Blackcat Nominees
113 Kawina Road,
BICKLEY WA 6076

Attention: Trent Poletti

Dear Trent,

WASTEWATER MANAGEMENT PLAN: ON-SITE WASTEWATER TREATMENT AND EFFLUENT DISPOSAL SYSTEM – PROPOSED DEVELOPMENT – LOT 602 KAWINA ROAD, BICKLEY

As requested we have prepared a Wastewater Management Plan to assist with the proposed development at Lot 602 (No 113) Kawina Road, Bickley. The proposed development comprises of six single bedroom chalets (short-term accommodation), a day spa, and an upgrade to the existing shed to facilitate a restaurant.

DESIGN

Existing Infrastructure

Water Corporation ESInet mapping indicates that there is no gravity sewer available to connect into within the vicinity of the site. Therefore, there is a requirement to treat and dispose of wastewater effluent on site for the development.

An existing conventional septic tank and leach drain system is located within the north-western corner of the site and currently services the existing building that is proposed to become a restaurant. We understand that the length of the two existing leach drains to be 13m. We anticipate that this system can be retained and used to supplement a proposed system that will service the proposed restaurant.

Wastewater Treatment System

Aerobic Treatment Units (ATU) were selected as the most viable systems for the site due to the higher level of treatment achievable and the ability to reuse/dispose of the secondary treated effluent for irrigation of open landscaped areas within the site.

Due to the proposed site plan and the natural fall of the site, we expect that two separate systems will be required; with one servicing the proposed restaurant and another servicing the proposed chalets and day spa.

Due to previous experience with BioMAX ATU systems, this system was selected for the site. Below is an overview of the BioMAX ATU system treatment process, as per the BioMAX website:

"The Wastewater Treatment Plant is divided into five principal chambers;

1. *Anaerobic chamber - anaerobic treatment*
2. *Aerobic chamber - aerobic treatment*
3. *Clarification chamber - sludge settlement and removal*
4. *Disinfection chamber - contact time with chlorine*
5. *Pumpout chamber - discharge to disposal system*

1. Anaerobic Chamber

Raw wastewater is initially received into the anaerobic chamber. Approximately 30 - 50% of the suspended solids settle out in this chamber where they undergo anaerobic digestion. The anaerobic digestion process is carried out by microorganisms which have the ability to feed, grow and multiply in the absence of free oxygen. In addition, settled sludge and skimmed material returned from the clarification chamber are

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further digested in this chamber. The plant is sized to enable these microorganisms to maintain a sufficient population naturally without the need for the addition of proprietary biological products.

2. Aerobic Chamber

The partially treated wastewater, still containing the colloidal and dissolved solids which represent approximately 65% of the pollution loading, flows from the anaerobic chamber to the aerobic chamber. Air is introduced to the liquid in this chamber by means of an aerator and diffusers, maintaining aerobic (free dissolved oxygen) conditions. The oxygen enriched effluent flows about packs of submerged media having a large surface area on which bacteria and other microorganisms thrive, forming a biological film. These microorganisms have a different growth process to those in the anaerobic chamber in that they utilise the dissolved oxygen in the effluent, while consuming the dissolved and colloidal organic matter as food to create new cell growth and stable oxidised products. The air pattern causes the liquid in the chamber to pass through the media in a discreet flow pattern and to have intimate contact with the microorganisms.

The process differs from ordinary suspended growth systems in that it is more stable and also allows the growth of sub-surface anaerobic microorganisms beneath the surface film of aerobic microorganisms. This allows anaerobic bacterial action to check the media growth, thereby reducing the biological sludge accumulation. Nevertheless, as the thickening of material on the media occurs, some sloughing off will take place.

The multiple compartment design of the aerobic chamber ensures that no short-circuiting can occur, preventing the possibility of partially treated wastewater passing to the clarification chamber. The diffused aeration system allows the air to be introduced below the media packs.

Basically, the reaction in the aerobic chamber converts the dissolved and non-settleable (colloidal) solids into carbon dioxide and a biological floc, which, under quiescent conditions, will settle.

3. Clarification Chamber

Following aeration, effluent flows into a circular hopper bottomed clarification chamber, where the biological floc (or sludge) settles under quiescent conditions. Settled sludge from the bottom of the chamber and floating material are returned to the anaerobic chamber. From the clarification chamber, the effluent is drawn off below surface level and flows through the chlorinator to the disinfection chamber.

This continuous return of sludge to the anaerobic chamber ensures continuous fluid movement in the plant even with zero inflow and keeps the system "live" during periods of extended vacancy.

4. Disinfection Chamber

The discharge from the clarification chamber passes through an automatic gravity chlorinator. The chlorinator is calibrated for above normal water usage. Chlorine stocks are provided to cover maximum usage with built in safety factors to cover all foreseeable circumstances between the service periods.

The disinfection chamber is designed to provide a minimum of 30 minutes contact time between the effluent and chlorine to ensure achievement of bacterial die-off.

5. Pump-out Chamber

After disinfection, the treated effluent enters the pump-out chamber. The discharge pump is automatically controlled by a level switch to operate and shut down as the level of the effluent rises and falls."

Land-Application System (Effluent Disposal)

We expect that the system serving the proposed chalets and day spa will dispose of the treated effluent via a sub-surface irrigation field. The system serving the proposed restaurant will use a combination of a sub-surface irrigation field and the existing leach drain to dispose of the treated effluent.

Site Soil Assessment

A site soil investigation was conducted on the 22 January 2018 and attended by Michael Ferritto from our office and Adrian Ranford from the City of Kalamunda Environmental Health Section.

The open area 100m to the east of the proposed restaurant and the area to the south of the proposed chalets were identified as two potential locations for the systems to be located. Two test holes,

TH1 and TH2 were dug with an excavator to allow for inspection and assessment of the soil profile near the proposed wastewater system locations. Refer Appendix 1 for Log of Holes site plan locations.
Table 1 describes the soil profile encountered within each test hole.

Table 1: Log of Test Holes

TEST HOLE	DEPTH (mm)	DESCRIPTION	NOTES
TH1	0 – 100	Topsoil	
	100 – 800	Fine Grained Gravel	
	800	Rock	Refusal at 800
TH2	0 – 100	Topsoil	
	100 – 300	Clayey Gravel	
	300 – 1000	Brown Loamy Soil	
	1000 - 1200	Yellow Granitic Clay	

Soil Category

The soil conditions observed within the test holes have been assessed and evaluated in accordance with AS/NZS 1547:2000 On-site Domestic-Wastewater Management (AS/NZS 2000).

Based on the soil conditions encountered within TH1, the fine-grained gravel can be classified as 'Soil Category 1 – Gravels and Sands' in accordance with AS/NZS 1547 Table 4.1.1.

Based on the soil conditions encountered within TH2, the clayey gravel and loamy soil encountered can be classified as 'Soil Category 5 – Light Clays' in accordance with AS/NZS 1547 Table 4.1.1.

These soil categories will be used to determine the appropriate Design Loading Rate (DLR) for the existing leach drain, and the appropriate conversion factor for the sizing of each irrigation field in accordance with the Western Australian Department of Health Draft Government Sewerage Policy November 2016 (DoH 2016).

Groundwater Levels

No groundwater table was encountered within the test holes during the site soil investigation. Based on these observations, we do not expect groundwater to adversely affect the disposal of the treated effluent via the proposed irrigation areas and the existing leach drain.

Estimated Wastewater Loading

The proposed concept plan for the development includes six single-bedroom chalets, a day spa and a proposed restaurant. Based on information provided by the client, the estimated maximum occupancy for the restaurant is 120 persons, and the maximum occupancy for the chalets is 12 persons. We anticipate that the primary usage of the day spa will be from patrons staying at the chalet accommodation. We have estimated a maximum of four staff at the day spa, and eight staff at the restaurant.

The wastewater hydraulic loading for the two proposed systems have been estimated based on the Supplement to Regulation 29 and Schedule 9 – Wastewater System Loading Rates (DoH 2017) and manufacturer specifications. Table 2 and Table 3 show the estimated loading.

Table 2: Wastewater Loading for Proposed Chalets and Day Spa System

Description	**Type of Premises (as per Supplement to Reg. 29 and Sch. 9)**	**Number of Persons**	**Wastewater Loading Rate (L/person/day)**	**Total Wastewater Loading (L/day)**
Chalet Patrons	Hotel	12	180	2,160
Day Spa Patrons	Factories & Shops – *Health Centre Patients (showering)*	12	70	840
Day Spa Staff	Public Building – *Offices (non-showering staff)*	4	30	120
Daily Wastewater Flow (L/day)				3,120
Additional Daily Wastewater Flow (L/day) *				-
Total Design Daily Flow (L/day)				**3,120**

*As per Note 1 of Supplement to Reg. 29 and Sch. 9

Table 3: Wastewater Loading for Restaurant System

Description	**Type of Premises (as per Supplement to Reg. 29 and Sch. 9)**	**Number of Persons**	**Wastewater Loading Rate (L/person/day)**	**Total Wastewater Loading (L/day)**
Restaurant Customers	Public Building – *Restaurant Customers*	120	30	3,600
Restaurant Staff	Factories & Shops – *Restaurant Staff*	8	70	560
Daily Wastewater Flow (L/day)				4,160
Additional Daily Wastewater Flow (L/day) *				780
Total Design Daily Flow (L/day)				**4,940**

*As per Note 1 of Supplement to Reg. 29 and Sch. 9

In addition to the wastewater flows from the restaurant customers and staff, wastewater loading from food production sources also need to be accounted for as per Table 2 and Note 1 of Supplement to Regulation 29 and Schedule 9. We have estimated an additional wastewater loading of 780L/day from the commercial dishwasher in the restaurant. This loading is based on a WashTech XU commercial dishwasher (washing capacity 600plates/h) with a water consumption of 78L/h running for 10 hours per day. This yields a total daily wastewater flow for the restaurant of 4,940L/day.

The flows from both the chalets/day spa and restaurant will only consist of domestic flows, with no commercial, industrial or non-human waste streams requiring a separate system. The two ATU and land application systems for the site require sufficient capacity to handle the wastewater loadings of 3,120L/day for the chalets/day spa and 4,940L/day for the restaurant.

ATU Systems

The proposed ATU systems have been sized in consultation with BioMAX to ensure that each ATU can provide the required treatment capacity for the Design Daily Flows. The BioMAX systems are

supplied with a pump system to allow for the distribution of the secondary treated effluent to the land application systems.

Restaurant System

The proposed ATU to service the proposed restaurant will be the BioMAX ATU Model C40 and will be located to the north of the restaurant building. The Model C40 ATU has a daily treatment capacity of 7,200L/day which is more than sufficient for the Total Design Daily Flow of 4,940L/day.

BioMAX has advised that this system is suitable for the treatment of wastewater from food production sources such as kitchens and dishwashers.

Alternative approved ATU suppliers can be considered as long as they provide for the total design daily flows calculated.

Chalets and Day Spa System

The proposed ATU system to service the new chalets and day spa is the BioMAX ATU Model C30 and will be located to the east of the proposed day spa. The Model C30 ATU has a daily treatment capacity of 5,400L/day which is more than sufficient for the Total Design Daily Flow of 3,120L/day.

Alternative approved ATU suppliers can be considered as long as they provide for the total design daily flows calculated.

Land Application Systems

Restaurant System

The proposed system serving the proposed restaurant will use a combination of sub-surface irrigation and the existing leach drain to dispose of the treated effluent from the ATU. Both the ATU and land application systems will need to be sized to handle the estimated wastewater loading of 4,940L/day from the 120-capacity restaurant.

The proposed system will be located in the vicinity of TH1. Based on the soil category classification of 'Soil Category 1 – Gravels and Sands' within TH1, the DLR for the leach drain is 50mm/day (50L/m^2/day) as per AS/NZS 1547 Table 4.2A1. It should be noted that the DLR of 50mm/day is valid only for effluent treated to a secondary standard.

The capacity of the existing 13m leach drain is based on the following formula from AS/NZS 1547 Clause 4.2A7.3.2:

$$L = \frac{Q}{DLR \times W}$$

where:

L = Length of leach drain/trench, in m
Q = Design Daily Flow, in L/day
DLR = Design Loading Rate as per AS 1547 Table 4.2A1, in mm/day
W = Width of leach drain/trench, in m

For a leach drain length of 13m, an assumed width of 1.5m, and a DLR of 50mm/day, the capacity of the existing leach drain is Q = 975L/day. As such, the remaining 3,965L/day will need to be disposed of via the irrigation field to the east of the restaurant.

The required size of the proposed irrigation field can be determined from the following formula as per the Draft Government Sewerage Policy November 2016 (DoH 2016):

$$A = Q \times f$$

where:

A = Area of irrigation field, in m^2
Q = Design Daily Flow, in L/day
f = Conversion factor as per Draft Government Sewerage Policy Table 4

For the required remaining daily flow of 3,965L/day, 'Soil Category 1 – Gravels and Sands', and a conversion factor for secondary treated effluent of 0.2, the minimum required size of the proposed irrigation field is $793m^2$.

In summary, the existing 13m leach drain combined with a minimum $793m^2$ sub-surface irrigation area is required to dispose of the estimated Design Daily Flow of 4,940L/day of secondary treated effluent.

There is in excess of $2,000m^2$ of open landscape area available for effluent disposal to the east of the existing restaurant building, therefore there is sufficient area for the proposed irrigation field. Some importation of sand and topsoil may be required to aid vegetation growth within the landscaped effluent disposal area, subject to the vegetation proposed.

Chalets and Day Spa System

The proposed system serving the chalets and day spa will use sub-surface irrigation to dispose of the treated effluent from the ATU system. Both the ATU and the land application system will need to be sized to handle the estimated wastewater loading of 3,120L/day from the proposed chalets and day spa. The proposed ATU system will be located within the vicinity of TH2, however the disposal area will be combined with the proposed effluent disposal area for the restaurant (in a separate zone but same soil type).

For the required daily flow of 3,120L/day, Soil Category 1 – Gravels and Sands', and a conversion factor for secondary treated effluent of 0.2, the minimum required size of the proposed irrigation field is $624m^2$.

In summary, a minimum $624m^2$ sub-surface irrigation area is required to dispose of the estimated Design Daily Flow of 3,120L/day of secondary treated effluent.

There is in excess of $2,000m^2$ of open landscape area available for effluent disposal to the east of the existing restaurant building, therefore there is sufficient area for the proposed irrigation field for both the restaurant and chalets combined. Some importation of sand and topsoil may be required to aid vegetation growth within the landscaped effluent disposal area, subject to the vegetation proposed.

Effluent Discharge Quality

As per AS/NZS 1547 Clause 4.2A10.6 and Schedule No.1 Item 13 of the Western Australian Department of Health Code of Practice for the Design, Manufacture, Installation and Operation of ATU's (DoH 2015), the effluent quality requirements are outlined below:

- 90% of 5-day BOD less than or equal to 20mg/L
- 90% of total suspended solids less than or equal to 30mg/L

- Faecal coliforms: median value not to exceed 10 organisms per 100mL, with four out of five samples containing less than 20 organisms per 100mL

Under Western Australian Department of Health testing, the BioMAX ATU systems produced an average effluent quality of:

- Less than 5mg/L of 5-day BOD
- Less than 10mg/L of total suspended solids
- Zero faecal coliform organisms per 100mL

As such the BioMAX ATU systems produce an effluent quality exceeding the current requirements for effluent discharge quality.

References

Department of Health (2015). *Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units (ATU's).* Department of Health, pp.13.
Department of Health (2016). *Draft Government Sewerage Policy November 2016.* Department of Health, pp.2-23.
Department of Health (2017). *Supplement to Regulation 29 and Schedule 9 – Wastewater System Loading Rates.* Environmental Health Directorate, Department of Health.
Standards Australia/Standards New Zealand (2000). *AS/NZS 1547:2000 On-site domestic-wastewater management.* Standards Australia/Standards New Zealand.

Conclusion

Based on the estimated Design Daily Flows from the proposed chalets and day spa and renovated restaurant, the BioMAX ATU Model C30 and C40 systems combined with the specified land application systems, will meet the wastewater treatment and disposal demands of the site for the expected soil conditions.

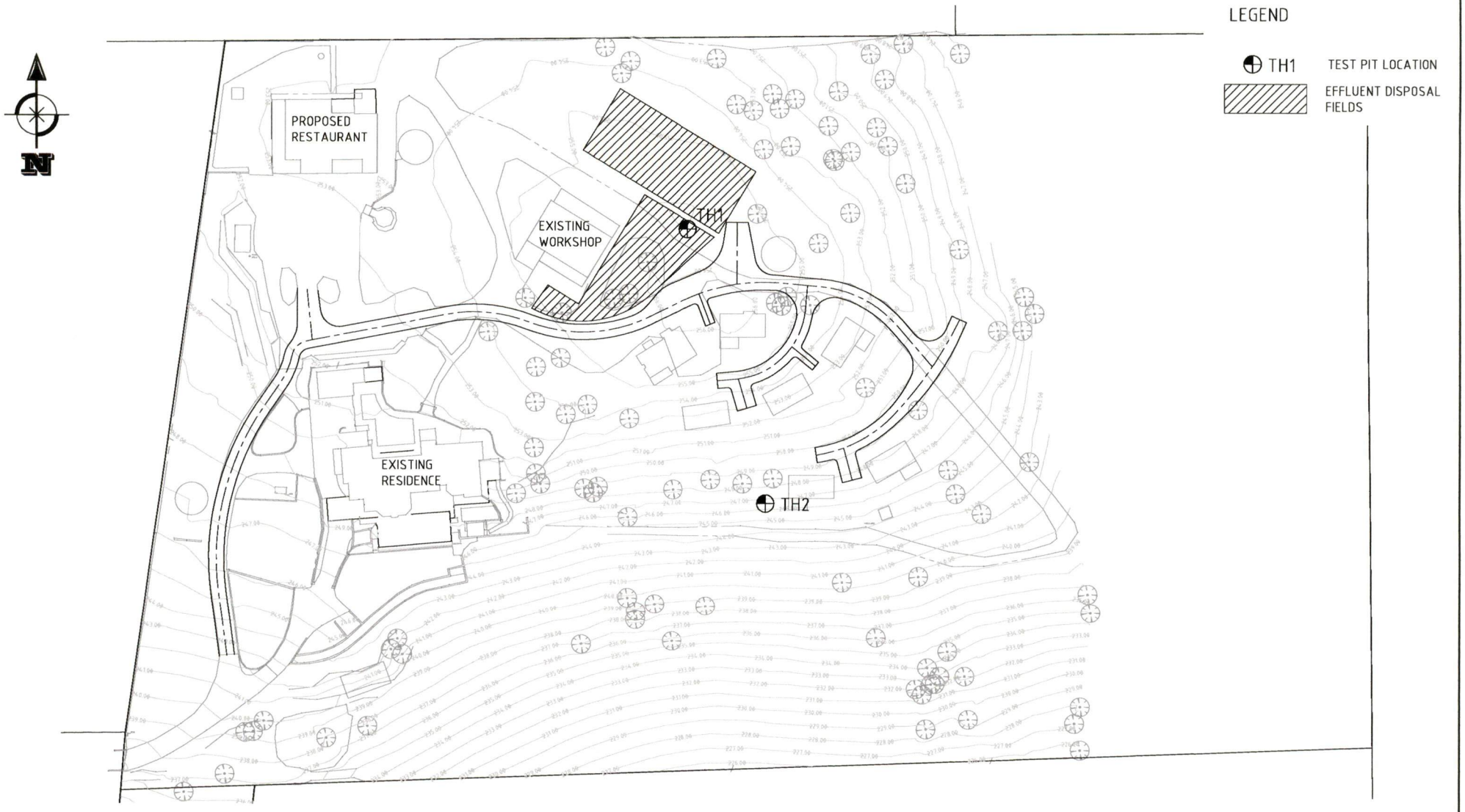
If you have any questions or require more information, please call me on 9274 6444 or mobile 0419 923 268.

Yours faithfully,

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1 June 2018
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Enclosures Appendix 1 – Log of Holes site plan

Appendix 1 – Log of Holes Site plan



REVISION	DESCRIPTION	DESIGN	DRAWN	CHECKED	DATE
A	INITIAL DRAWING	N/A	SAH	MF	31/05/2018

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CLIENT: BLACKCAT NOMINEES

PROJECT: PROPOSED DEVELOPMENT LOT 602 KAWINA ROAD BICKLEY

TITLE: TEST PIT LOCATIONS PLAN

ENGINEER SIGN:

DRAWING NUMBER: 15601-SK09

REVISION: A

5 CONCLUSION

The proposed development at 113 Kawina Road, Bickley includes chalets, a day spa and restaurant. The chalets will have a maximum capacity for 12 guests at any one time, whilst the restaurant can accommodate a maximum of 120 patrons. The existing house on the property will remain.

The chalets are proposed to operate twenty-four hours a day, seven days a week. The restaurant will operate mainly in the evenings and at lunch time over weekends and typically four to five days a week. The day spa will be open during typical business hours and weekends and is for incidental use of the chalet guests only.

The access to the site is proposed via an existing driveway located at the eastern end of the cul-de-sac Kawina Road.

Service deliveries will be via the existing access to the site on Kawina Road.

The site is estimated to generate approximately 383 trips per day when the restaurant is in operation, of these only approximately 36 vehicle trips will occur during the PM peak hour.

Kawina Road and the surrounding road network can readily accommodate this additional traffic with no significant impact to existing operation and traffic conditions.

In conclusion, the proposed chalets and restaurant are forecast to operate satisfactorily from a traffic perspective. The low impact of the traffic to/from the proposed development on the surrounding road network, good access/egress and ample parking within the development all indicate a well planned development proposal which is supported by this Transport Impact Statement report.

6 References

Bennett E. (2006). Flora and Vegetation Reserve 2145 and Percy Cullen Oval, Gidgegannup. A report prepared for the City of Swan. Bennett Environmental Consulting Pty Ltd.

Havel J. & Mattiske E. (2000). Vegetation Mapping of South West Forest Regions of Western Australia. A report for CALM. Mattiske Consulting Pty Ltd.

Keighery B. (1994) Bushland Plant Survey. Wildflower Society of WA.

Mattiske, E. and Havel, J. (1998) Vegetation Mapping in the South West of Western Australia and Regional Forest Agreement vegetation complexes. Department of Conservation and land Management, Perth.