Iron Gates
Biting Insect Impact Assessment
For
Gold Coral Pty Ltd
C/- Planit Consulting Pty Ltd

Prepared by

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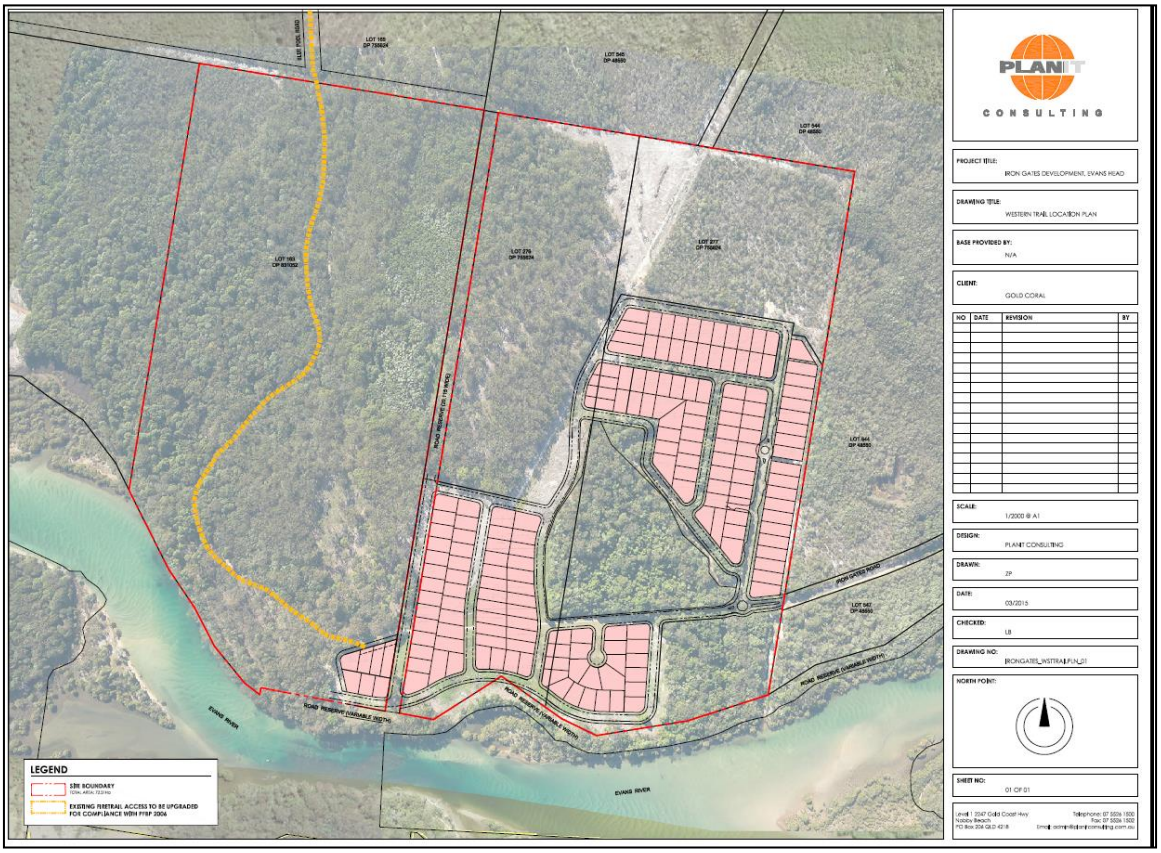
1.0 Introduction

Mosquito Consulting Services Pty Ltd (MCS) was engaged by Gold Coral Pty Ltd in March 2015 to undertake a biting insect (mosquito and biting midge) impact assessment on property at Iron Gates within the Richmond Valley Council area. The investigation included an entomological survey of the site (Plate 1 for site plan) to collect representative samples of biting insects and to characterise the site and adjoining habitats in terms of its ability to support biting insect breeding.

Plate 1: Site Plan: Iron Gates



The biting insect impacts likely to be experienced on the site have been considered in context with the completed proposed development and; with reference to the generally expected biting insect species range and abundance typical for the locality. This report addresses Richmond Valley Council's letter of 18 November 2014 (Council's Ref: DA2015/096 – SMc:SL) requesting further information - Item 16b:

> ***16. Council requires the following potential impacts be considered in the SCC;***
>
> ***b. Impacts on future residents from mosquitos, sandflies and midges.***
>
> ***What mitigation measures/buffers can be introduced to limit the impacts on future residents?***

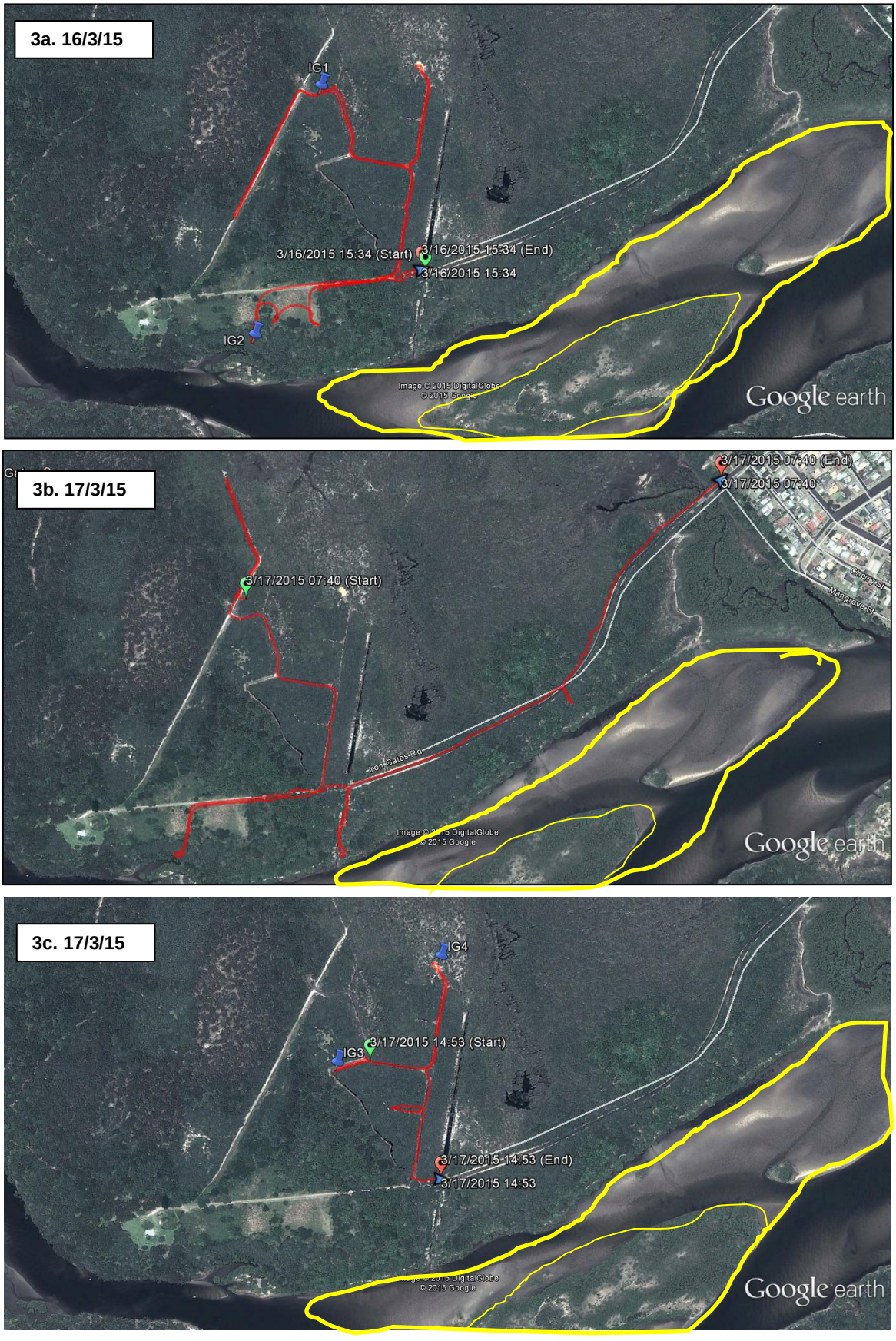
2.0 Investigation Methodology

Biting insect assessment was undertaken using standard entomological methods for collecting mosquitoes and biting midge and characterising likely breeding habitat on and adjacent to the site. Adult biting insects were collected using traps (Plate 2). Biting insect traps are baited using carbon dioxide gas (as dry ice) and a chemical attractant (1-Octen-3-ol) that mimics the human host of blood feeding insects. Biting insects are further attracted by artificial light emitted by the trap and are vacuumed in by an electric fan where they are collected into 70% alcohol for preservation. The collections are sorted to species and counted under a dissecting microscope in the laboratory.

Plate 2: Biting insect trap as used at Iron Gates

Plate 3 shows the locations of traps deployed in 4 sites over two nights (16-17 March) and GPS tracks for breeding habitat assessment. Aerial photography was also used to identify and assess potential biting insect breeding habitat relevant to the site.

Plate 3 a,b,c Trap locations and habitat survey GPS tracks 16-17 March 2015



The survey included sampling for mosquito larvae by dipping into ground pools along the GPS tracks. At the time of the survey, there was very little surface water present on the site due to apparently free draining sandy soils. Drains intersecting and adjoining the site had water standing (at the water table level) and/or flowing (into the Evens River) were sampled. There were no mosquito larvae collected from any ground water within the site at the time of inspection.

3.0 Biting Insect Collection Results

Table 1 provides the results of the biting insect trapping at Iron Gates between 16 and 18 March 2015.

Table 1: Biting Insect Collection Results

Iron Gates Adult Biting Insect Collections March 2015							
	* = disease vector	Trap Location/night					
Mosquito	# = serious biting	IG 1	IG 2	IG 3	IG 4		
Species	2015 March	16/17	16/17	17/18	17/18	Sp total	Sp %
Aedes	*alternans #*	2	0	2	0	4	0.1
	bupengaryensis	2	0	0	0	2	0.1
	ghanicola	2	2	4	6	14	0.4
	multiplex	12	0	2	0	14	0.4
	*procax * #*	88	44	42	64	238	6.2
	*vigilax * #*	14	10	16	10	50	1.3
Coquillettidia	*linealis * #*	28	26	32	16	102	2.6
	variegata	0	4	6	0	10	0.3
Culex	*annulirostris * #*	968	786	754	842	3350	87.0
	sitiens	10	4	6	0	20	0.5
Mansiona	*uniformus #*	2	2	4	0	8	0.2
Uranotaenia	*novaguinensis*	0	2		0	2	0.1
	nivipes	2			0	2	0.1
Verrallina	*funerea * #*	14	6	10	4	34	0.9
	Night total	1144	886	878	942	**3850**	**100**
Biting Midge Species		Approximate Abundance					
Culicoides	*subimmaculatus #*	<100	>5000	<500	<10		
	longior #	<10	<500	<50	<10		

Over the four trap nights, 3,850 mosquitoes from 14 species across 6 genera were collected in traps. The most abundant mosquito present was *Culex annulirostris*. It represented 87% of all mosquitoes collected. The next three most abundant mosquito species were *Aedes procax, Coquillettidia linealis* and *Aedes vigilax* at 6.2%, 2.6% and 1.3% of the collection respectively.

Two biting midge species were most abundant. *Culicoides* (species near) *subimmaculatus* was highly abundant (several thousand in trap IG2) adjacent to the river shoreline. Biting midge numbers decreased significantly in traps located further away from the river shore.

The habitat survey produced no mosquito breeding in the site itself however some ground pools capable of breeding mosquitoes, in particular, *Verrallina funerea* were located in remanent drainage lines within the site. There were very few mosquitoes of this species collected (0.9%) which is consistent with the site not producing at the time. The salt marsh mosquito *Aedes vigilax* is typically a very abundant mosquito along coastal Australia. It breeds in intertidal saltmarsh ground pools and is a significant pest and vector of human disease including Ross River virus. There was however very little presence of this species in the Iron Gates collections. Observation of the site habitat, adjacent habitats did not identify any significant salt marsh. Further investigation of aerial photography over a wider region shows that there appears to be no significant saltmarsh habitat associated with the Evans River.

Marine biting midge breed in intertidal zones associated with estuaries and protected shorelines. There are a number of marine biting midge species present in coastal Australia that cause a biting nuisance in close proximity to breeding habitat. The specific type of intertidal habitat determines the species mix of the local biting midge population. For the Ion Gates site, the dominate biting midge collected both in traps and also biting the author was *Culicoides* sp.nr. *subimmaculatus*. This insect breeds in relatively clean muddy sands between the tidal levels of Mean High Water Neap and Mean High Water Spring. Observation of the river shoreline adjacent to the Iron Gates site confirms the presence of suitable habitat (especially east of the site) for this species (See plates 3 a-c with likely *C.* sp.nr *subimmaculatus* breeding habitat within yellow line).

4.0 Discussion

The Iron Gates site currently contains open drains formed as part of a previous development. Information from Planit Consulting Pty Ltd indicates that these drains will be re-engineered to natural ground levels. As such, they should play no part in biting insect production when completed.

The most abundant mosquito species present at the time of the investigation, *Cx. annulirostris*, is ubiquitous within much of Australia. It breeds in permanent and temporarily freshwater ground pools. The high numbers of this species collected is very likely a reflection of recent high rainfall within the region creating suitable breeding conditions over a wide area. There was little evidence of habitat supporting *Cx annulirostris* on the site or immediately adjoining. It is likely that the abundance of *Cx*

annulirostris at Iron Gates would be consistent with its general abundance across the wider region at the time of the investigation. Drying conditions will limit the production of this species by reduction in temporary (rain filled) habitat. It would be expected that *Cx annulirostris* numbers would be significantly lower following 2-3 weeks of dryer weather. The relative low numbers of *Aedes vigilax* would be expected to remain so given the limitation of suitable breeding habitat within its pest range of the site.

The presence of biting midge was expected and the abundance of this insect would be relative consistent with peak emergence during summer neap tides and at this location would be expected to have an adverse impact on future residents, especially those in close proximity to the river.

Biting midge are not considered to be of medical importance in Australia as they do not transmit disease directly to humans. However in a broader sense, they do have a negative health impact due to their highly aggressive biting behaviour when they are actively seeking a blood meal following emergence from the breeding site. For some individuals, the bites of these insects produce an allergic reaction causing localised inflammation and irritation. For some individuals, especially children, the irritation leads to scratching and increases risk of secondary skin infection. The allergic reactions may be treated using anti-pruritic preparations with severe reactions referred for medical treatment with antihistamines and antibiotics to control secondary infections.

5.0 Risk Assessment

The general basis of assessing risk is to understand hazards and likely exposure. Risk is highly contextual and differing exposures to the same hazard will produce a different view of risk. To organise the elements of risk, assess their relative contributions and development management approaches, a number of systematised approaches exist. The current standard for risk management in Australia is AS/NZS ISO 31000: 2009.

The specific issue raised in Council's RFI relates to the likely impact on future residents to biting insects. The specific hazards include likely reduction in lifestyle by exposure to disease transmitted by biting insects; secondary medical conditions from adverse reactions to biting insects and; diminished enjoyment of outdoor activity due to nuisance biting.

The biting insect study has identified that the site is exposed to mosquitoes and biting midge, Some of the mosquitoes have no impact on humans due to their very low numbers and/or their preference for non-human hosts. A further group have more serious impacts due to the nuisance and disruption they cause through their aggressive biting habits and their abundance. A

third group are of medical importance due to their ability to directly transmit human disease.

The biting insect impacts for future residents can be prioritised based on the anticipated level of exposure to biting. Notwithstanding the consequences of exposure may be variable between nil impact to serious medical involvement, it is the initial exposure that is firstly experienced by the residents and is the basis for this risk assessment. The priority risk management issues for the Iron Gates sites are assessed as:

1. Biting midge associated with the Evens River dispersing into the development.
2. The mosquito, *Culex annulirostris* present in high abundance following periods of high rainfall.
3. General exposure to other known mosquito vectors of human disease however with relatively low abundance.

6.0 Risk Management

6.1 Biting Midge

Unlike many mosquito control techniques, there are no currently acceptable methods for minimising biting midge breeding in natural habitats. There are no chemical control methods or control agents registered for use against biting midge larvae in natural habitats. (The Gold Coast City Council does have historical exemptions to treat biting midge breeding along constructed canals however this is unlikely to be available elsewhere). There are no physical modifications that may be made to natural breeding habitat to limit biting midge production. (Again, GCCC mechanically scarify exposed canal beach sand to disrupt biting midge breeding however this is on a very narrow linear zone consistent with canal construction.)

What then may be an effective and practical method for reducing the dispersal of adult biting midge from their river breeding habitat into the Iron Gate site?

Biting midge are relatively feeble flyers (compared with many mosquito species) and flying is supressed in breezy conditions. Open ground exposed to breeze is a relatively effective barrier to their dispersal. The site plan (Plate 1) shows a road reserve separating residential allotments from the river shoreline. Such roadways offer poor harbourage for dispersing biting midge and promote a breezeway following the alignment of the river. The breezeway effect may be further enhanced to limiting the planting of street trees and other vegetation other than shortly mown grass. The inclusion of formed roads and minimal street plantings separating residential allotments from the shoreline would provide a biting midge buffer. There are no specific minimum dimensions for a biting midge buffer to be effective. However maximising the available space for a buffer will

improve its effectiveness to the extent possible. As a guide a buffer minimum of 20m has been used with effect elsewhere. Plate 4 is an example of a biting midge buffer (in this case a cycleway) using a combination of hard surface and minimal vegetation to maximise a breezeway separating biting midge breeding habitat and an aged care facility located at Bli Bli on the Sunshine Coast, Qld.

Plate 4: Biting Midge Buffer: Sunshine Coast

There are currently other methods for chemical control to reduce passage of adult biting insects into residential areas by use of residual insecticide treated physical barriers and specifically placed landscape vegetation. While considered effective, these methods are not further detailed within this report as the technique is generally provided within the context of large local government supplied biting insect control programs or provided for by Body Corporate based contracted services. Further information on chemical barrier treatment can be supplied as required.

6.2 Mosquitoes

The Iron Gates site is not especially more so exposed to mosquitoes than the general region within the context of a bushland environment. At the time

of the investigation, *Cx annulirostris* was common however it is considered likely above normal abundance due to high rainfall in the weeks preceding the study. It would be expected that its abundance would diminish significantly with drying conditions. It is considered that in the context of the Iron Gates site, that general background mosquito abundance would be a given and that no specific mosquito reduction strategies would be required. However, that does not adequately address the risk identified of mosquito borne disease transmission, secondary health impacts and diminished lifestyle quality during times of heightened mosquito activity. It is considered that there should be information made accessible to future residents (and indeed the general public) regarding self-protection measures against biting insects. Use of appropriate measures includes awareness of biting insect presence and basic knowledge of environmental factors causing periodic increases in abundance; personal protective measures including use of insect repellents, timing of outdoor activity to avoid peak biting insect activity and seeking medical advice if suspected mosquito borne disease or secondary health impacts appear. At the statutory level, DA and BA Approval conditions including appropriate inclusion of insect screening to dwellings, anti-mosquito screens for rainwater storage tanks, free drainage of stormwater management systems may be imposed.

7.0 Recommendations

The following recommendations are designed to achieve a reduction in biting insect risk to future residents. There are however no controls that can effectively manage all biting insect scenarios as may occur during prolonged and widespread weather events significantly increasing biting insect breeding. At such times there will be a need for increased reliance on self-protection by the methods mentioned above.

7.1 Biting Midge Buffer

Residential allotments adjoining the Evans River should be separated from the foreshore by a buffer of clear land not less than 20m wide free of significant vegetation (except for mown grass) to serve as a breezeway to minimise dispersal of biting midge from their intertidal breeding habitat into the residential allotments. Such an open space may include roadways, hard pathways or other infrastructure that does not conflict with the function of the breezeway. Street lighting should be minimised as far as allowable to reduce light attraction of biting midge.

7.2 Biting Insect Management Information and Conditions

Stormwater management systems should be engineered to prevent them acting as mosquito breeding sites. Detention basins should be designed to drain within 48hrs of filling. Building Approvals should include conditions

regarding installation of insect screening to dwellings and anti-mosquito screens to any rainwater storage tanks.

Biting Insect advisory information should be accessible by future residents and provide advice on general knowledge regarding presence of and changing abundance of biting insects, personal protection measures and advice on potential medical and secondary health impacts that should be referred for medical consultation.

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