Iron Gates
Revised Biting Insect Impact Assessment
For
Gold Coral Pty Ltd

Ver. 2.6

Prepared by

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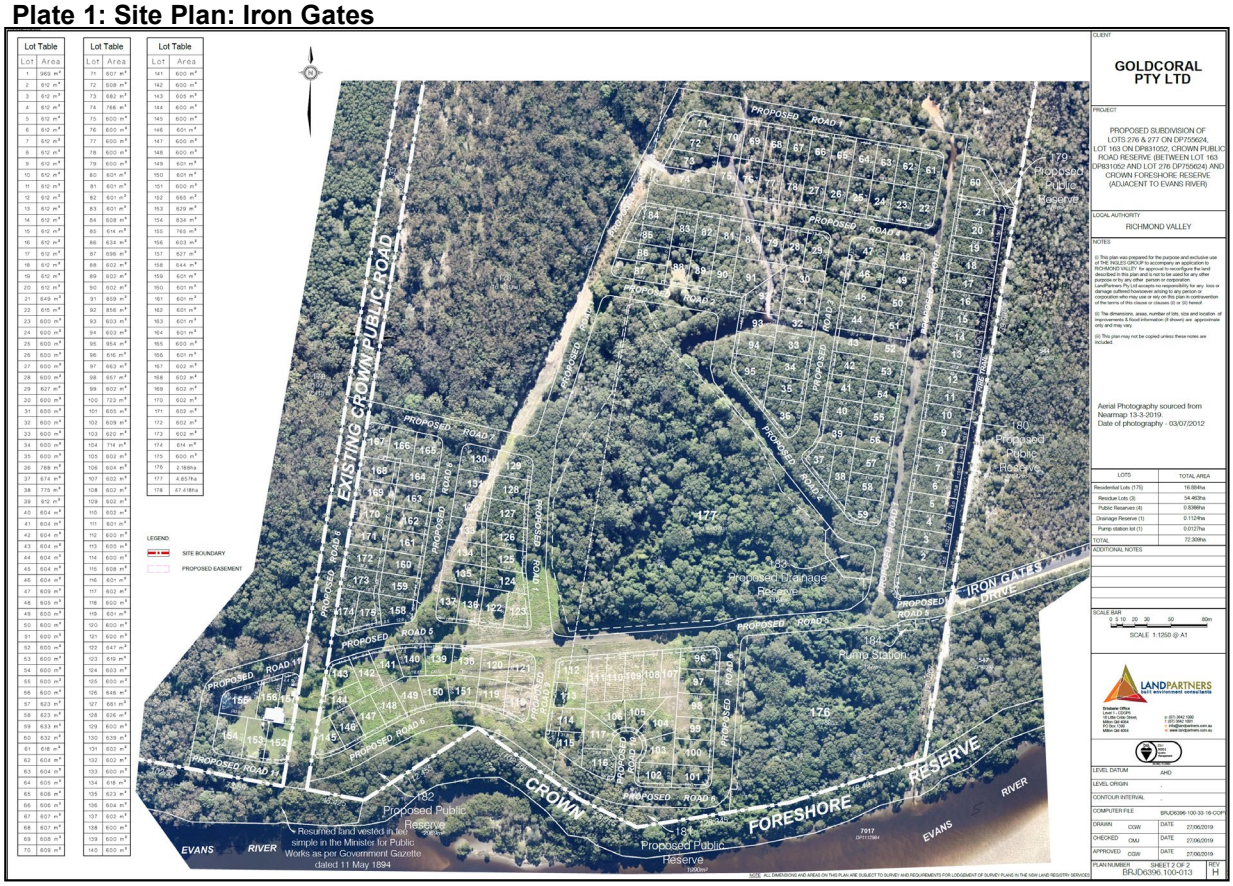
1.0 Introduction

Mosquito Consulting Services Pty Ltd (MCS) was engaged by Gold Coral Pty Ltd in March 2019 to review and update the biting insect (mosquito and biting midge) impact assessment (25 March 2015) which relates to a proposed urban subdivision consisting of:

- One Hundred and Seventy- Five (175) Residential Lots,
- Three (3) Residue Lots,
- Proposed Sewer Pump Station Lot,
- Four (4) Public Reserves,
- One (1) Drainage Reserve,
- Upgrading of Iron Gates Drive,
- Demolition of Existing Structures Onsite and,
- Subdivision Work including road works, drainage, water supply, sewerage, landscape and embellishment work and street planting.

At Lot 163 DP 831052, Lots 276 & 277 DP755624 and Crown Road Reserve between Lots 163 DP 831052 and Lot 276 DP 755624,Crown Foreshore Reserve and Iron Gates Drive, Evans Head. 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. At the time of the initial report in March 2015, the biting insect impact assessment addressed 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?***

The responses to those issues has been retained within this report and includes additional responses to further requested information by Council's consultant town planner, Malcolm Scott (by letter dated 2 Feb 2019) to update the subdivision layout, provide the correct land descriptions, include comment on proposed stormwater management and street lighting.

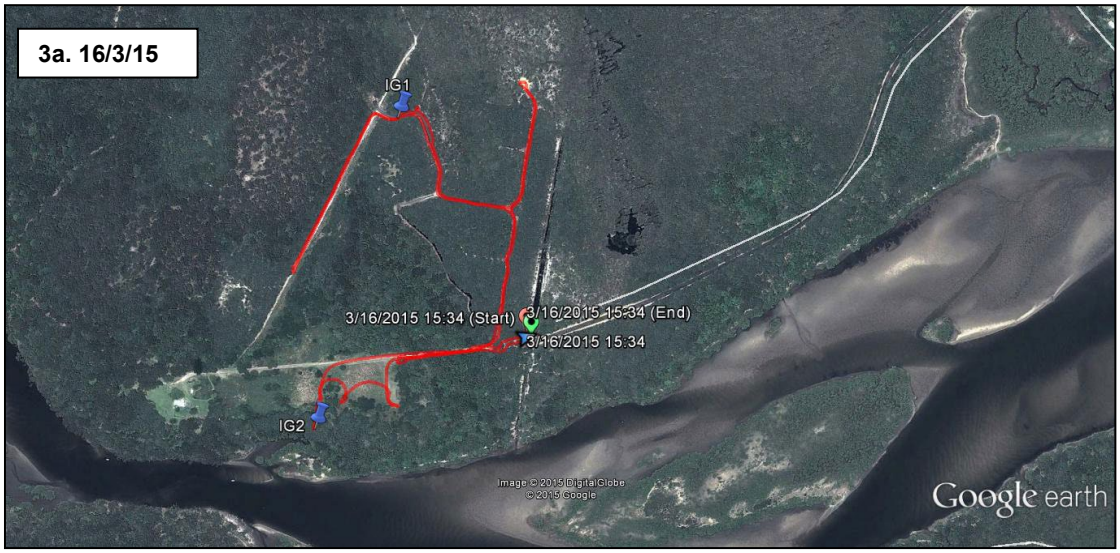
2.0 Investigation Methodology

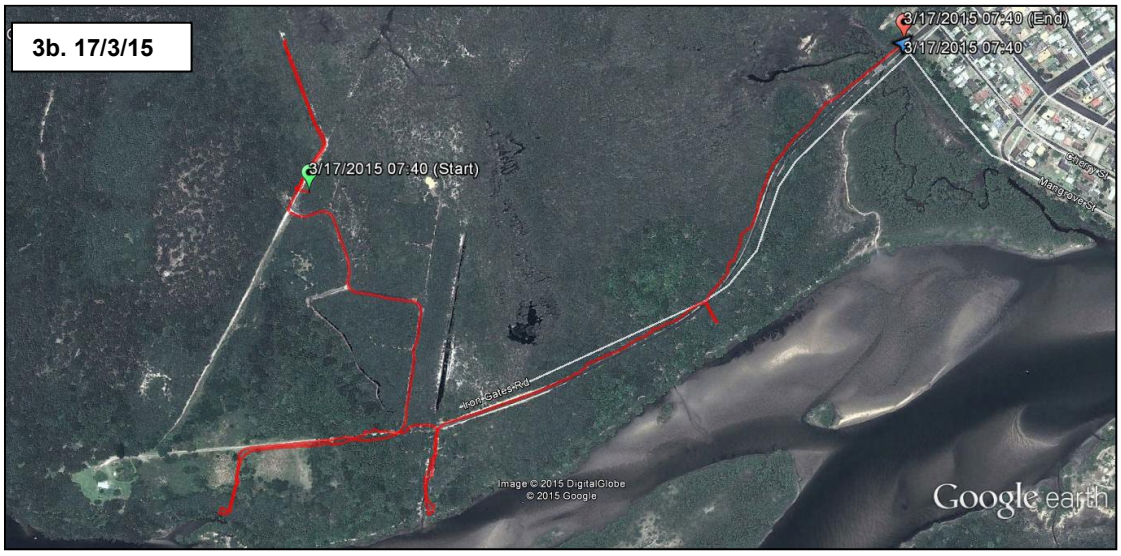
Biting insect assessment was undertaken using standard entomological methods for collecting mosquitoes and biting midge and characterising likely breeding habitat on and adjacent to the site. Adult biting insects were collected using traps (Plate 2). Biting insect traps are baited using carbon dioxide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

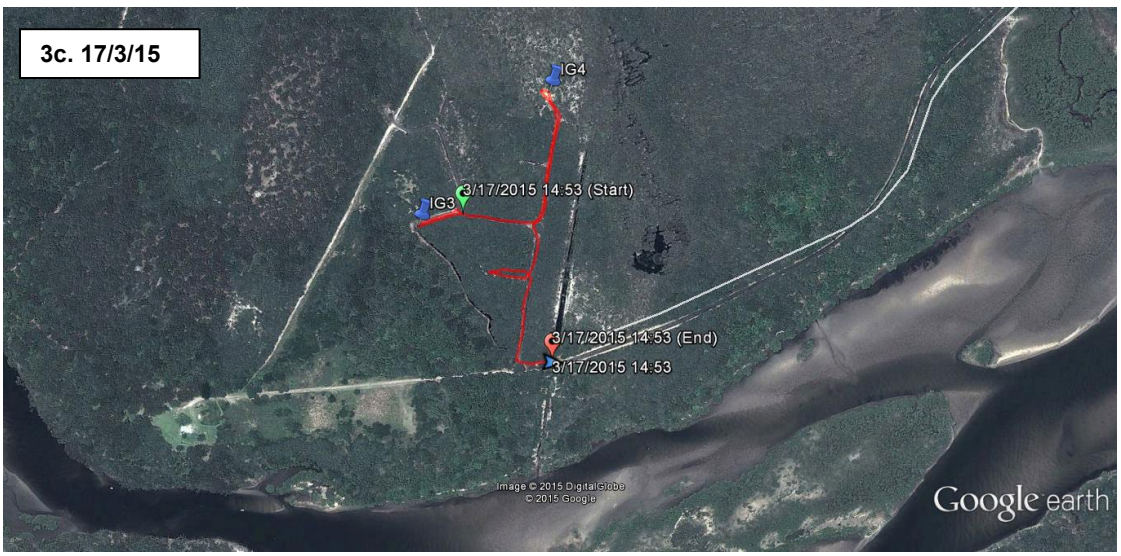
Plate 2: Biting insect trap as used at Iron Gates and Identification in the Laboratory

Plates 3a,b&c show 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 taking water (dipping) from 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 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 several 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 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 some areas of suitable habitat for this species.

4.0 Discussion

The Iron Gates site currently contains open drains formed as part of a previous development. Advice received from Arcadis indicates that the existing open drains on-site will be filled. 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.

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 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.

The presence of biting midge was expected at this location and the abundance of this insect would be relative consistent with peak emergence during summer neap tides. Without addressing this risk, by providing effectively management strategies (e.g. urban design including buffer/breezeway separation between residential allotments and river foreshore), biting midge could be expected to have an adverse impact on future residents near the river.

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, several 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 urban 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 urban canal construction.)

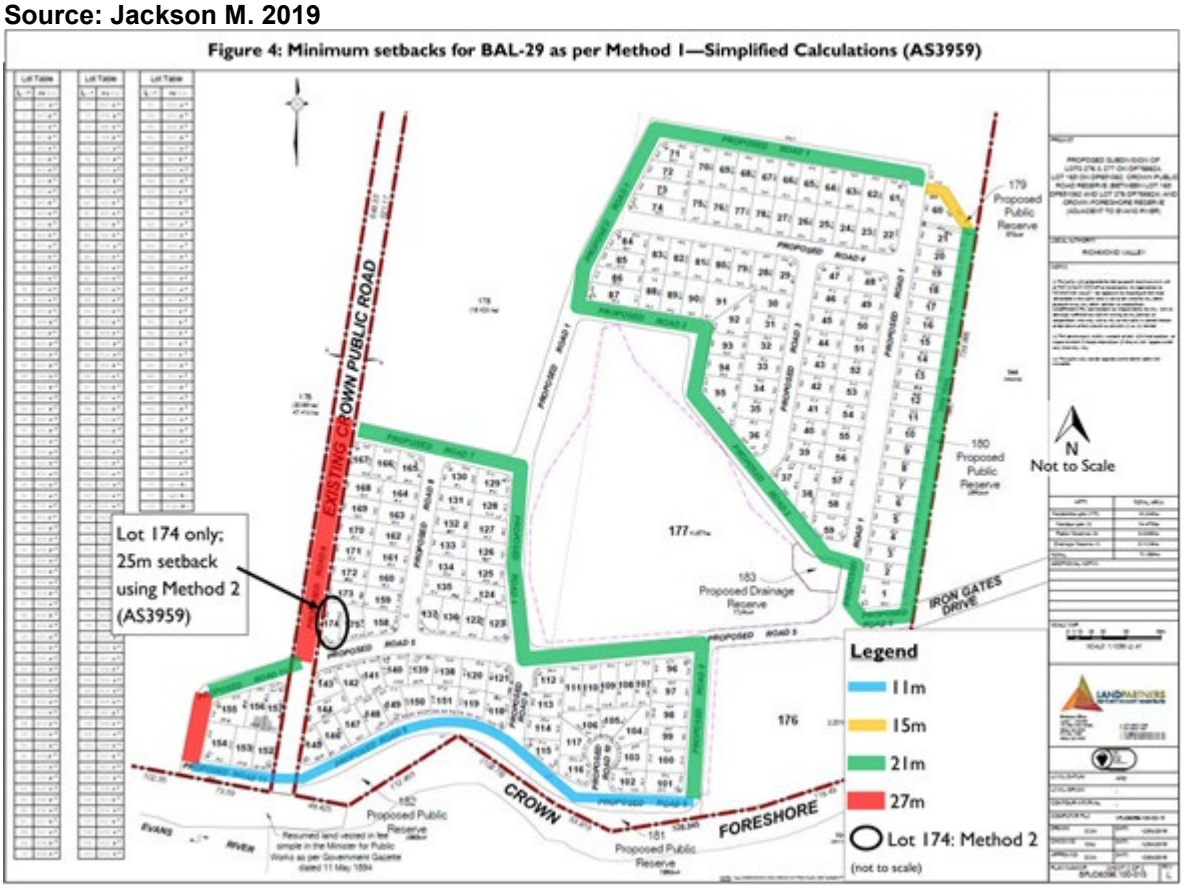
What then may be an effective and practical method for reducing the dispersal of adult biting midge from their river breeding habitat into the Iron Gate site?

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. Additional breezeways can be achieved by considering the open space offsets created by proposed Asset Protection Zones (APZ) as also serving the function of open space biting insect buffers. There are no specific minimum dimensions for a biting midge buffer to be effective. However, the proposed APZ buffers provide reasonable breezeways physically

separating residential allotments from connecting harbourage vegetation to external biting insect breeding locations.

Plate 4 illustrates the proposed arrangement of APZ buffers in relation to residential allotments. It is considered that the APZ buffers will provide adequate biting insect breezeways to minimise passage of biting midge and mosquitoes from identified breeding locations to residential allotments.

Plate 4: Proposed APZ setbacks also providing biting insect buffer breezeways
Source: Jackson M. 2019



6.2 Mosquitoes

The Iron Gates site is not significantly more so exposed to mosquitoes than is 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, Building Application 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 Insects Buffer

Residential allotments within the development will be physically separated from biting insect breeding habitat by open space buffers as provided by APZ offset requirements. The open space required for biting midge suppression is relatively narrow and it is considered that the proposed APZ setbacks will be adequate for that purpose also. Plate 4 provides details of the proposed APZ setbacks.

It is recommended that the APZ setbacks be accepted as also providing adequate biting insect buffer separations.

7.2 Street Lighting Considerations

The previous biting insect impact assessment (25 March 2015) commented on minimising street lighting as a method of reducing attraction of biting insects at night into residential areas of the development. This advice is now withdrawn due to it being redundant. Civil engineering specifications on streetlighting are consistent with AS/NZS 1158 series for Lighting for Roads and Public Spaces. The standards include consideration of providing effective targeted illumination while minimising light pollution and glare. Therefore, the intent of the 2015 biting insect advice on streetlighting will be achieved through application of existing civil engineering standards.

7.3 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 72 hrs 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 health impacts.

8.0 Conclusions

Biting insects are a seasonal risk in most coastal locations within Australia. Biting midge breeding in intertidal zones of river estuaries have been identified adjacent to the proposed Iron Gates development site. Mosquitoes have also been collected within the development site. The abundance of biting insects within the site, however, are typical of the expected background levels in the given environmental context. There is little mosquito breeding habitat within or adjacent to the site. Any existing mosquito breeding habitat currently on the site will be removed by engineering works during construction. Biting midges will be managed adequately through the action of breezeways created by the required APZ setbacks between potential harbourage vegetation and residential allotments.

The risk of typical seasonal biting insect exposure to future residents is not considered unmanageable if the recommendations of this report are implemented.

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