understood that there would be up to 1,500 personnel (total) working at the site during construction across different shifts. Based on the information outlined in section 3.2.1, a total maximum daily traffic generation of up to 195vpd could be expected.

Based on the yearly traffic counts undertaken on Channel Island Road by DIPL (DIPL Annual Traffic Report, 2019), the current daily traffic volume is approximately 1,895vpd.

Adding the maximum traffic anticipated to be generated by the site (195vpd), to the existing traffic and the identified traffic from Kittyhawk development 1,920vpd (i3 consultants updated TIA) a total daily traffic of approximately 4,010vpd could be expected. This is less than the traffic volumes experienced in 2014 and therefore could reasonably be accommodated by the existing road network.

Traffic Distribution.

It is anticipated that traffic from the construction of the site (195 vehicle trips per day) is distributed as per below:

- All bus movements (26 trips per day) would occur between the construction camp (Bladin Village) and the site and via Channel island Road (Figure 7). It is assumed that workers will commute to site using a bus service at 7am and 5pm, hence during the morning peak hour (7:30 to 8:30am) Channel Island Road will not have any bus movement. However, during the evening peak hour (4:30 to 5:30pm) buses will be departing the site, it is assumed that within the evening peak hour all the buses turn right out of the new Kittyhawk Access Road and drive towards the construction camp.
- It is assumed that the remaining trips would be distributed to and from the north. It is assumed that approximately 17 trips will occur during each AM (80% in and 20% out) and PM (20% in and 80% out) peak hours. Figures 5 and 6 below show AM and PM peak volumes generated by this proposed development only.

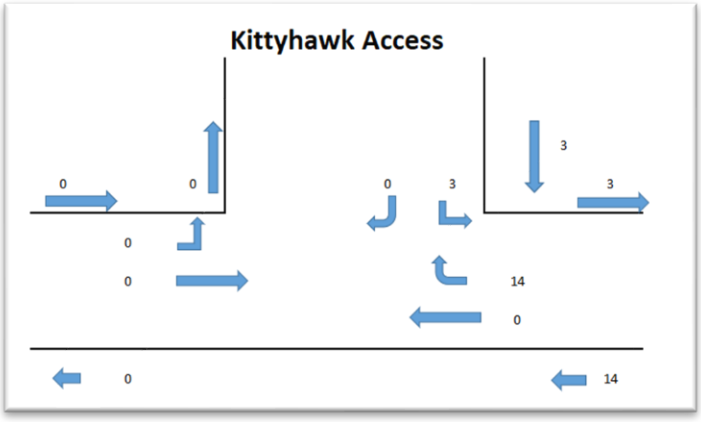

Figure 5 AM peak hour volumes- Magnetite facility only

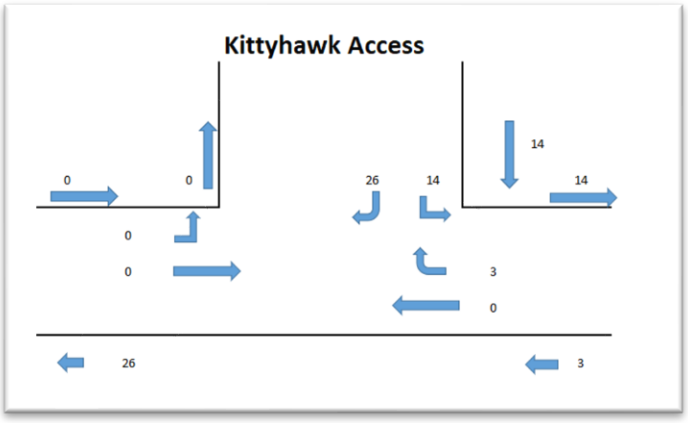

Figure 6 PM peak hour volumes-Magnetite facility only

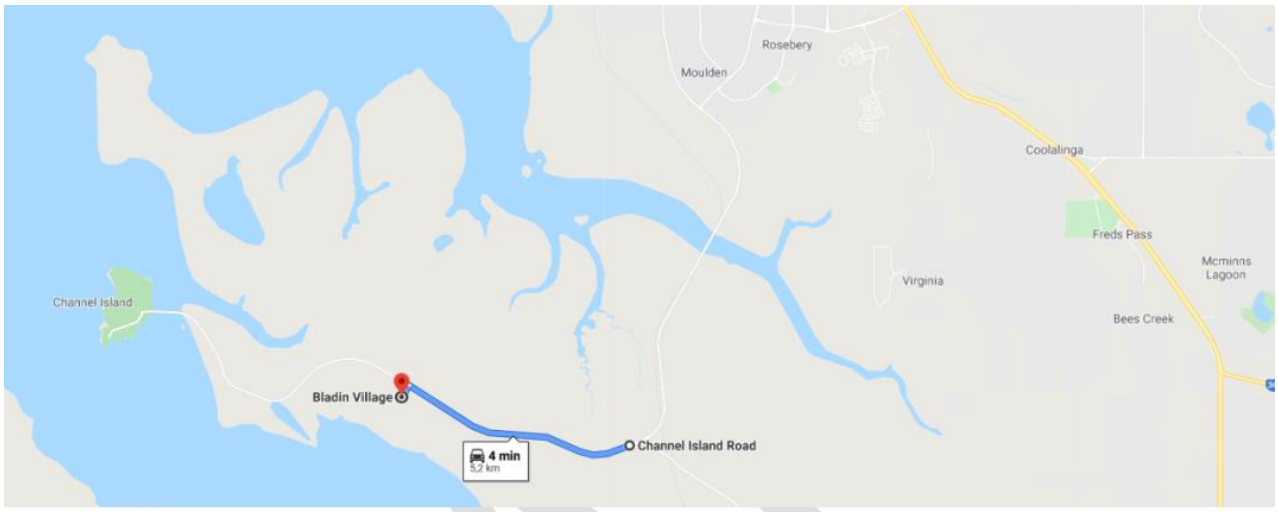

Figure 7 Route between the construction camp and the site.

i3 consultants WA has developed an updated TIA report (dated January 2020) based on a preliminary report prepared by Jacobs in March 2015 for the revised first stage of the Kittyhawk Estate development proposed within the Middle Arm Industrial Precinct on Channel Island Road. As part of their assessment they assessed the traffic volumes expected to be *generated* by the development of Stage 1 of Kittyhawk

Estate and their effect on three junctions (Channel Island Road/ Kittyhawk Access, Channel Island Road/ Jenkins Road and Channel Island Road/ Elrundie Avenue/ Chung Wah Terrace). The expected peak hour traffic volumes to be generated from the Kittyhawk Estate development are shown in Figures 8 and 9.

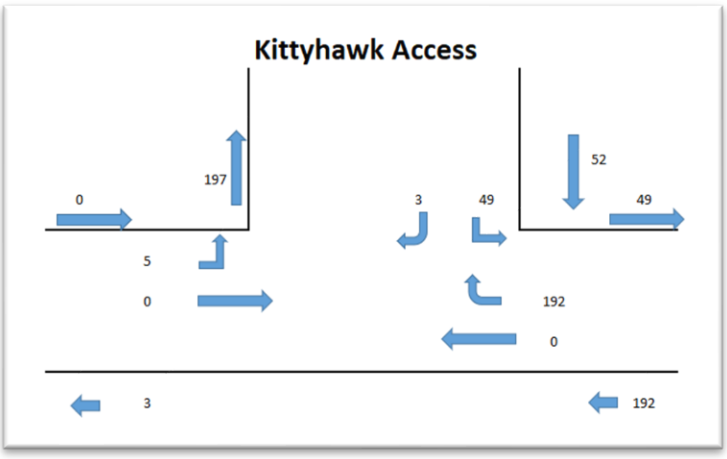

Figure 8 AM peak hour volumes- Kittyhawk Development only

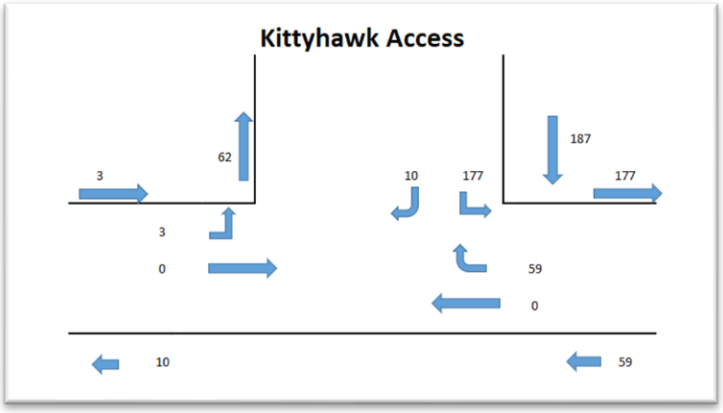

Figure 9 PM peak hour volumes- Kittyhawk Development only

Tonkin have combined the anticipated traffic flow to be generated by both developments as well as the traffic volumes along Channel Island Road (data from DIPL Annual Traffic Report, 2019). The total expected AM and PM peak hour volumes are shown in Figure 10 and 11.

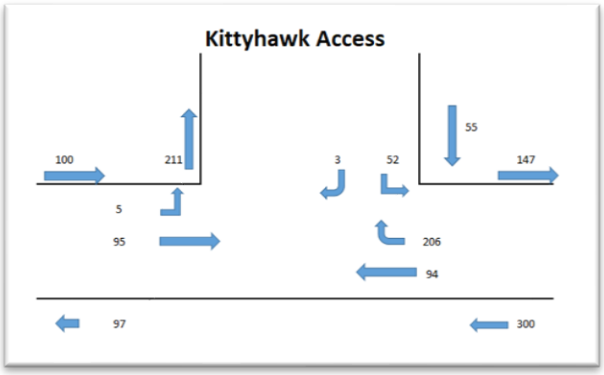

Figure 10 AM Peak Hour Volumes of Magnetite Facility, Kittyhawk development and 2019 traffic volumes on Channel Island Road (Construction Phase only).

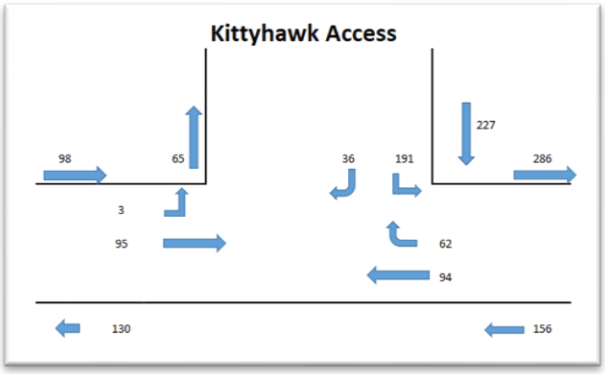

Figure 11 PM Peak Hour Volumes of Magnetite Facility, Kittyhawk development and 2019 traffic volumes on Channel Island Road (Construction Phase only).

The forecast total 2020 AM and PM traffic volumes with the Kittyhawk stage 1 development report are shown in Figure 12 and 13.

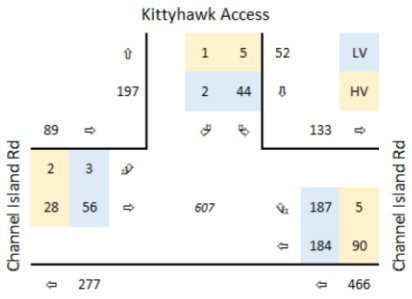

Figure 12 Extract from Figure 33 in TRAFFIC IMPACT ASSESSMENT (UPDATE OF JACOBS 2015 TIA): 2020 AM peak hour volumes (Channel Island Road/ Kittyhawk Access)

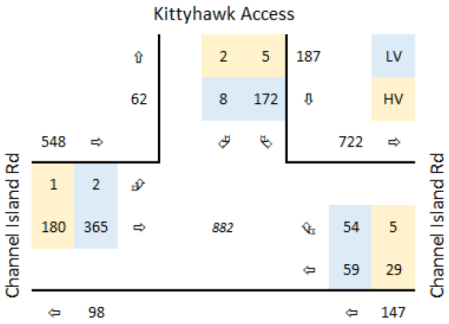

Figure 13 Extract from Figure 34 in TRAFFIC IMPACT ASSESSMENT (UPDATE OF JACOBS 2015 TIA): 2020 PM peak hour volumes (Channel Island Road/ Kittyhawk Access)

A comparison between Figures 10/11 and 12/13 shows that the i3 consultants have assessed the expected traffic conservatively (as the assessment assumed linear growth from 2018 volumes where the actual 2019 volumes show a significant decrease). It is noted that the i3 reporting identifies that, even with conservative background traffic volumes, the road network can successfully accommodate the proposed increase in traffic.

4.1.3 Operational Phase

There is a potential (worst case) of up to 636 vehicle trips per day if all staff drive independently to and from the site. Adding the maximum traffic anticipated to be generated while the site is operating 636vpd and the identified traffic from Kittyhawk development 1,920vpd (i3 consultants updated TIA) to the current daily traffic volume 1,895vpd (DIPL Annual Traffic Report, 2019) a total daily traffic of approximately 4,725vpd would be expected (worst case) which is higher than the volume experienced in 2014 by approximately 138 vehicle trips per day or approximately 3%.

Traffic Distribution

It is anticipated that all the expected traffic commuters to the site will travel through either Palmerston (via Elrundie Avenue and Chung Wah Terrace) or Berry Springs (via Finn Rd and Jenkins Rd).

Based on the proposed shift times, it is anticipated that there would be approximately 180 vehicle trips will be within the morning peak hour (80% in and 20% out) and 60 vehicle trips will be within the evening peak hour (20% in and 80% out). The expected AM and PM traffic volumes to be generated from the Magnetite development (during operational phase) are shown in Figures 14 and 15.

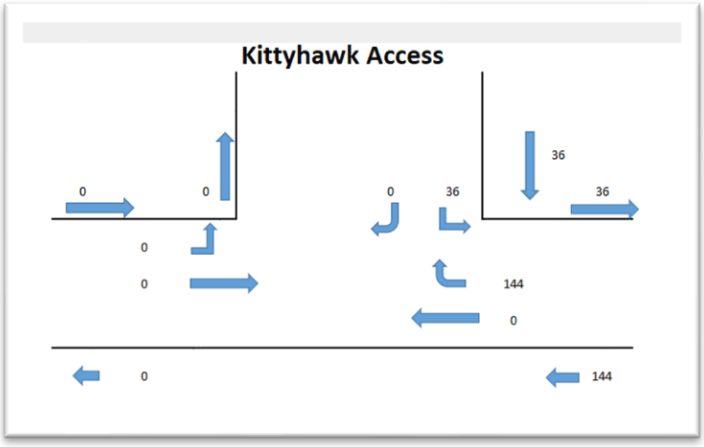

Figure 14 AM Magnetite facility (operational phase) only

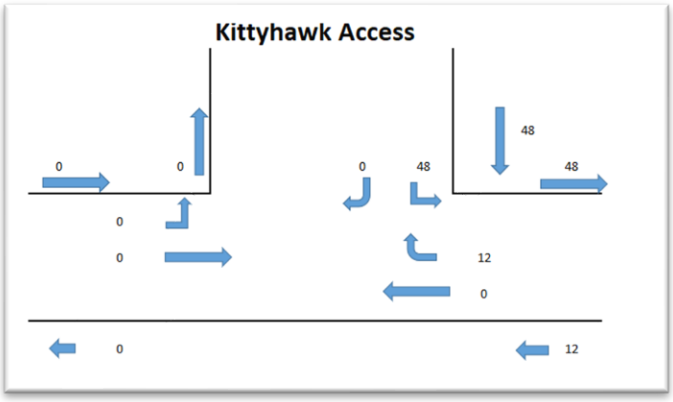

Figure 15 PM Magnetite Facility (operational phase) only

Adding the above volumes into the expected volumes from the Kittyhawk Estate (Figures 8 and 9) as well as the current traffic volumes along Channel Island Road (DIPL Annual Traffic Report, 2019). The total expected AM and PM peak hour volumes are shown in Figure 16 and 17.

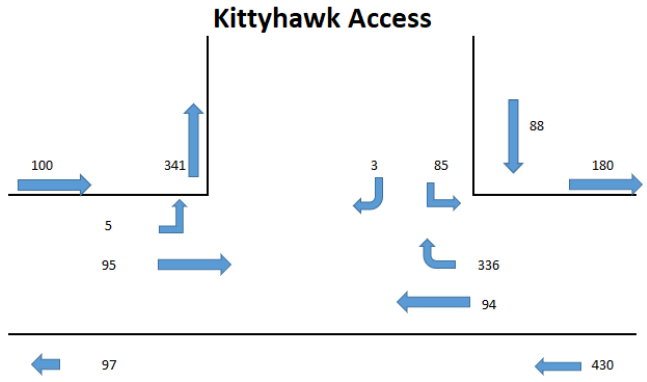

Figure 16 AM Peak Hour Traffic Volumes of Magnetite facility, Kittyhawk development and 2019 traffic volumes on Channel Island Road (Operational Phase only).

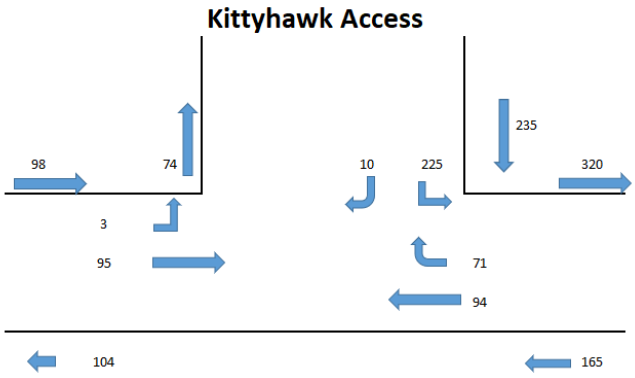

Figure 17 PM Peak Hour Traffic Volumes of Magnetite facility, Kittyhawk development and 2019 traffic volumes on Channel Island Road (Operational Phase only).

4.2 Site Access

It is understood that there has been ongoing discussion with Land Development Corporation (LDC) regarding the location of the site access and that agreement has been reached to allow the development to connect to the internal road network of Kittyhawk Estate rather than providing direct access to and from Channel Island Road. The junction which has recently been constructed on Channel Island Road is shown below.

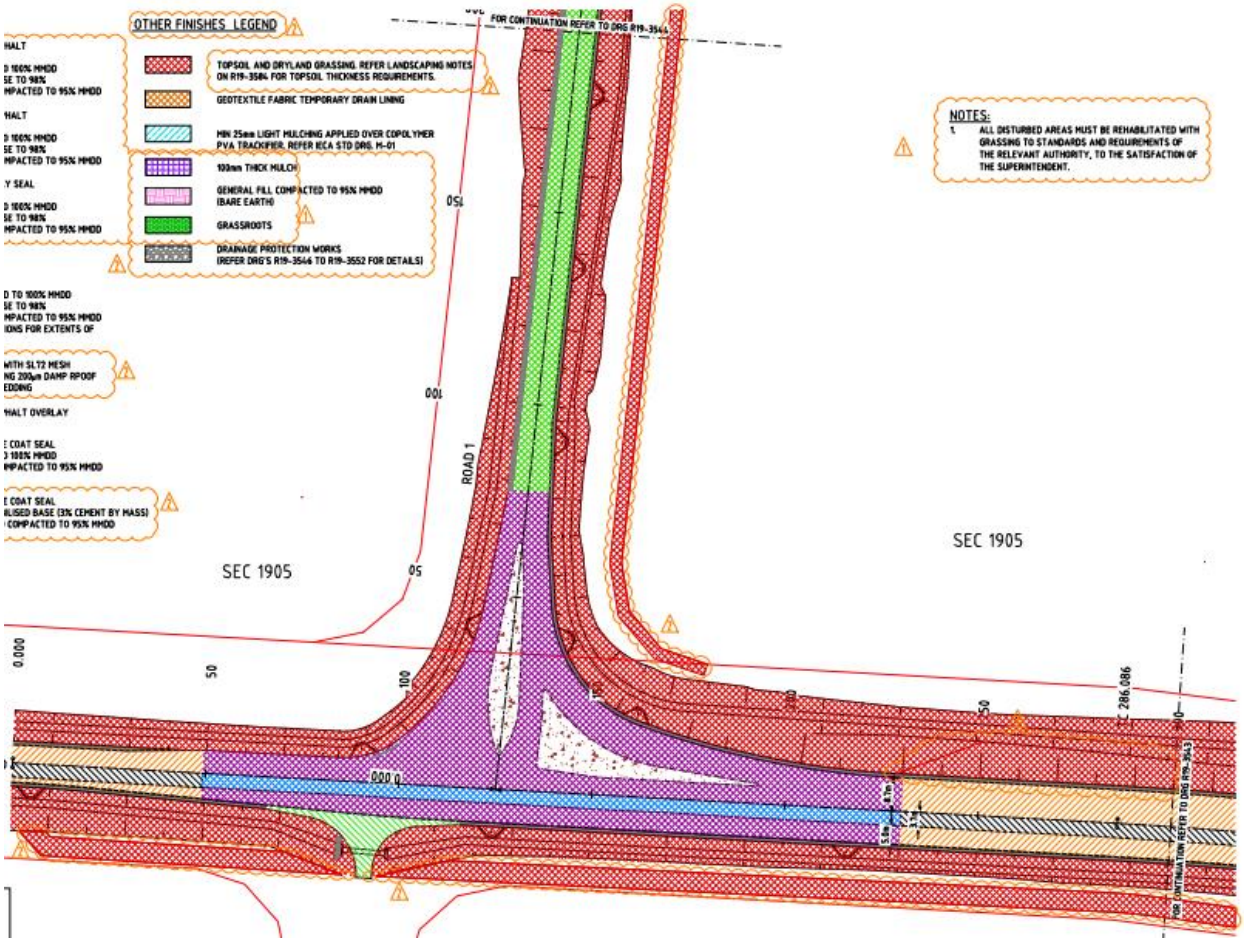

Figure 18 Intersection layout (Byrne Consulting).

Based on AGRD Part 4A (Austroads 2017), the required sight distances at the junction are:

- approach sight distance (ASD),
- safe intersection sight distance (SISD), and
- minimum gap sight distance (MGSD).

The design speed of Channel Island Road is 110 km/hr (posted speed limit of 100km/h). The required ASD for trucks is 241m and for cars is 209, the required SISD for trucks is 241m and for cars is 300m; and the required MGSD for both trucks and cars is between 275 and 305m.

The available sight distance to and from the site exceeds 350 m in both directions, and therefore the minimum sight distance requirements are met.

4.3 Parking

The site is of a sufficient size to allow parking to be provided for all vehicles and to allow large vehicles to enter and leave the site in a forward gear and for the parking arrangements to be compliant with the NT Planning Scheme and Australian Standards requirements.

It is recommended that the following considerations are taken into account within the detailed design stages of the project:

- Separation of heavy vehicles and light vehicles.
- Provision of all weather access to parking.
- Potential bus parking to reduce the overall parking requirement on the site.
- Any on-site parking that may be required to keep vehicles on site (if buses are the primary method of access to and from the site).
- Parking provision for cyclists.

4.4 Traffic Impact

4.4.1 Additional Traffic

The site has the potential to generate approximately a 195vpd during the construction phase and 636vpd during the operational phase (worst case). It is noted that this is adopting buses to transport workers in the construction phase and assuming all private vehicles during the operational phase of the site.

Based on past traffic volumes on Channel Island Road, it is clear that the projected traffic from the development during both phases can be accommodated by the existing infrastructure. However, it is noted that if background volumes were to proceed at a relatively high growth rate as identified within the i3 reporting, the Chung Wah Terrace and Elrundie Avenue junction would require upgrading to accommodate the background growth in traffic volumes.

In addition, and based on the comparison between current traffic volumes and those assumed within the (conservative) i3 updated TIA, the traffic impact on the local road network and intersections is likely to be able to be accommodated by the existing infrastructure.

4.4.2 Level Crossing Delays

The traffic at the two level crossings at Channel Island Road and Jenkins Road has the potential to be impacted by slow moving trains. Tonkin has assessed the traffic flow at these two locations in order to understand the extent of delays and queues at the level crossings.

It is understood that for a train to pass the level crossing, the following clearance times (including 30 seconds before and after a train) would be required:

- 9 minutes (if the train was travelling at 10km/h)
- 17 minutes (if the train was travelling at 5km/hr)
- 2.5 minutes if the train was travelling at 50km/h, and
- 1.85 minutes if the train was travelling at 70km/hr.

It is anticipated that trains will arrive and depart the Darwin Processing Plant as per Table 1.

Table 1 Anticipated arrving and departing times

Day	Arrive	Depart
Sunday	N/A	1200
Tuesday	0630	**1600**
Thursday	**0830**	2000
Saturday	1200	N/A

Based on the above table it is expected that the trains arriving on Thursdays and trains departing on Tuesdays will have an impact on the local network as they arrive/depart within the peak hours.

Tonkin has assessed the expected extent of delays and length of queues at both level crossings (Table 3). During the assessment Tonkin has adopted the DIPL traffic data (DIPL Annual Traffic Report, 2019) and assumed traffic volumes along Jenkins Road (Table 2).

Table 2 Traffic Volumes on Channel Island Road and Jenkins Road

	Channel Island Road	Jenkins Road
Total Volume on each direction	950	700
AM and PM peak hour volume	95	70
% Light vehicles	87%	87%
% heavy vehicles	13%	13%

Table 3 Extent of delays at each level crossing

			Level crossing at Channel Island Road			Level crossing at Jenkins Road		
Trains Speed (km/hr)	Clearance time required (mins)	Assumed peak flow within clearance time (%)	Number of light vehicles	Number of Heavy vehicles	Queue length (m)	Number of light vehicles	Number of Heavy vehicles	Queue length (m)
5 (train arriving)	17	75	62	9	**928**	46	7	**684**
10 (train arriving)	9	50	41	6	**618**	30	5	**456**

50 (train departing)	2.5	10%	8	1	**124**	6	1	**91**
70 (train departing)	1.85	7.5%	6	1	**93**	5	1	**68**

The above represents a significant delay to traffic along both Channel Island Road and Jenkins Road. It is noted that TNG have limited control over the timing of trains as this is controlled by the train operator (to fit with other demands on the train line). However, it is understood that TNG will work with the train operator to minimise potential delay on the road network as much as possible.

5 Conclusions

This TIA has reviewed the proposed development of a magnetite processing facility located on Channel Island Road.

Based on the assessment undertaken, it is identified that the proposed development can generally be accommodated without having an adverse impact on the safety and capacity of road network.

The proposed access to Channel Island Road will be adopting the Kittyhawk Estate junction. Tonkin have reviewed the TIA associated with the Kittyhawk Estate and have identified that the addition of the Magnetite processing facility will not exceed the volumes assumed in the previous reporting (noting the Kittyhawk Estate TIA adopted conservative background growth on Channel Island Road). It is however noted that if sustained growth is experienced, the Chung Wah Terrace/Elrundie Avenue would require an upgrade to cater for background growth.