DEPARTMENT OF HEALTH
AND COMMUNITY SERVICES

NORTHERN TERRITORY OF AUSTRALIA

Your Ref:

Our Ref:

4 August, 1993

Mr Tony Cox
Senior Landscape Architect
Clousten
GPO Box 1118
DARWIN NT 0801

Dear Tony,

RE:RAPID CREEK MANAGEMENT STRATEGY

Further to the meeting 27/7/93, I am enclosing mosquito monitoring data from three trap sites around Mararra Swamp for 1992, plus a check list of the mosquito species recovered from the swamp area, and information on the common mosquito species. Also included is a paper on the mosquito habitats in the swamp system.

This data, with due acknowledgement, could form part of the base line information on the fauna of the area, as well as part of the health information. We have maintained the same trap sites in this area for 10 years and it forms part of a monitoring system to detect mosquito problems, both local and exotic, as conditions change.

The condition of the upper reaches of Rapid Creek, from the confluence of the two arms of Mararra Swamp to the catchment limits is critical with regard to mosquito breeding. It is in the three major subsections of the swamp system, namely the round Melaleuca Swamp, the South east end of the airstrip, and the old Rifle Range area at the confluence of the two arms of the swamp, where the greatest potential for increased mosquito breeding exists.

If significant mosquito breeding begins in these areas it may be necessary to carry out engineering rectification measures for public health reasons, so maintaining the system in a healthy state is in the interests of all concerned bodies.

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Factors necessary to maintain the above areas relatively free of mosquito breeding include ensuring low nutrient levels in the water, forest canopy cover over creeklines and swamps, the maintenance of good freshwater fish

populations in all areas of the swamp, and the maintenance of the relatively small or reduced areas of freshwater semi aquatic reed species such as Eleocharis and Typha. There are already signs of increased nutrient levels in the round Melaleuca swamp area, with green filamentous algae adjacent to Amy Johnston Avenue. The likely source of these nutrients is from the orchid farm or the nearby school grounds. The return of a dense Melaleuca stand in this area after the considerable damage of Cyclone Tracy would assist in reducing semi aquatic reed growth in future. The semi aquatic reed growth is conducive to mosquito breeding by protecting mosquito larvae from fish and other aquatic predators.

The round Melaleuca swamp is regarded as having the greatest potential for increased mosquito breeding by reason of its area, the vulnerability to increased nutrient levels and subsequent reed growth, and the possibility of disruption of access for fish recolonization.

The area at the south east end of the airstrip has increased channelization due to the new RAAF facilities, and former mosquito drainage works to reduce the area of flooded reeds. There is still a possibility for mosquito breeding in this area if siltation blocks the channels or there is disturbance of the margins by vehicles, animals or soil and sand "borrowings". There may be a future need to carry out maintenance or rectification works in this area to ensure the relatively free draining nature is maintained.

The area at the confluence of the two arms of the swamp, and the lower reaches of Rapid Creek are vital in maintaining the native rainbow fish populations that effectively control mosquito breeding in much of the swamp system. The greatest threat to these fish populations is pollution or elimination of their refuge areas in the late dry season.

Organic pollution of the confluence area is not significant at present but the threat of increased organic loads is present from the storm water drainage system at the rear of the caravan park on Mc Millan's Road, and nutrients from the golf course. There is an additional minor threat to this area by storm water, if

areas of the airport upstream of the present development are further developed.

It is vital that there are good vegetation filters in the area upstream of the northern arm of the confluence area to reduce the effect of this organic and nutrient pollution. It is also important to prevent increased low flows from the stormwater drains and golf club entering this area. Any perennial low flows that develop in future pose a great potential for increased mosquito breeding.

The lower reaches of Rapid Creek below the confluence area are not so significant mosquito breeding areas because of the discrete nature of the creek. There are areas of concern, however. There are a number of large storm water drains entering the creek with perennial low flows from the airport, Mararra Sports Stadium, and the suburban areas. Any public education and other measures to reduce these low flows is seen as essential in preserving the creek. There may be additional engineering works necessary to pipe or channel these flows to the creek to prevent mosquito breeding in the drains themselves.

There is a great deal of silt accumulation in the main channel of the creek from the Water Gardens down to Trower Road bridge. If this process continues and leads to cut off pools or flooding problems, it may be necessary to carry out maintenance operations in this section

I hope these comments are helpful. Best regards.

Yours sincerely'

PETER WHELAN
DIRECTOR
MEDICAL ENTOMOLOGY BRANCH
SCIENTIFIC SERVICES

MARRARA ROUND SWAMP	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr	May	May	May	May	Jun	Jun	Jun	Jun	Jun	Sub/tot
	7	14	22	29	5	11	18	25	3	10	17	24	31	7	14	22	28	6	12	19	26	2	10	16	24	30	1st 1/2
Ae.daliensis		NIL																									0
Ae.alternans																											0
Ae.elchoensis																											0
Ae.funereus																											0
Ae.britteni																											0
Ae.kochi				1	1	4		2	1	2	11	8	2	3	1					1	1						38
Ae.notoscriptus						1			2	1	5			1													10
Ae.pecuniosus																											0
Ae.phaecasiatus																											0
Ae.reesi			1	3		1				1	1					1											8
Ae.tremulus																											0
Ae.vigilax	14		1		14						1		4			9					1	8		3			55
Ae.lineatopennis												1				15	1										17
Ae.normanensis					1	1																					2
Ae.alboscutellatus																1											1
Ae.species 76																											0
Ae.species 121			1																								1
Ae.species 160																											0
An.amictus																											0
An.annulipes							1				1		3	1								4	1	1	1	2	15
An.bancroftii												1	1		2	3	3	3	12		42	39	3		2	1	112
An.farauti									1			1			4	2	1		4	1	1	1	2				18
An.hilli											1							1				1					3
An.meraukensis				1	5	2	3	10	3	13	2	7	30	47	18	122	113	40	288	43	94	94	12	1	1		949
An.novaguinensis								1		1			1	1			1					8	3	1			17
An.powelli																											0
Cx.annulirostris	4		3		3	2	3	5	4	14	5	7	22	13	37	5	2	3	2	2	3	10	11	2	6	12	180
Cx.bitaeniorhynchus													2														2
Cx.quinquefasciatus																									3	1	4
Cx.pullus															4												4
Cx.sitiens	2			1																							3
Cx.squamosus																											0
Cx.vicinus																						1					1
Cx.species 32															1												1
Cx. vishnui grp.																	1										1
Cx.cubiculi																											0
Cx.hilli																											0
Cx.species 155																											0
Cx.species 167															1												1
Ad.catasticta														1									1				2
Cq.xanthogaster									1			1	3	15	19			5		1	30	48	68	4	70	45	310
Ho.species 157																											0
Ma.uniformis	1			1						1				6	2	1	1				8	8	2	3			34
Mi.elegans																											0
Tp.magnesianus																											0
Ur.albescens																											0
Ur.argyrotarsis																											0
Ur.lateralis																											0
Ur.moresbyensis																											0
Ur.nivipes																								1			1
Ur.novaguinensis																											0
Ur.species 49																											0
Ur.species (unid)																											0
Totals	21	0	6	7	24	11	7	18	12	33	27	26	68	88	89	159	123	52	306	48	180	222	103	16	83	61	1790
1/7/92																											1790

(1)
Marrara Round Swamp 1992

MRS292.XLS

DARWIN ADULT MOSQUITO MONITORING PROGRAM

	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Sep	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec	Dec	Sub/tot	Sub/tot	ANNUAL	% OF
	6	14	21	28	6	11	18	25	1	8	16	22	29	6	13	21	27	4	10	18	24	1	7	15	22	30	2nd 1/2	1st 1/2	TOTAL	TOTAL
Ae.daliensis																	nil	nil	nil		nil	nil					0		0	.
Ae.alternans																	mos	mos	mos		mos	mos					0		0	.
Ae.elchoensis																											0		0	.
Ae.funereus																											0		0	.
Ae.britteni																											0		0	.
Ae.kochi																								1	1		2		2	.57
Ae.notoscriptus							1													1				2	1		5		5	1.425
Ae.pecuniosus																											0		0	.
Ae.phaecasiatus																											0		0	.
Ae.reesi																									2		2		2	.57
Ae.tremulus																									1		1		1	.285
Ae.vigilax						1	1	1		13	11	3	3	16	16					1			1		1	5	73		73	20.798
Ae.lineatopennis																											0		0	.
Ae.normanensis																									1	1	2		2	.57
Ae.alboscutellatus																											0		0	.
Ae.species 76																											0		0	.
Ae.species 121																											0		0	.
Ae.species 160																											0		0	.
An.amictus																											0		0	.
An.annulipes		1	1				1	2	1																		6		6	1.709
An.bancroftii		1																									1		1	.285
An.farauti		1																									1		1	.285
An.hilli		1																									1		1	.285
An.meraukensis																											0		0	.
An.novaguinensis																											0		0	.
An.powelli																											0		0	.
Cx.annulirostris	1	1	4	5	5	2	4	8	9	6		1	2										1	1		10	60		60	17.094
Cx.bitaeniorhynchus																											0		0	.
Cx.quinquefasciatus		1	1				2	1	2		1	1	1							1							11		11	3.134
Cx.pullus																											0		0	.
Cx.sitiens				1					1		1	4		1		3				1							12		12	3.419
Cx.squamosus																											0		0	.
Cx.vicinus																											0		0	.
Cx.species 32																											0		0	.
Cx.vishnui grp					1																						1		1	.285
Cx.hilli																											0		0	.
Cx.species 155																											0		0	.
Cx.species 167																											0		0	.
Ad.catasticta																											0		0	.
Cq.xanthogaster	2	77	6	45	14		6	19	1		1	1	1														173		173	49.288
Ho.species 157																											0		0	.
Ma.uniformis																											0		0	.
Mi.elegans																											0		0	.
Tp.magnesianus																											0		0	.
Ur.albescens																											0		0	.
Ur.argyrotarsis																											0		0	.
Ur.lateralis																											0		0	.
Ur.moresbyensis																											0		0	.
Ur.nivipes																											0		0	.
Ur.novaguinensis																											0		0	.
Ur.species 49																											0		0	.
Ur.species (unid)																											0		0	.
Totals	3	83	12	51	20	3	15	31	14	19	14	10	7	17	16	3	0	0	0	4	0	0	2	3	4	20	351	0	351	100
																											351			

(2)

Maparra Swamp. South East End of Airstrip

MSE192.XLS

DARWIN ADULT MOSQUITO MONITORING PROGRAM

(1)

MARRARA SOUTH EAST	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr	May	May	May	May	Jun	Jun	Jun	Jun	Jun	Sub/tot
	7	14	21	29	4	11	18	25	3	10	17	24	31	7	14	22	28	6	12	19	26	2	10	16	24	30	1st 1/2
Ae.daliensis																											0
Ae.alternans																											0
Ae.elchoensis																											0
Ae.funereus															2												2
Ae.britteni																											0
Ae.kochi		1	5	4	41	12	8	38	25	15	43	43	99	21	11	11	17	19	6	14	10	9	3		2	8	465
Ae.notoscriptus			1	1	3				1		1					1				1							9
Ae.pecuniosus																											0
Ae.phaecasiatus																											0
Ae.reesi					1												2	5									8
Ae.tremulus																											0
Ae.vigilax	10			3	5		1			1	2					12	5				1	3		2			45
Ae.lineatopennis													1			1		1									3
Ae.normanensis											1					1											2
Ae.alboscutellatus																											0
Ae.species 76																											0
Ae.species 121																											0
Ae. (mac). unid								1																			1
Ae.species 160																											0
An.amictus																											0
An.annulipes												1				1				1	1					3	7
An.bancroftii														4	2		3	6	2	2	26	43	16	9	19	15	147
An.farauti								1	4	9	11	16	29	23	16	38	46	27	30	30	21	11	14	7	14		347
An.hilli					1								8											1			10
An.meraukensis				1				2		1	2	2	4		7	6	5	11	21	15	11	16	6	8	5	10	133
An.novaguinensis										1			2	4	6			2	2		2	3	2	2	1		27
An.powelli																											0
Cx.annulirostris	5	3	3	5	1	1	9	2		9	10	25	113	476	108	36	41	24	1	6	11	39	28	14	24	44	1038
Cx.bitaeniorhynchus																						1					1
Cx.quinquefasciatus																						1				1	2
Cx.pullus													1		4	7	3			1		3	1	1		2	23
Cx.sitiens				1		4	1				1							1			1						9
Cx.squamosus																						2					2
Cx.vicinus																						1		1			2
Cx.species 32															4												4
Cx. vishnui grp.																			1	2	1	5				8	17
Cx.cubiculi																						1					1
Cx.hilli																											0
Cx.species 155																										7	7
Cx.species 167															1												1
Ad.catasticta																											0
Cq.xanthogaster							1	1			1	3	7	558	56		17	20	1	6	32	179	122	7	130	105	1246
Ho.species 157																											0
Ma.uniformis	1			2	8					2	2	3	1	16	5		4	6	3	4	21	15	5	7	12	8	125
Mi.elegans																											0
Tp.magnesianus																											0
Ur.albescens																											0
Ur.argyrotarsis																											0
Ur.lateralis																											0
Ur.moresbyensis																											0
Ur.nivipes														1													1
Ur.novaguinensis																											0
Ur.species 49																											0
Ur.species (unid)																											0
Totals	16	4	9	17	60	17	20	44	27	33	72	88	244	1117	229	92	135	141	64	82	147	342	194	65	201	225	3685

CO2 baited EVS trap run overnight.

Figures are number of female mosquitoes per trap night.

PETER WHELAN
Senior Medical Entomologist
Medical Entomology Branch

Marara Swamp South East End of Airstrip Site 1992

(2)

MSE292.XLS

DARWIN ADULT MOSQUITO MONITORING PROGRAM

	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Sep	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec	Dec	Sub/tot	Sub/tot	ANNUAL	% OF
	6	14	21	28	6	11	18	25	1	10	16	22	29	6	13	20	27	4	10	18	24	2	7	15	22	30	2nd 1/2	1st 1/2	TOTAL	TOTAL
Ae.daliensis																											0		0	.
Ae.alternans																											0		0	.
Ae.elchoensis																											0		0	.
Ae.funereus																											0		0	.
Ae.britteni																											0		0	.
Ae.kochi	2		1		3			3	2		6	5	1	1		5		1	1		1			3	5	1	41		41	4.096
Ae.notoscriptus	1				1																1			1		1	5		5	.5
Ae.pecuniosus																											0		0	.
Ae.phaecasiatus																											0		0	.
Ae.reesi															-							1	1		4		6		6	.599
Ae.tremulus																									2		2		2	.2
Ae.vigilax		1		1			4	1		52	9	1		23	23	3	1	3	2				1		1		126		126	12.587
Ae.lineatopennis																											0		0	.
Ae.normanensis																									3		3		3	.3
Ae.alboscutellatus																											0		0	.
Ae.species 76																											0		0	.
Ae.species 121																											0		0	.
Ae.species 160																											0		0	.
An.amictus																											0		0	.
An.annulipes					1																						1		1	.1
An.bancroftii	14	17	2	4	3			6																			46		46	4.595
An.farauti	6	1		3			1																				11		11	1.099
An.hilli																											0		0	.
An.meraukensis	1	3	1	5	1																						11		11	1.099
An.novaguinensis	1	4	2	2			2	1																			12		12	1.199
An.powelli																											0		0	.
Cx.annulirostris	4	32	4	45	33	5	13	95	20	6	3	12		3	4	3		4			3	1				6	296		296	29.57
Cx.bitaeniorhynchus																											0		0	.
Cx.quinquefasciatus		2			1	1		4	2			1	1	2		4	1										19		19	1.898
Cx.pullus				5	4	1	1																				11		11	1.099
Cx.sitiens									2		4	3								2							11		11	1.099
Cx.squamosus																											0		0	.
Cx.vishnui grp	1			1		1																					3		3	
Cx.vicinus																											0		0	.
Cx.species 32																											0		0	.
Cx.cubiculi																											0		0	.
Cx.hilli																											0		0	.
Cx.species 155				2						1																	3		3	.3
Cx.species 167										1		1						1									3		3	.3
Ad.catasticta																											0		0	.
Cq.xanthogaster	14	132	17	132	23	3	8	45		1				1													376		376	37.562
Ho.species 157																											0		0	.
Ma.uniformis	2	9		1	1		1																				14		14	1.399
Mi.elegans																											0		0	.
Tp.magnesianus																											0		0	.
Ur.albescens																											0		0	.
Ur.argyrotarsis																											0		0	.
Ur.lateralis																											0		0	.
Ur.moresbyensis																											0		0	.
Ur.nivipes															1												1		1	.1
Ur.novaguinensis																											0		0	.
Ur.species 49																											0		0	.
Ur.species (unid)																											0		0	.
Totals	46	201	27	201	71	11	30	155	26	61	22	23	2	30	28	15	2	9	3	2	5	2	2	4	15	8	1001	0	1001	99.7003
																											1001			

PETER WHELAN
Senior Medical Entomologist
Medical Entomology Branch

8/1/93

DARWIN ADULT MOSQUITO MONITORING PROGRAM

MARRARA RIFLE RANGE	Jan	Jan	Jan	Jan	Feb	Feb	Feb	Feb	Mar	Mar	Mar	Mar	Mar	Apr	Apr	Apr	Apr	May	May	May	May	Jun	Jun	Jun	Jun	Jun	Sub/tot
	7	14	21	29	4	11	18	25	3	10	18	24	31	7	14	22	28	6	12	19	26	2	10	16	24	30	1st 1/2
Ae.daliensis																											
Ae.alternans																					Trap						0
Ae.elchoensis																					fail						0
Ae.funereus																					x 2						0
Ae.britteni																											0
Ae.kochi	8	30	36	43	43	36	18	135	11	8	17	26	29	6		9	13	13	4	3		3	1				492
Ae.notoscriptus			1		1						4			1				1									8
Ae.pecuniosus																											0
Ae.phaecasiatus																											0
Ae.reesi				3	1							1				14	4	12									35
Ae.tremulus										1			1												1		3
Ae.vigilax	3	1	1		8				1	1			1			4	4							1			25
Ae.lineatopennis														1		1	1	4									7
Ae.normanensis																											0
Ae.alboscutellatus																											0
Ae.species 76																											0
Ae.species 121																											0
Ae.species 160																											0
An.amictus																											0
An.annulipes																											0
An.bancroftii																1	3	7	1	7		8	9	6	6	4	52
An.farauti										1		2			4	7	12	26	6	8		10	2	4	1	1	84
An.hilli																											0
An.meraukensis												1		1		2	1	5		4			4				18
An.novaguinensis																		1					1				2
An.powelli																								1			1
Cx.annulirostris	15	6	1	1		1	3	9		2			3	9	1	4	13	9		3		5	3		2	9	99
Cx.bitaeniorhynchus																											0
Cx.quinquefasciatus		1					1															1	12	4	15	15	49
Cx.pullus																											0
Cx.sitiens	1							1																			2
Cx.squamosus																											0
Cx.vicinus																									1		1
Cx.species 32														1													1
Cx.cubiculi																1											1
Cx.hilli																											0
Cx.species 155																											0
Cx.species 167																							1				1
Ad.catasticta																									1		1
Cq.xanthogaster														18	4		3	3		2		47	20	4	24	9	134
Ho.species 157					1						1			5			2	1		1		2	1	2	1	1	18
Ma.uniformis																											0
Mi.elegans																											0
Tp.magnesianus																											0
Ur.albescens																											0
Ur.argyrotarsis																											0
Ur.lateralis																											0
Ur.moresbyensis																											0
Ur.nivipes																											0
Ur.novaguinensis																											0
Ur.species 49																											0
Ur.species (unid)																											0
Totals	27	38	39	47	54	37	22	145	12	13	22	30	34	41	10	43	56	82	11	28	0	76	54	22	52	39	1034
																											1034

1/7/92

Marrara Rifle Range Site (old) near FAC buildings at confluence of two arms of swamp. At swamp edge. 1992.

(i)

PETER WHELAN
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Marrara Swamp at Rifle Range Site (near FAC buildings at edge of swamp at confluence of two arms) 1992

MARRARA.XLS

DARWIN ADULT MOSQUITO MONITORING PROGRAM

	Jul	Jul	Jul	Jul	Aug	Aug	Aug	Aug	Sep	Sep	Sep	Sep	Sep	Oct	Oct	Oct	Oct	Nov	Nov	Nov	Nov	Dec	Dec	Dec	Dec	Dec	Sub/tot	Sub/tot	ANNUAL	% OF
	6	14	21	28	6	11	18	25	1	8	16	22	29	6	13	20	27	4	10	18	24	1	7	15	23	30	2nd 1/2	1st 1/2	TOTAL	TOTAL
Ae.daliensis																											0		0	.
Ae.alternans																										1	1		1	.321
Ae.elchoensis																											0		0	.
Ae.funereus																											0		0	.
Ae.britteni																											0		0	.
Ae.kochi	1			1	2	1													1		2		1		4	8	21		21	6.731
Ae.notoscriptus													2							1		1				2	6		6	1.923
Ae.pecuniosus																											0		0	.
Ae.phaecasiatus																											0		0	.
Ae.reesi																											0		0	.
Ae.tremulus	1																				1	1					3		3	.962
Ae.vigilax							1			5	4		2	5	4		1	1	5						4	1	33		33	10.577
Ae.lineatopennis																											0		0	.
Ae.normanensis																											0		0	.
Ae.alboscutellatus																											0		0	.
Ae.species 76																											0		0	.
Ae.species 121																											0		0	.
Ae.species 160																										1	1		1	.321
An.amictus																											0		0	.
An.annulipes		1				1																					2		2	.641
An.bancroftii	5	2						1																			8		8	2.564
An.farauti	1			1																							2		2	.641
An.hilli																											0		0	.
An.meraukensis						1																	1				2		2	.641
An.novaguinensis																											0		0	.
An.powelli																											0		0	.
Cx.annulirostris	1	1		3	1	2	1	3	1	6	6			1						2	1					2	31		31	9.936
Cx.bitaeniorhynchus																											0		0	.
Cx.quinquefasciatus	2	7	5	24	3	34	4	1	6	11	7	3	2				3										112		112	35.897
Cx.pullus																											0		0	.
Cx.sitiens									1	1	6	5									1						14		14	4.487
Cx.squamosus									1	1																	2		2	.641
Cx.vicinus	1																										1		1	.321
Cx.species 32																											0		0	.
Cx.cubiculi																											0		0	.
Cx.hilli																											0		0	.
Cx.species 155																											0		0	.
Cx.species 167					1																						1		1	.321
Ad.catasticta												1															1		1	.321
Cq.xanthogaster	4	10	5	21	3	1	6	12	3			1					1			1							68		68	21.795
Ho.species 157																											0		0	.
Ma.uniformis	1							1		1																	3		3	.962
Mi.elegans																											0		0	.
Tp.magnesianus																											0		0	.
Ur.albescens																											0		0	.
Ur.argyrotarsis																											0		0	.
Ur.lateralis																											0		0	.
Ur.moresbyensis																											0		0	.
Ur.nivipes																											0		0	.
Ur.novaguinensis																											0		0	.
Ur.species 49																											0		0	.
Ur.species (unid)																											0		0	.
Totals	17	21	10	50	10	40	12	18	12	25	23	10	6	6	4	0	5	1	6	4	5	2	1	1	8	15	312	0	312	100
																											312			

(2)

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Check list of the Mosquito Species recovered from three trap sites in Marapna Swamp 1989-1993.

Ae.daliensis
Ae.alternans
Ae.funereus
Ae.kochi
Ae.notoscriptus
Ae.phaecasiatus
Ae.reesi
Ae.tremulus
Ae.vigilax
Ae.lineatopennis
Ae.normanensis
Ae.alboscutellatus
Ae.species 76
Ae.species 121
Ae.species 160
An.amictus
An.annulipes
An.bancroftii
An.farauti s.l. (most likely sp 3 of sibling species complex)
An.hilli
An.meraukensis
An.novaguinensis
An.powelli
Cx.annulirostris
Cx.bitaeniorhynchus
Cx.quinquefasciatus
Cx.pullus
Cx.sitiens
Cx.squamosus
Cx.vicinus
Cx.species 32
Cx.cubiculi
Cx.hilli
Cx.species 155
Cx.species 167
Ad.catasticta
Cq.xanthogaster
Ma.uniformis
Mi.elegans
Ur.albescens
Ur.argyrotarsis
Ur.lateralis
Ur.nivipes
Totals 43

PETER WHELAN
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27/7/93

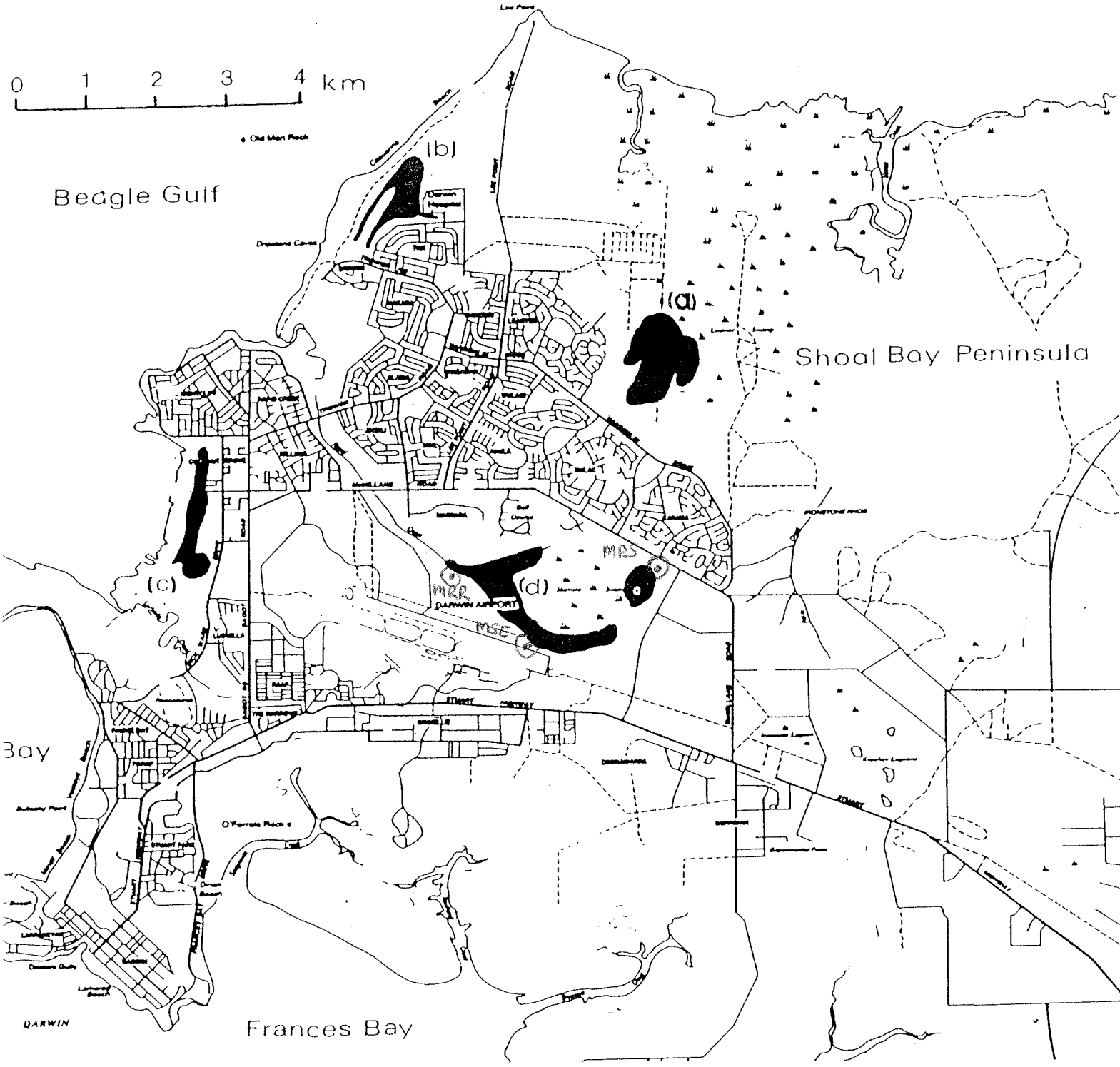

FIG. 1. Darwin. The northern suburbs and the four major mosquito breeding areas (full black shading): (a) Leanyer Swamp; (b) Casuarina Swamp; (c) Coconut Grove Swamp; (d) Marrara Swamp.

⊙ Mosquito Monitoring Sites Ma ra Swamp.
MRS – Marara Round Swamp. MRR – Marara Rifle Range. MSE – South East End of Air strip.

THE POTENTIAL MOSQUITO VECTORS AT THE PROPOSED DARWIN AIRPORT TERMINAL WITH RECOMMENDED VECTOR CONTROL MEASURES

MEDICAL ENTOMOLOGY SECTION
NORTHERN TERRITORY DEPARTMENT OF HEALTH

1. INTRODUCTION

There have been three proposed sites for the new International Airport Terminal at Darwin Airport. One of the important factors that needs to be involved in the choice of a site is the implication of the International Health Regulations governing the prevention of the transport and establishment of exotic insect vectors and their diseases. The Northern Territory Department of Health maintains mosquito monitoring sites in the Darwin area, and a summary of these results for 1980 are presented, to indicate the potential mosquito problem that could be encountered at each site. The possible control measures necessary to reduce these potential vectors and their diseases are discussed.

2. CURRENT MOSQUITO SITUATION

A total of 55 mosquito species have been recorded by the Northern Territory Health Department from the Darwin area. Of these 33 have been recorded from the Marrara area by trapping methods during 1980. (See Table 1). This list includes potential vectors of disease, including Anopheles farauti and Anopheles hilli which are vectors of malaria, Culex annulirostris, which is a vector of Murray Valley Encephalitis virus, Kunjin virus and Ross River virus, and Aedes vigilax, which is a vector of Ross River virus.

NB 43 of 1993

Other possible vectors include *Culex quinquefasciatus*, *Mansonia uniformis*, *Anopheles annulipes*, and *Anopheles bancroftii*.

Mosquitoes occur in very large numbers adjacent to certain areas of urban Darwin and some of the major sources of these mosquitoes are within the flight range of some of the proposed sites for the International Terminal. Extensive collections of insects from overseas aircraft arriving in Darwin over the last few years have indicated a high potential for transporting insect vectors in aircraft. It is important that the mosquito breeding sites near the International Terminal are eliminated in order to reduce the potential for introducing exotic vectors, as well as insuring that the terminal surrounds are not sources for the introduction of local vectors and their diseases to other countries.

3.0 RESULTS OF THE MOSQUITO MONITORING PROGRAM

A summary of the relevant mosquito monitoring results is shown in Table 2. A more complete result for the Marrara monitoring site is shown in Appendix 1. The figures in Table 2 show the maximum number of mosquitoes trapped at a particular site per trap night during 1980. The mosquito monitoring sites and their relationship to the proposed terminal sites and to the major mosquito sites is shown on Map 1. The Coconut Grove and the Marrara monitoring sites have relevance to proposed Site 3 and Site 1, while the Palm Creek, Marrara and Leanyer monitoring sites are of relevance to Site 2.

The three monitoring methods used are complimentary to each other to enable an accurate assessment of relative mosquito numbers. From Table 2, the light trap detected 31 species; the CO2 trap detected 25 species and the man biting collections detected 16 species of mosquitoes. The relevance of these monitoring sites to the proposed terminal sites is discussed below.

3.1 SITE 1

The trap results from the Marrara site are most relevant to Site 1 due to the similarity in vegetation and the mosquito breeding sites nearby. There is a continuous dense forested area between the Marrara monitoring site and Site 1, which facilitates mosquito movement and provides ideal mosquito harbouring sites. From the monitoring results at Marrara it is evident Site 1 will have very high numbers of Culex annulirostris, Aedes vigilax and Anopheles bancroftii. The maximum number of Anopheles farauti detected, while low compared with the other species, is quite high for this species as it is regarded as a very efficient vector of malaria. Site 1 is likely to experience only relatively small numbers of Anopheles hilli.

3.11 Location of the Nearest Mosquito Breeding Grounds to Site 1

There would be mosquioto breeding grounds within 400 metres of this proposed site. Culex annulirostris would be the most frequently encountered species breeding in this vicinity.

Other significant species would be Anopheles farauti, Anopheles bancroftii, Aedes kochi and Coquillettidia xanthogaster (See Appendix 1). The majority of the mosquito breeding occurs in the shallow vegetated edges of Rapid Creek and Marrara Swamp, particularly as the area dries out after the wet season. The fresh water section of Rapid Creek where the creek is well defined is not a major source of mosquitoes, as is the body of Marrara Swamp at the convergance of the two arms of the swamp, due to the predation of mosquito larvae by the native rainbow fish. The mosquito monitoring program detected high numbers of Aedes vigilax but this species does not breed in this area.

Both Anopheles hilli and Aedes vigilax have relatively long flight ranges and originate from the brackish/salt water breeding areas at Leanyer Swamp and Coconut Grove. The dense forested areas of Marrara Swamp and along Rapid Creek are ideal harbouring sites for mosquitoes during the day and this would lead to an accumulation of mosquitoes in these areas. These harbouring areas would lead to the increased longevity of mosquitoes in this area and hence increase their vector potential. There are a number of open earth drains entering Rapid Creek and Marrara Swamp in the vicinity of Site 1 and these would be sources of mosquitoes, particularly during the dry season when pooling in these drains occurs.

3.12 Rectification Measures Needed Around Site 1

To conform with International Health Regulations, a sanitary zone of 400 metres round this site would need to be established, in which all mosquito breeding was eliminated.

It is not recommended that insecticidal mosquito control measures be solely relied on to maintain this zone mosquito free, due to the likelihood of the control measures not being carried out as regularly and as efficiently as necessary, and because it would introduce a large continuing cost. Any mosquito breeding within the 400 metre perimeter would need to be engineered in such a way that the area was free draining and required the minimum of maintenance. Lined concrete drains with dry season flow inverts emptying into formalised streams or stormwater drains would be the preferred measure to reduce this mosquito breeding. All drains should be constructed so that no pooling can occur in the drains. Those margins of Rapid Creek and Marrara Swamp that have shallow marginal areas where pooling occurs, would need to be contoured and formalised so that the margins were free draining.

It is recommended that the mosquito breeding areas outside the 400 metre sanitation zone and within flight range of the most important vectors be rectified. The accepted flight range of 1.6 kilometers for Anopheles farauti would be regarded as a minimum distance from the sanitation zone in which these measures should be carried out. For Site 1 this would involve draining some of the areas on the south side of Marrara Swamp and insuring that the margins of the swamp are free draining into the body of the swamp. The drain on the north-east side of Marrara Swamp would need to be extended to drain the shallow marginal areas of the round Melaleuca Swamp at the east end of Marrara Swamp. The major mosquito breeding areas near Coconut Grove will be within flight range of the proposed terminal and it is recommended that source reduction measures be carried out in this area.

This would involve the draining of the shallow fresh water reed swamp to the daily flushed mangrove creek, and the formalisation of the drains between Bagot Road and Dick Ward Drive. The ill draining sections of the creek in this area would also need to be rectified. Marrara Swamp will still be a breeding ground for some species of mosquitoes, and it will remain a mosquito harbouring area. It is recommended that an all weather access track be constructed all around the swamp and on both sides of the creek so that vehicle mounted vector control operations can be carried out when necessary. These control operations would need to be based on a mosquito monitoring program. This program would need to be carried out by a special section of suitably trained and equipped officers who would also be responsible for the maintenance and control measures.

3.2 Site 2

The trap results from the Marrara Site are most relevant to Site 2 due to its proximity and to the similarity to breeding sites nearby. The comments on the mosquito situation at Site 1 would apply equally to Site 2 except that the Coconut Grove breeding areas would not influence this site to as large an extent and there would be a large influence from the Palm Creek and Leanyer areas as indicated by the Leanyer Dump and the Palm Creek monitoring sites. The Palm creek site indicates that Site 2 is likely to have much higher numbers of Aedes vigilax, Anopheles bancroftii, Culex annulirostris and Anopheles hilli while the Leanyer Dump site indicates that Site 2 will have a large Aedes vigilax problem.

3.21 Location of the Nearest Mosquito Breeding Sites to Site 2

Site 2 would have considerable areas of shallow marginal swamp within the 400 metres sanitation zone. The main area of this type of habitat would be on the south side of the round Melaleuca Swamp at the east end of the swamp. The main species breeding in this habitat would be Culex annulirostris, Anopheles meraukensis and Anopheles bancroftii. The body of the round Melaleuca Swamp is not a large source of mosquito for most of the year due to the presence of predaceous fish. Site 2 is in close proximity to the Palm Creek/Holmes Jungle Complex as well as being nearer to the major mosquito breeding area of Leanyer Swamp. The Palm Creek Holmes/Jungle mosquito breeding sites are not separated from Site 2 by residential areas and so would be expected to be a major source of Anopheles hilli and Aedes vigilax, while Leanyer Swamp area would be a considerable source of Aedes vigilax.

3.22 Rectification Measures Necessary Around Site 2

Those measures that were mentioned for Site 1 would apply for Site 2 with more emphasis on formalisation of the round Melaleucu Swamp at the east end of the Marrara Swamp and the draining of the south-east corner of Marrara Swamp. A large open unlined earth drain on the north side of Marrara Swamp would need to be extended eastward to drain the marginal areas of the round Melaleuca Swamp and this drain would need to be concrete lined and include dry season flow inverts to ensure that the drain is relatively maintenance free.

The Palm Creek/Holmes Jungle area would pose serious problems for mosquito reduction measures, due to the fact that Holmes Jungle is a Reserve. There are measures already proposed to partially reduce the mosquito breeding in Leanyer Swamp, and these measures would need to be carried out thoroughly if the numbers of Aedes vigilax were to be reduced at Site 2.

3.3 Site 3:

The trap results from the Coconut Grove monitoring site are most relevant to this site. This is due to its proximity and to the relatively undeveloped nature of the area in between Coconut Grove and Site 3. Site 3 would be expected to have considerable numbers of Anopheles bancroftii, Aedes vigilax, Anopheles hilli and Culex annulirostris and significant numbers of Anopheles farauti.

3.3 The location of the nearest mosquito breeding grounds.

There are only minor mosquito breeding areas within the 400 metre sanitation zone at Site 3. This includes the unlined stormwater drains from Bagot Road to Dick Ward Drive. These would be a source of Culex annulirostris during the dry season. However the nearby Coconut Grove area has a considerable range of mosquito breeding sites ranging from the shallow ephemeral fresh water swamp to the salt water inundated areas.

There are also considerable areas of dense forest which would provide ideal mosquito harbourage. The Coconut Grove area is a major source of Aedes vigilax and Anopheles hilli in the upper reaches of the ill draining mangrove creek. Culex annulirostris is found breeding in the cut-off creeks, borrow pits and the fresh water swamp while Anopheles bancroftii breeds in the shallow fresh water swamp areas that are partially shaded. Anopheles farauti has been found breeding in considerable numbers in the brackish water areas of the upper reaches of the mangrove creek.

3.32 Elimination of the Mosquito Breeding Grounds

The elimination of the major mosquito grounds at Coconut Grove would be strongly recommended if Site 3 is selected as the terminal site as the mosquito breeding grounds are within flight range of Site 3. The fresh water swamp would need to be drained to the lower reaches of the mangrove creek. The upper reaches of the mangrove creek would need to be free draining to the lower reaches to eliminate the pooling that now occurs. Numerous borrow pits in the area would need to be filled and the drainage lines from the area would need to be formalised and made free draining. There may be problems in carrying out the necessary mosquito breeding reduction measures due to private land ownership in this area. At the moment there are access problems through the area, both of a physical and ownership nature, that prevents the necessary vector control measures being carried out.

4.0 Conclusions

1. All the proposed sites will experience considerable numbers of important vector mosquitoes.

2. Site 1 would be the site of choice, due to its distance from the major mosquito breeding areas and the likelihood of rectifying the mosquito breeding areas in the sanitation zone and within flight range of the mosquitoes.

3. All sites would need a 400 metre sanitary zone surrounding the terminal in which all mosquito breeding is eliminated by engineering methods. In particular all drains in the area would need to be concrete lined with dry season inverts and constructed so that no pooling would occur that would lead to mosquito breeding.

4. It is strongly recommended that, due to the high susceptibility of Darwin to the introduction of malaria and other insect vector borne diseases and their vectors, and the proximity to local vector breeding sites that all major mosquito breeding sites within 1.6 kilometers of the terminal perimeter be engineered to reduce mosquito breeding.

5. It will be necessary to establish a vector monitoring and control section to monitor and maintain the 400 metre sanitary zone around the terminal and to maintain and carry out vector control measures outside the 400 metre sanitary zone. This section would need to consist of at least two officers, suitably trained and equipped and it is expected that they would maintain liaison with the NT Department of Health.

6. If Site 1 is chosen -

(a) it will be necessary to establish an all weather track around both sides of Marrara Swamp and Rapid Creek, as close as possible to the margins, so that vector control operations can be carried out when necessary.

(b) The mosquito breeding areas at the east end and the south-east end of Marrara Swamp and the major mosquito areas of Coconut Grove be either drained, filled or formalised to eliminate these areas as sources of vector mosquitoes and to make these areas less susceptible to the introduction of exotic mosquitoes.

P. Whelan
SENIOR MEDICAL ENTOMOLOGIST
1981

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MOSQUITO SPECIES COLLECTED BY ADULT TRAPPING
AT MARRARA MONITORING SITE DARWIN 1980

SPECIES	Trap Method INCAND	CO^2	M/B
An. annulipes		x	x
An. bancroftii	x	x	x
An. farauti	x	x	x
An. hilli		x	x
An. powelli	x	x	x
An. meraukensis	x	x	x
An. novaguinensis		x	x
Ae. lineatopennis		x	x
Ae. kochi	x	x	x
Ae. funereus	x		
Ae. notoscriptus	x	x	x
Ae. vigilax	x	x	x
Ae. reesi	x	x	x
Ae. tremulus	x	x	x
Cx. annulirostris	x	x	x
Cx. pullus	x	x	
Cx. hilli	x		
Cx. squamosus	x	x	
Cx. bitaeniorhynchus	x	x	x
Cx. quinquefasciatus	x	x	
Cx. fraudatrix-annulata	x		
Cx. sitiens	x	x	
Cx. Sp. 167	x	x	
Mi. metallica	x		
Ur. hirsutifemora	x		
Ur. novaguinensis	x		
Ur. lateralis	x		
Ur. nivipes	x		
Fi. elegans	x	x	
Ad. catasticta	x	x	
Ho. Sp No. 157		x	
Cq. xanthogaster	x	x	
Ma. uniformis	x	x	x

TABLE II

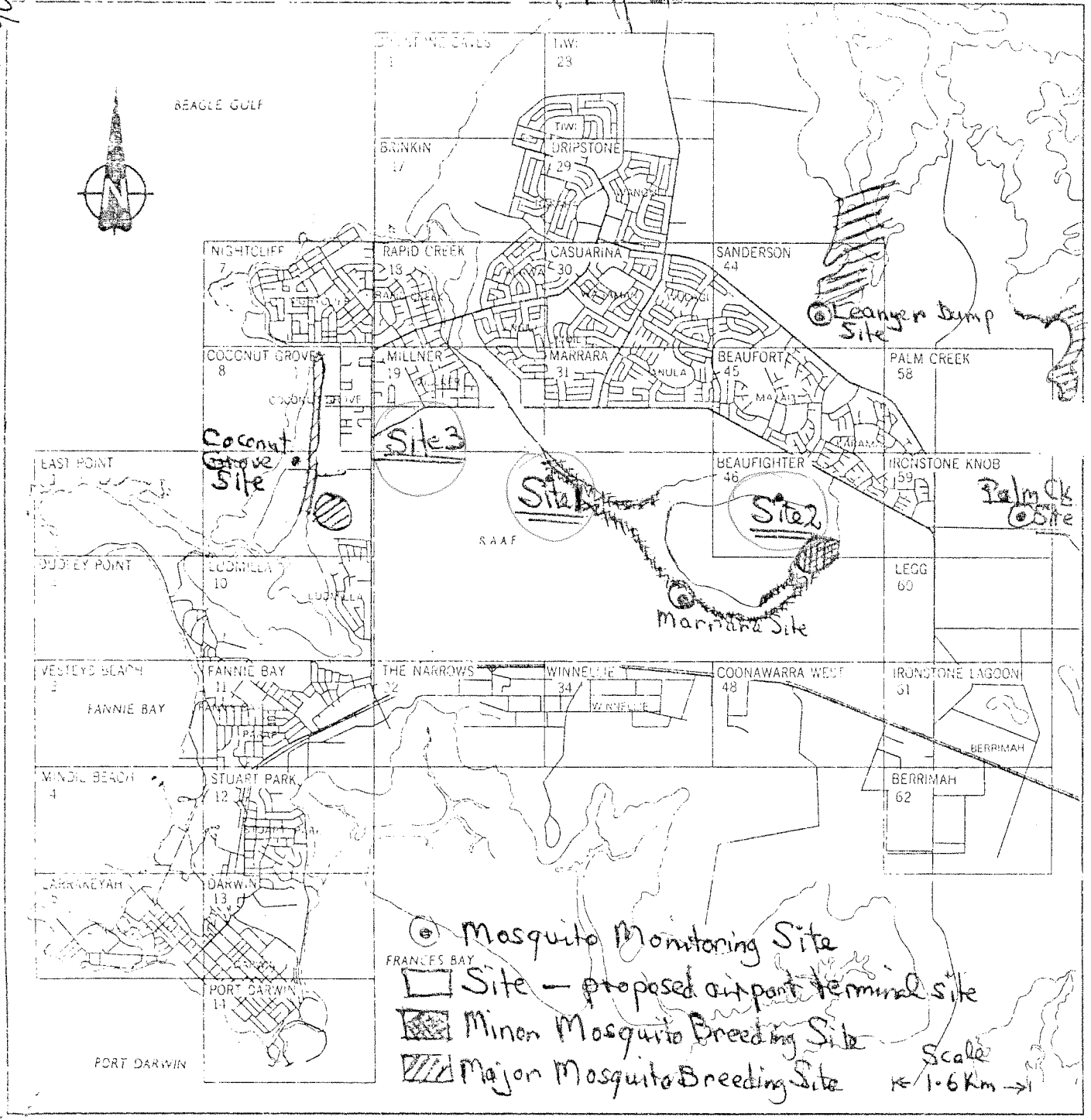
MOSQUITO TRAPPING AT MONITORING SITES DARWIN 1980

Maximum numbers of mosquitoes per trap night by three trapping methods

	MARRARA			LEANYER DUMP			PALM CREEK			COCONUT GROVE		
	LT	CO^2	M/B	LT	CO^2	M/B	LT	CO^2	M/B	LT	CO^2	M/B
Selected Species												
An. farauti	46	30	30	22	7	24	4	15	108	5	43	6
An. bancroftii	33	248	246	157	115	336	26	460	624	12	473	120
An. hilli	1	2	24	65	104	768	90	56	144	5	81	132
Ae. vigilax	75	360	318	54	915	378	125	1000	408	42	840	228
Cx. annuli-rostris	204	587	270	430	233	1044	188	1100	1020	47	283	612
	359	1227	888	728	1374	2550	433	2631	2304	111	1720	1098
Total No. of Species	31	25	16	29	22	17	30	25	16	23	25	15

Light trap and Carbondioxide trap figures are the maximum number of female mosquitoes per trap night.

Man biting figures are the number of female mosquitoes biting per man hour. CO^2 trap results are only for a 7 month period from June to December.



SHEET ASSEMBLY GREATER DARWIN