

SHOREBIRD HABITAT MAPPING PROJECT

CLARENCE RIVER ESTUARY

8 FEBRUARY 2006

Author:

Dr David Rohweder

© Sandpiper Ecological Surveys 2006
ABN: 82 084 096 828

PO Box 401
ALSTONVILLE NSW 2477
Ph/Fax: 02) 6628 8223
sandpiper_ecological@bigpond.com

Approved by: _



Report Not Finalised Unless Signed

Cover Photographs

Centre: Shorebird foraging habitat in Wooloweyah Lagoon, Clarence Estuary – D. Rohweder.
Left side: Shorebird footprints – D. Rohweder.

Disclaimer

This report has been prepared in accordance with the scope of services described in the contract or agreement between Sandpiper Ecological Surveys (ABN 47 327 438 027) and WWF Australia. The report relies upon data, surveys, measurements and results taken at or under the particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by WWF Australia. Furthermore, the report has been prepared solely for use by WWF Australia and Sandpiper Ecological Surveys accepts no responsibility for its use by other parties.

TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	METHODS	1
2.1	INCEPTION MEETING	1
2.2	FIELD SURVEY	1
2.3	COLLATION OF SUPPORTING INFORMATION.....	2
2.4	MAPPING.....	2
3.	RESULTS	2
4.	REFERENCES	4
	APPENDIX A	5
	APPENDIX B	7
	APPENDIX C	10
	APPENDIX D	13

1. INTRODUCTION

Major shorebird roosts and selected foraging sites in the lower Clarence River Estuary were mapped as part of the Phase II Shorebird Conservation Project. The aim of the mapping project was to provide supporting information to assist Clarence Valley Council (CVC) protect and manage shorebirds and their habitat in the Clarence River Estuary. The project objectives included:

- In conjunction with CVC prepare a GIS data layer that shows the location and extent of shorebird roost sites in the lower Clarence Estuary.
- Provide background information to support the data layer. For each site include: a list of species; conservation status of each species; maximum number of each species; maximum number of individuals; and number of time sampled.
- Provide information to assist CVC staff interpret the mapping.
- Prepare a brief (2 page) fact sheet on threats to shorebirds and their habitat to assist Council planners in strategic and development planning.

The following report presents a brief overview of the habitat mapping project. The shorebird fact sheet prepared as part of this project is included in Appendix A.

2. METHODS

2.1 INCEPTION MEETING

An inception meeting was held on 4 July at CVC's office in Maclean. The purpose of the meeting was to introduce the project to representatives of Councils planning and GIS sections and to discuss technical issues regarding mapping and the value of a fact sheet for Council staff.

2.2 FIELD SURVEY

Two methods were used to map roost and foraging habitat:

1. Delineation of roost boundaries onto orthorectified aerial photographs.
2. Using a hand held Global Positioning System (GPS) to plot the boundary of each site.

A combination of orthophotos and the GPS was used to map known roosts on private land, whilst the GPS was used solely on public land.

Surveys were undertaken at both high and low tides during a spring tide cycle. The spring tide cycle was selected as spring tide roosts are the most critical for management. High tide surveys were conducted during tides of 1.6m and low tide surveys were conducted during tides of 0.3 and 0.4m (Australian Government 2004). The boundary of spring tide roosts and selected foraging habitat were traversed on foot. The edge of a roost or foraging site included exposed substrate and adjacent water to a depth of 10cm. A hand held GPS (Garmin GPS 76) was used to take grid coordinates (Datum - AGD 66) at each change in direction. All GPS coordinates had an accuracy reading of between 4 and 5m. A single coordinate was taken at approximately the highest point of neap tide roosts. Neap roosts were inundated during the field surveys and consequently the coordinates are approximate only. Surveys were concentrated in the lower estuary as this is where most important roosts occur and where there is greatest development pressure.

2.3 COLLATION OF SUPPORTING INFORMATION

Supporting information on each roost and foraging site were collated to enhance the value of the GIS layer as a planning tool. It was envisaged that the supporting information would be integrated into Councils GIS system to enable staff to view the location of a site and obtain information on the species of shorebird that have been recorded at that site. The following information was gathered for each roost:

- A list of species recorded.
- Maximum number of each species.
- Maximum number of individuals recorded at a site during a single survey.
- The number of times that a site has been sampled.
- Major habitat type.
- Number of threatened species
- Number of migratory species

Supporting information was obtained from previous shorebird surveys collated by Sandpiper Environmental (2004) and the more recent surveys reported by Sandpiper Environmental (2005). Additional survey data, namely Holmes (1983) was reviewed, although these data were unsuitable for inclusion as they did not distinguish between sites.

One new site, Hickey Island Saltmarsh, was mapped; however, there are no supporting data available for the site. The extent to which shorebirds utilise the site is unclear, although between 150 and 200 birds and seven species were recorded at the site during the field survey. Supporting information was initially summarized in an excel spreadsheet and then transferred into Arcview.

2.4 MAPPING

Coordinates were downloaded directly from the GPS into an excel spreadsheet using MapSource software. The coordinates were then downloaded into Arcview 3.2 and separate shapefiles created for roost and foraging areas. Some locations, such as Wooloweyah Entrance and Dart and Hickey Islands, include multiple roost sites (polygons). Each site is shown as a separate polygon in the shapefile; however, the same supporting data is replicated for each polygon in the Arcview table. Combining sites was considered appropriate due to their close proximity and because data from each site has been combined during numerous surveys. The shapefiles were then provided to CVC for integration into their mapping system.

Council was also provided with excel files of AMG coordinates for roost and foraging sites (dbf format) and the supporting information on shorebirds. A summary table with information on each site and how the data were gathered was also provided with basic guidelines on how to interpret the data, Appendix B.

3. RESULTS

A total of 29 roosts and five foraging areas were mapped during the survey (Table 3.1). Figure 3.1 shows a section of the Clarence Estuary, with mapped roost and foraging sites. An extract of the supporting data available through the GIS system is shown in Appendix C. The AMG coordinates for all roost and foraging sites are included in Tables D1 and D2, Appendix D.

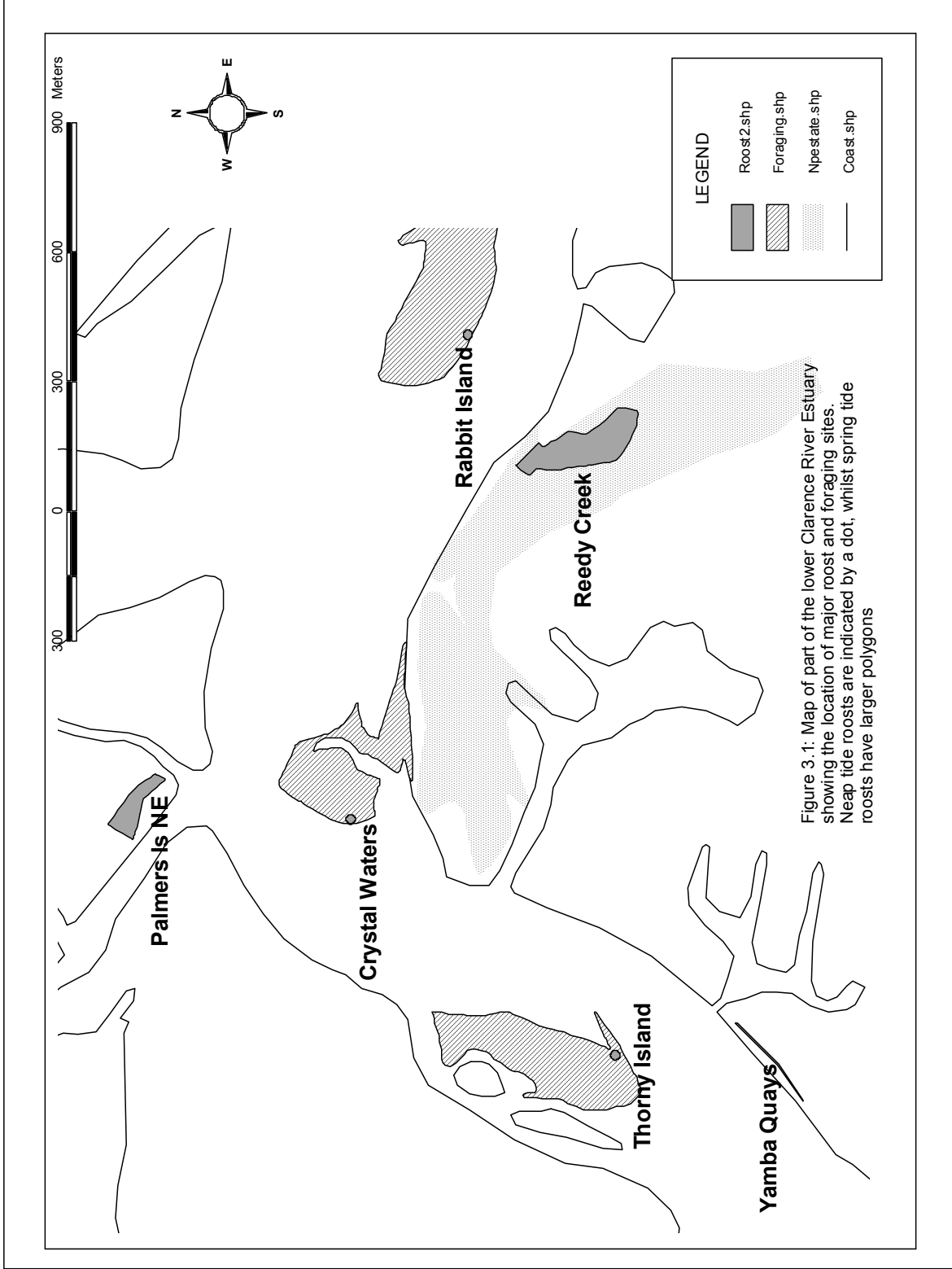


Table 3.1: Sites mapped in the lower Clarence Estuary as part of the shorebird habitat mapping project. NA = not applicable.

Site Type	Site Name	Roost Type
Roosting	Bolorobo North	Neap
	Borolobo Island	Spring
	Dart Island	Spring
	Esk Mouth	Neap
	Freeburn Island	Spring
	Goodwood Island	Spring
	Hickey Island	Neap
	Hickey Saltmarsh	Spring
	Iluka Breakwall	Spring
	Peninsula	Neap
	Rabbit Island	Neap
	Woram Channel	Spring
	Corokos Island	Spring
	Crystal Waters	Neap
	Joss East	Low Spring
	Joss West	Spring
	Mid Channel	Neap
	Palmers SE	Spring
	Yamba Quays (SR)	Spring
	Reedy Creek (SR)	Spring
	Sleeper Island (SR)	Spring
	Thorny Island (NR)	Neap
	Iluka Bluff (SR)	Spring
	Back Beach (SR)	Spring
	Woody Head (SR)	Spring
	Frasers Reef (SR)	Spring
	Shark Bay (SR)	Spring
	Prawn Farm (SR)	Spring
	Micalo Nth (SR)	Spring
	Foraging	Dart Island
Rabbit Island		NA
Crystal Waters		NA
Thorny Island		NA
Whyna Island		NA

4. REFERENCES

Australian Government (2004). *NSW Tides 2005-2006*. Bureau of Meteorology, National Tidal Centre.

Holmes, G. (1983). *Birds of Oyster Channel and Wooloweyah Lagoon*. Wandering Star Resort EIS. Dept of Lands Grafton.

Sandpiper Environmental (2004). *Clarence Estuary Shorebird Issues Paper*. Unpublished report prepared for WWF Australia by Sandpiper Environmental.

Sandpiper Environmental (2005). *Shorebird Conservation Project. Clarence Estuary Community Shorebird Monitoring Program*. Unpublished report prepared for WWF Australia by Sandpiper Environmental.

APPENDIX A
SHOREBIRD FACT SHEET

FACT SHEET

APPENDIX B
METADATA AND GUIDELINES ON MAP INTERPRETATION

GUIDELINES TO ASSIST WITH INTERPRETATION AND APPLICATION OF THE SHOREBIRD ROOST MAPPING

Correct interpretation of the habitat mapping is essential. It is vital that the limitations of mapping, ecology of shorebirds and threatening processes be considered when using the mapping to assist with planning. Key points for consideration include:

- The mapping has focused on those roosts that were used during field surveys in 2005 and does not include all historical roosts within the lower estuary or any of the roosts in the upper estuary.
- The mapping focuses on spring tide roosts. During neap tides birds are likely to occur outside of the above sites as many species prefer to roost near the waters edge. Some of the spring tide roosts are also used during neap tides.
- The location of roosts will change over time. Some sites will become more suitable and others will decline. Evidence of declining roost quality is noticeable at some sites. The mapping represents a guide to roosts and care must be taken to ensure that information is up to date. Due to the known changes in the use of some sites it would be valuable to update the mapping after a period of five years.
- Shorebirds have been shown to utilise different roosts between day and night. The mapping includes day time roosts only and the supporting information is based on data gathered during the day only. Some of the mapped sites may be substantially more important at night and birds may utilise unknown roosts at night.
- The shorebird population in the Clarence Estuary requires several roosts to satisfy their daily requirements and it is therefore essential that a matrix of sites be protected.
- During the highest spring tides less habitat will be available than indicated by the mapping. This is an important consideration when assessing impacts on shorebird roosts.
- The mapping has emphasised the small amount of roosting habitat available in the lower estuary, although some of the saltmarsh roosts appear expansive birds only roost within small sections of these sites.
- Buffers should be considered for each roost to ensure adequate protection from disturbance and development. The requirement for a buffer will vary depending on the type of activity, for example a larger buffer may be required for pedestrians than for boats. There is at present limited information on appropriate buffer distances for shorebirds and until such information is available it is suggested that buffers should be assessed on a case-by-case basis. As a guide it is suggested that 100 to 150m radius buffers be designated around spring tide roosts and 50m buffers around neap tide roosts for pedestrian (any activity that involves walking) and boat-based activities. Some activities such as dog exercise should not be allowed within 250m of shorebird roost or foraging habitat. Primary roosts include, Dart Island, Goodwood Island, Iluka Breakwall, Yamba Quays and all roosts in Wooloweyah Lagoon.
- The background data collated to support the mapping uses readily available records. The data are not exhaustive and it is likely that additional species could occur at a site. The data provide a guide to species abundance and richness and habitat should be considered when determining which species may be affected by a proposal.

Table B1: Information of each of the mapped shorebird roosts.

Site Name	Site Description & Notes
Bolorobo North	Bolorobo north is a small spit of sand on the north end of an unnamed mangrove island. The highest part of the roost is being enveloped by mangroves leaving a small sandbar exposed during neap high tides.
Bolorobo Island	The Bolorobo Island site is a mangrove roost situated on the western side of the island. The roost is typically used by whimbrels during spring high tides. Birds typically roost in the tallest mangrove branches.
Dart Island	The Dart Island roost is situated on a slightly elevated spit of sand on the eastern edge of the main island. The area of available roosting habitat expands considerably during neap tides. Virtually all of the Dart Island roost is inundated during the highest spring tides.
Esk Mouth	The Esk Mouth roost includes two sites, Eureka and Narrabarribi Islands. Roosting habitat at these sites is restricted to a sandbar that is exposed during neap high tides.
Freeburn Island	Historically shorebirds have been recorded roosting at several sites on Freeburn Island. The site mapped is situated on the northern side of the island. Small numbers of shorebirds roost over an extensive area of the north shore and are not restricted to the point shown on the map.
Goodwood Island	Goodwood Island is a combination of Goodwood South and Goodwood East. The site includes an extensive area of saltmarsh and the eastern and southern shoreline. Although a large area of saltmarsh has been mapped birds typically roost at three or four discrete sites within the mapped area. Goodwood Island was mapped using a combination of aerial photographs and GPS.
Hickey Island	The Hickey Island roost is characterised by a small sandspit on the western side of Hickey Island. The spit is inundated during spring high tides or reduced in size to such an extent that it is unsuitable for shorebirds.
Hickey Saltmarsh	Hickey Saltmarsh represents a new site that has not been surveyed as part of previous estuary-wide shorebird surveys. The site is situated on the southern side of Hickey Island. It is uncertain how this site is used by shorebirds but it may be used as a refuge site by birds disturbed from Dart Island during spring high tides.
Iluka Breakwall Peninsula	The Iluka Breakwall roost extends along the lower section of wall that is situated north of the Spencer Street boat ramp. Birds typically roost immediately south of the more elevated section of wall.
Rabbit Island	The Peninsula is a very small sandspit that is situated east of The Peninsula road.
Woram Channel	Rabbit Island is used during neap high tides, when birds can roost over an extensive area of intertidal sandflat. Woram Channel is a mangrove roost that is situated on the eastern side of Narrabarribi Island. The roost extends over a small area along the edge of the water.
Wooloweyah Entrance	Wooloweyah Entrance combines a number of small sites, Corokos Island, Joss Island west, Joss Island east and mid channel that are situated at the northern end of Wooloweyah Lagoon. These sites are situated in close proximity to each other and birds move regularly between sites. It is possible that all roosts within Wooloweyah Entrance are inundated during high spring tides.
Crystal Waters	Crystal Waters is a neap tide roost that is situated on an intertidal sandbar within Oyster Channel.
Palmer's SE	Palmer's Island SE is a large saltmarsh situated on the southeastern tip of Palmer's Island.
Yamba Quays	The Yamba Quays roost is situated along a rock wall immediately south of the entrance to the Quays. In the 1990's birds were often recorded roosting within the Quays. Although small numbers continue to roost along the shoreline within the Quays the major roost is situated along the rock wall. The supporting data for Yamba Quays includes records of birds roosting at both sites.
Reedy Creek	The Reedy Creek roost is situated within an extensive area of saltmarsh immediately east of Reedy Creek. This site is situated within the Clarence Estuary Nature Reserve.
Palmer's Is NE	The Palmer's Island NE roost is situated within a small saltmarsh near the northeastern corner of Palmer's Island. Palmer's Island NE was mapped using a combination of aerial photographs and GPS.
Thorny Island	The Thorny Island roost is situated on an intertidal sandbar within Oyster Channel.
Iluka Bluff	Iluka Bluff is a coastal rock platform. The mapped site is situated on the northern end of the platform and conforms broadly to the area used for roosting.
Back Beach	The Back Beach roost is situated at the southern end of the Woody Head rock platform. The roost includes a combination of rock platform and sandy beach. Due to disturbance and changes in beach topography the location of roosting birds varies at this site. Occasionally birds are recorded outside of the mapped area.
Woody Head	Birds have been recorded roosting at several sites within the Woody Head rock platform. The mapped polygon conforms broadly to the area exposed during the highest spring tides. During neap tides birds often roost outside of the mapped area.
Frasers Reef	The Frasers Reef site includes both Frasers Reef and the Middle Bluff rock platform. The mapped site is situated adjacent to Frasers reef, although birds can often roost at several sites within the above area.
Shark Bay	The Shark Bay rock platform represents the northernmost roost mapped during this project. The polygon conforms broadly to the area used by shorebirds during spring tides. The entire rock platform represents roosting habitat.
Prawn Farm	The Prawn Farm roost includes the eastern three ponds that are part of a much larger area of ponds used previously for aquaculture. The eastern ponds were mapped as these are known to be used regularly by shorebirds. Shorebirds have been recorded using several other ponds within the Prawn Farm. The Prawn farm may be particularly important during high spring tides. The Prawn Farm was mapped using a combination of aerial photographs and a 1:25,000 topographic map.
Micalo Nth	The Micalo North roost is situated on the western side of Oyster Channel near the entrance channel to the Prawn Farm. The roost includes an area of saltmarsh and the drain edge. Micalo North was mapped using aerial photographs.

APPENDIX C
SUPPORTING DATA FOR MAPPING

Table C1: Extract of tabulated information prepared to support the roost mapping.

ID	SITE_NAME	MAP_METHOD	SUBSTRATE	ROOST_TYPE	NO. TIMES SAMPLED	MAX_COUNT	TOTAL_SP	NO_THR_SP	NO_MIG_S
1	Palmer's Is SE	GPS	Saltmarsh	Spring Tide	12	118	7	1	5
2	Wooloweyah Entrance	GPS	Muddy Sand	Spring & Neap	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Spring & Neap	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Spring & Neap	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Spring & Neap	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Spring & Neap	53	1460	23	6	17
3	Micalo North	Air Photo	Saltmarsh	Spring Tide	11	82	9	1	6
4	Yamba Quays	GPS	Rock Wall	Spring Tide	40	301	13	3	7
5	Palmer's Is NE	GPS & Air Photo	Saltmarsh	Spring Tide	39	87	8	1	7
6	Reedy Creek	GPS	Saltmarsh	Spring Tide	17	114	3	0	3
7	Peninsula	GPS	Sand	Neap Tide	40	247	12	4	8
8	Dart & Hickey Is.	GPS	Sand	Spring & Neap	60	1050	26	8	19
8	Dart & Hickey Is.	GPS	Sand	Spring & Neap	60	1050	26	8	19
9	Hickey Is Saltmarsh	GPS	Saltmarsh	Spring Tide	0	0	0	0	0
10	Iluka Breakwall	GPS	Rock Wall	Spring Tide	16	135	11	3	8
11	Goodwood Island	GPS & Air Photo	Saltmarsh & Shore	Spring & Neap	11	151	14	3	10
12	Woram Channel	GPS	Mangroves	Spring	12	24	4	0	4
13	Iluka Bluff	GPS	Rock Platform	Spring	7	13	4	1	3
14	Back Beach	GPS	Rock Platform	Spring & Neap	11	196	9	4	6
14	Woody Head	GPS	Rock Platform	Spring & Neap	11	0	0	0	0
15	Shark Bay	GPS	Rock Platform	Spring & Neap	11	144	11	4	6
16	Prawn Farm	Air Photo	Saltmarsh	Spring Tide	15	1277	18	2	12
2	Wooloweyah Entrance	GPS	Muddy Sand	Neap Tide	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Neap Tide	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Neap Tide	53	1460	23	6	17
2	Wooloweyah Entrance	GPS	Muddy Sand	Neap Tide	53	1460	23	6	17
17	Thorny Island	GPS	Muddy Sand	Neap Tide	0	0	0	0	0
18	Crystal Waters	GPS	Sand	Neap Tide	34	194	10	2	9
19	Rabbit Island	GPS	Sand	Neap Tide	38	367	13	5	10
20	Freeburn Island	GPS	Rock Wall	Spring & Neap	7	11	4	2	1
21	Bolorobo Island	GPS	Mangroves	Spring	4	13	1	0	0
22	Bolorobo North	GPS	Sand	Neap Tide	11	50	7	1	7
23	Esk Mouth	GPS	Sand	Neap Tide	12	115	13	3	11
24	Fraser's Reef	GPS	Rock Platform	Neap Tide	11	25	5	1	3

Table C1: cont.

ID	SPECIES 1	SPECIES 2	SPECIES 3	SPECIES 4	SPECIES 5
1	Bar-tailed Godwit (14)	Common Greenshank (14)	Grey-tailed Tattler (4)	Sharp-tailed Sandpiper (5)	Pied Oystercatcher (1)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
3	Bar-tailed Godwit (25)	Whimbrel (33)	Eastern Curlew (26)	Marsh Sandpiper (9)	Common Greenshank (6)
4	Bar-tailed Godwit (189)	Whimbrel (48)	Eastern Curlew (16)	Common Greenshank (1)	Terek Sandpiper (10)
5	Bar-tailed Godwit (61)	Whimbrel (12)	Eastern Curlew (4)	Common Greenshank (7)	Terek Sandpiper (9)
6	Bar-tailed Godwit (66)	Whimbrel (40)	Eastern Curlew (70)		
7	Bar-tailed Godwit (150)	Whimbrel (25)	Eastern Curlew (55)	Terek Sandpiper (4)	Grey-tailed Tattler (39)
8	Black-tailed Godwit (92)	Bar-tailed Godwit (587)	Whimbrel (150)	Eastern Curlew (120)	Marsh Sandpiper (1)
8	Black-tailed Godwit (92)	Bar-tailed Godwit (587)	Whimbrel (150)	Eastern Curlew (120)	Marsh Sandpiper (1)
9	No Data				
10	Bar-tailed Godwit (1)	Whimbrel (6)	Eastern Curlew (1)	Common Greenshank (2)	Terek Sandpiper (6)
11	Bar-tailed Godwit (83)	Whimbrel (55)	Eastern Curlew (39)	Common Greenshank (1)	Terek Sandpiper (6)
12	Bar-tailed Godwit (1)	Whimbrel (13)	Common Greenshank (22)	Grey-tailed Tattler (4)	
13	Whimbrel (1)	Ruddy Turnstone (6)	Red-necked Stint (4)	Pied Oystercatcher (2)	Sooty Oystercatcher (11)
14	Whimbrel (2)	Wandering Tattler (2)	Ruddy Turnstone (18)	Red-necked Stint (69)	Pied Oystercatcher (2)
14	Combined with Back Beach				
15	Bar-tailed Godwit (15)	Wandering Tattler (1)	Ruddy Turnstone (30)	Red-necked Stint (56)	Pied Oystercatcher (17)
16	Bar-tailed Godwit (48)	Whimbrel (21)	Eastern Curlew (9)	Marsh Sandpiper (142)	Common Greenshank (19)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
2	Black-tailed Godwit (258)	Bar-tailed Godwit (448)	Whimbrel (38)	Eastern Curlew (70)	Marsh Sandpiper (50)
17	No Data				
18	Bar-tailed Godwit (120)	Whimbrel (22)	Eastern Curlew (30)	Common Greenshank (1)	Terek Sandpiper (10)
19	Black-tailed Godwit (10)	Bar-tailed Godwit (264)	Whimbrel (12)	Eastern Curlew (75)	Grey-tailed Tattler (4)
20	Whimbrel (8)	Pied Oystercatcher (3)	Beach Stone-Curlew (2)	Masked Lapwing (2)	
21	Whimbrel (13)				
22	Bar-tailed Godwit (7)	Whimbrel (13)	Eastern Curlew (4)	Common Greenshank (25)	Terek Sandpiper (13)
23	Bar-tailed Godwit (75)	Whimbrel (34)	Eastern Curlew (24)	Common Greenshank (1)	Grey-tailed Tattler (12)
24	Bar-tailed Godwit (11)	Whimbrel (2)	Ruddy Turnstone (11)	Red-necked Stint (8)	Sooty Oystercatcher (10)

APPENDIX D
AMG's FOR ROOST AND FORAGING SITES

Table D1: AMG's and site names of shorebird roosts mapped in the lower Clarence River Estuary.

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Bolorobo North (NR)	B1	12/8/2005	56	533191	6749385
Borolobo Island (SR)	B2	12/8/2005	56	533042	6748878
Dart Island (SR)	D1	12/8/2005	56	533517	6744376
Dart Island (SR)	D10	12/8/2005	56	533494	6744340
Dart Island (SR)	D2	12/8/2005	56	533498	6744340
Dart Island (SR)	D4	12/8/2005	56	533482	6744318
Dart Island (SR)	D5	12/8/2005	56	533459	6744280
Dart Island (SR)	D6	12/8/2005	56	533445	6744277
Dart Island (SR)	D7	12/8/2005	56	533409	6744331
Dart Island (SR)	D8	12/8/2005	56	533414	6744345
Dart Island (SR)	D9	12/8/2005	56	533436	6744333
Eureka Island (NR)	E1	12/8/2005	56	532026	6749901
Freeburn Island (SR)	FI1	12/8/2005	56	532841	6746875
Goodwood Island east (SR)	GE1	12/8/2005	56	532924	6748217
Goodwood Island east (SR)	GE2	12/8/2005	56	532721	6748349
Goodwood South (SR)	GS1	12/8/2005	56	532806	6748516
Goodwood South (SR)	GS2	12/8/2005	56	532770	6748552
Goodwood South (SR)	GS3	12/8/2005	56	532721	6748601
Goodwood South (SR)	GS4	12/8/2005	56	532711	6748642
Goodwood South (SR)	GS5	12/8/2005	56	532150	6748777
Goodwood South (SR)	GS6	12/8/2005	56	532230	6748833
Goodwood South (SR)	GS7	12/8/2005	56	532346	6748891
Goodwood South (SR)	GS8	12/8/2005	56	532486	6748888
Goodwood South (SR)	GS9	12/8/2005	56	532592	6748825
Goodwood South (SR)	GS10	12/8/2005	56	532668	6748714
Goodwood South (SR)	GS11	12/8/2005	56	532920	6748214
Hickey Island (NR)	H1	12/8/2005	56	533874	6744211
Hickey Island (NR)	H2	12/8/2005	56	533817	6744150
Hickey Island (NR)	H3	12/8/2005	56	533825	6744133
Hickey Island (NR)	H5	12/8/2005	56	533844	6744124
Hickey Island (NR)	H6	12/8/2005	56	533824	6744146
Hickey Island (NR)	H7	12/8/2005	56	533831	6744161
Hickey Island (NR)	H8	12/8/2005	56	533873	6744202
Hickey Saltmarsh (SR)	HS1	12/8/2005	56	534411	6743788
Hickey Saltmarsh (SR)	HS2	12/8/2005	56	534454	6743803
Hickey Saltmarsh (SR)	HS3	12/8/2005	56	534460	6743768
Hickey Saltmarsh (SR)	HS4	12/8/2005	56	534464	6743750
Hickey Saltmarsh (SR)	HS5	12/8/2005	56	534460	6743726
Hickey Saltmarsh (SR)	HS6	12/8/2005	56	534417	6743732
Hickey Saltmarsh (SR)	HS7	12/8/2005	56	534424	6743756
Iluka Breakwall (SR)	I1	12/8/2005	56	533434	6747531
Iluka Breakwall (SR)	I2	12/8/2005	56	533465	6747681
Peninsula (NR)	P1A	12/8/2005	56	532824	6745159
Peninsula (NR)	P2A	12/8/2005	56	532793	6745159
Peninsula (NR)	P3A	12/8/2005	56	532775	6745169
Peninsula (NR)	P5A	12/8/2005	56	532805	6745146
Rabbit Island (NR)	R1	12/8/2005	56	532281	6745495
Woram Channel (SR)	W1	12/8/2005	56	532494	6750434
Woram Channel (SR)	W2	12/8/2005	56	532517	6750397
Corokos Island (SR)	C1	1/5/2006	56	532316	6740325
Corokos Island (SR)	C10	1/5/2006	56	532248	6740301

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Corokos Island (SR)	C11	1/5/2006	56	532277	6740303
Corokos Island (SR)	C12	1/5/2006	56	532303	6740314
Corokos Island (SR)	C2	1/5/2006	56	532292	6740324
Corokos Island (SR)	C3	1/5/2006	56	532283	6740328
Corokos Island (SR)	C4	1/5/2006	56	532272	6740324
Corokos Island (SR)	C5	1/5/2006	56	532269	6740322
Corokos Island (SR)	C7	1/5/2006	56	532245	6740320
Corokos Island (SR)	C8	1/5/2006	56	532231	6740320
Corokos Island (SR)	C9	1/5/2006	56	532226	6740303
Crystal Waters (NR)	CW1	1/5/2006	56	531158	6745772
Joss East (SR)	J1	1/5/2006	56	532436	6739837
Joss East (SR)	J10	1/5/2006	56	532410	6739648
Joss East (SR)	J11	1/5/2006	56	532392	6739630
Joss East (SR)	J12	1/5/2006	56	532377	6739631
Joss East (SR)	J13	1/5/2006	56	532398	6739682
Joss East (SR)	J14	1/5/2006	56	532410	6739705
Joss East (SR)	J15	1/5/2006	56	532414	6739735
Joss East (SR)	J16	1/5/2006	56	532417	6739752
Joss East (SR)	J17	1/5/2006	56	532408	6739774
Joss East (SR)	J19	1/5/2006	56	532417	6739805
Joss East (SR)	J2	1/5/2006	56	532461	6739818
Joss East (SR)	J20	1/5/2006	56	532415	6739822
Joss East (SR)	J21	1/5/2006	56	532416	6739840
Joss East (SR)	J3	1/5/2006	56	532448	6739785
Joss East (SR)	J4	1/5/2006	56	532434	6739768
Joss East (SR)	J6	1/5/2006	56	532429	6739707
Joss East (SR)	J9	1/5/2006	56	532431	6739678
Joss East (NR)	JEA	1/5/2006	56	532577	6739797
Joss East (NR)	JEB	1/5/2006	56	532512	6739800
Joss West (SR)	JW1	1/5/2006	56	532036	6739673
Joss West (SR)	JW10	1/5/2006	56	532035	6739653
Joss West (SR)	JW20	1/5/2006	56	532051	6739700
Joss West (SR)	JW21	1/5/2006	56	532053	6739721
Joss West (SR)	JW22	1/5/2006	56	532057	6739744
Joss West (SR)	JW23	1/5/2006	56	532075	6739745
Joss West (SR)	JW24	1/5/2006	56	532084	6739726
Joss West (SR)	JW25	1/5/2006	56	532103	6739721
Joss West (SR)	JW26	1/5/2006	56	532098	6739705
Joss West (SR)	JW27	1/5/2006	56	532087	6739687
Joss West (SR)	JW28	1/5/2006	56	532099	6739672
Joss West (SR)	JW29	1/5/2006	56	532082	6739628
Joss West (SR)	JW3	1/5/2006	56	532048	6739658
Joss West (SR)	JW30	1/5/2006	56	532062	6739666
Joss West (SR)	JW4	1/5/2006	56	532063	6739635
Joss West (SR)	JW40	1/5/2006	56	532010	6739606
Joss West (SR)	JW5	1/5/2006	56	532067	6739618
Joss West (SR)	JW6	1/5/2006	56	532056	6739597
Joss West (SR)	JW7	1/5/2006	56	532039	6739609
Joss West (SR)	JW8	1/5/2006	56	532037	6739627
Mid Channel (SR)	M1	1/5/2006	56	532428	6740080
Mid Channel (SR)	M10	1/5/2006	56	532424	6740093
Mid Channel (SR)	M2	1/5/2006	56	532445	6740069
Mid Channel (SR)	M3	1/5/2006	56	532454	6740064
Mid Channel (SR)	M4	1/5/2006	56	532462	6740080
Mid Channel (SR)	M42	1/5/2006	56	530971	6741760
Mid Channel (SR)	M5	1/5/2006	56	532476	6740091

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Mid Channel (SR)	M6	1/5/2006	56	532480	6740116
Mid Channel (SR)	M7	1/5/2006	56	532463	6740111
Mid Channel (SR)	M8	1/5/2006	56	532441	6740107
Mid Channel (SR)	M9	1/5/2006	56	532430	6740109
Palmers SE (SR)	P1	1/5/2006	56	530236	6738136
Palmers SE (SR)	P10	1/5/2006	56	530305	6738307
Palmers SE (SR)	P11	1/5/2006	56	530256	6738331
Palmers SE (SR)	P12	1/5/2006	56	530237	6738267
Palmers SE (SR)	P13	1/5/2006	56	530214	6738231
Palmers SE (SR)	P14	1/5/2006	56	530207	6738198
Palmers SE (SR)	P15	1/5/2006	56	530194	6738177
Palmers SE (SR)	P16	1/5/2006	56	530171	6738159
Palmers SE (SR)	P17	1/5/2006	56	530130	6738161
Palmers SE (SR)	P18	1/5/2006	56	530130	6738120
Palmers SE (SR)	P19	1/5/2006	56	530184	6738111
Palmers SE (SR)	P2	1/5/2006	56	530253	6738145
Palmers SE (SR)	P20	1/5/2006	56	530222	6738115
Palmers SE (SR)	P21	1/5/2006	56	530226	6738136
Palmers SE (SR)	P3	1/5/2006	56	530246	6738170
Palmers SE (SR)	P4	1/5/2006	56	530268	6738178
Palmers SE (SR)	P5	1/5/2006	56	530264	6738207
Palmers SE (SR)	P6	1/5/2006	56	530284	6738232
Palmers SE (SR)	P7	1/5/2006	56	530300	6738234
Palmers SE (SR)	P8	1/5/2006	56	530301	6738251
Palmers SE (SR)	P9	1/5/2006	56	530326	6738278
Yamba Quays (SR)	Q1	1/5/2006	56	530687	6744860
Yamba Quays (SR)	Q2	1/5/2006	56	530593	6744761
Yamba Quays (SR)	Q3	1/5/2006	56	530510	6744703
Reedy Creek (SR)	R1	1/5/2006	56	531978	6745381
Reedy Creek (SR)	R10	1/5/2006	56	532109	6745140
Reedy Creek (SR)	R11	1/5/2006	56	532052	6745219
Reedy Creek (SR)	R12	1/5/2006	56	532056	6745256
Reedy Creek (SR)	R13	1/5/2006	56	532024	6745316
Reedy Creek (SR)	R14	1/5/2006	56	532029	6745327
Reedy Creek (SR)	R2	1/5/2006	56	531958	6745349
Reedy Creek (SR)	R3	1/5/2006	56	531970	6745333
Reedy Creek (SR)	R4	1/5/2006	56	531974	6745261
Reedy Creek (SR)	R5	1/5/2006	56	531979	6745209
Reedy Creek (SR)	R6	1/5/2006	56	531998	6745138
Reedy Creek (SR)	R7	1/5/2006	56	532040	6745110
Reedy Creek (SR)	R8	1/5/2006	56	532073	6745097
Reedy Creek (SR)	R9	1/5/2006	56	532105	6745097
Sleeper Island (SR)	S1	1/5/2006	56	531211	6746195
Sleeper Island (SR)	S2	1/5/2006	56	531252	6746214
Sleeper Island (SR)	S3	1/5/2006	56	531263	6746234
Sleeper Island (SR)	S4	1/5/2006	56	531116	6746288
Sleeper Island (SR)	S5	1/5/2006	56	531149	6746345
Thorny Island (NR)	T1	1/5/2006	56	530615	6745145
Iluka Bluff (SR)	IB1	1/27/2006	56	536069	6747970
Back Beach (SR)	BB1	1/27/2006	56	536299	6750873
Back Beach (SR)	BB2	1/27/2006	56	536222	6750774
Back Beach (SR)	BB3	1/27/2006	56	536254	6750783
Back Beach (SR)	BB4	1/27/2006	56	536253	6750880
Back Beach (SR)	BB5	1/27/2006	56	536191	6750863
Back Beach (SR)	BB6	1/27/2006	56	536158	6750832
Back Beach (SR)	BB7	1/27/2006	56	536124	6750797

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Back Beach (SR)	BB8	1/27/2006	56	536109	6750736
Back Beach (SR)	BB9	1/27/2006	56	536124	6750693
Back Beach (SR)	BB10	1/27/2006	56	536149	6750724
Back Beach (SR)	BB11	1/27/2006	56	536190	6750759
Woody Head (SR)	WH1	1/27/2006	56	536203	6751443
Frasers Reef (SR)	FR1	1/27/2006	56	535850	6749140
Shark Bay (SR)	SB1	1/27/2006	56	535144	6752079
Prawn Farm (SR)	PF1	1/27/2006	56	530927	6740993
Prawn Farm (SR)	PF2	1/27/2006	56	530023	6741128
Prawn Farm (SR)	PF3	1/27/2006	56	529911	6740340
Prawn Farm (SR)	PF4	1/27/2006	56	530803	6740210
Prawn Farm (SR)	PF5	1/27/2006	56	530597	6740239
Prawn Farm (SR)	PF6	1/27/2006	56	530721	6741025
Micalo Nth (SR)	MN1	1/27/2006	56	531037	6741740
Micalo Nth (SR)	MN2	1/27/2006	56	531019	6741638
Micalo Nth (SR)	MN3	1/27/2006	56	531019	6741525
Micalo Nth (SR)	MN4	1/27/2006	56	531010	6741464
Micalo Nth (SR)	MN5	1/27/2006	56	531090	6741434
Micalo Nth (SR)	MN6	1/27/2006	56	531139	6741434
Micalo Nth (SR)	MN7	1/27/2006	56	531108	6741515
Micalo Nth (SR)	MN8	1/27/2006	56	531063	6741597
Micalo Nth (SR)	MN9	1/27/2006	56	531081	6741647

Table D2: AMG's and site names of shorebird foraging areas mapped in the lower Clarence River Estuary.

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Crystal Waters (F)	CL1	1/12/2006	56	531173	6745842
Crystal Waters (F)	CL10	1/12/2006	56	531347	6745709
Crystal Waters (F)	CL11	1/12/2006	56	531474	6745667
Crystal Waters (F)	CL12	1/12/2006	56	531568	6745643
Crystal Waters (F)	CL13	1/12/2006	56	531464	6745644
Crystal Waters (F)	CL14	1/12/2006	56	531395	6745631
Crystal Waters (F)	CL15	1/12/2006	56	531249	6745628
Crystal Waters (F)	CL16	1/12/2006	56	531297	6745648
Crystal Waters (F)	CL17	1/12/2006	56	531270	6745659
Crystal Waters (F)	CL18	1/12/2006	56	531250	6745705
Crystal Waters (F)	CL19	1/12/2006	56	531311	6745743
Crystal Waters (F)	CL2	1/12/2006	56	531203	6745896
Crystal Waters (F)	CL20	1/12/2006	56	531341	6745781
Crystal Waters (F)	CL21	1/12/2006	56	531347	6745832
Crystal Waters (F)	CL22	1/12/2006	56	531340	6745849
Crystal Waters (F)	CL23	1/12/2006	56	531319	6745859
Crystal Waters (F)	CL24	1/12/2006	56	531320	6745788
Crystal Waters (F)	C25	1/12/2006	56	531280	6745760
Crystal Waters (F)	CL26	1/12/2006	56	531167	6745718
Crystal Waters (F)	CL27	1/12/2006	56	531151	6745768
Crystal Waters (F)	CL28	1/12/2006	56	531164	6745823
Crystal Waters (F)	CL3	1/12/2006	56	531241	6745941
Crystal Waters (F)	CL4	1/12/2006	56	531333	6745902
Crystal Waters (F)	CL5	1/12/2006	56	531361	6745821

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Crystal Waters (F)	CL6	1/12/2006	56	531429	6745758
Crystal Waters (F)	CL8	1/12/2006	56	531371	6745742
Crystal Waters (F)	CL9	1/12/2006	56	531351	6745721
Dart Island (F)	D1	1/12/2006	56	533844	6744332
Dart Island (F)	D10	1/12/2006	56	533524	6744377
Dart Island (F)	D11	1/12/2006	56	533500	6744337
Dart Island (F)	D12	1/12/2006	56	533437	6744325
Dart Island (F)	D13	1/12/2006	56	533359	6744347
Dart Island (F)	D14	1/12/2006	56	533318	6744333
Dart Island (F)	D15	1/12/2006	56	533282	6744354
Dart Island (F)	D16	1/12/2006	56	533257	6744386
Dart Island (F)	D17	1/12/2006	56	533249	6744456
Dart Island (F)	D18	1/12/2006	56	533223	6744472
Dart Island (F)	D19	1/12/2006	56	533233	6744345
Dart Island (F)	D2	1/12/2006	56	533788	6744331
Dart Island (F)	D20	1/12/2006	56	533236	6744165
Dart Island (F)	D21	1/12/2006	56	533278	6744210
Dart Island (F)	D22	1/12/2006	56	533329	6744210
Dart Island (F)	D23	1/12/2006	56	533350	6744191
Dart Island (F)	D24	1/12/2006	56	533371	6744145
Dart Island (F)	D25	1/12/2006	56	533426	6744081
Dart Island (F)	D26	1/12/2006	56	533429	6744047
Dart Island (F)	D27	1/12/2006	56	533417	6743996
Dart Island (F)	D28	1/12/2006	56	533382	6743982
Dart Island (F)	D29	1/12/2006	56	533384	6743972
Dart Island (F)	D3	1/12/2006	56	533756	6744356
Dart Island (F)	D30	1/12/2006	56	533437	6743988
Dart Island (F)	D31	1/12/2006	56	533472	6744041
Dart Island (F)	D32	1/12/2006	56	533475	6744122
Dart Island (F)	D33	1/12/2006	56	533479	6744152
Dart Island (F)	D34	1/12/2006	56	533527	6744131
Dart Island (F)	D35	1/12/2006	56	533569	6744090
Dart Island (F)	D36	1/12/2006	56	533629	6744076
Dart Island (F)	D37	1/12/2006	56	533678	6744076
Dart Island (F)	D38	1/12/2006	56	533740	6744055
Dart Island (F)	D39	1/12/2006	56	533771	6744098
Dart Island (F)	D4	1/12/2006	56	533653	6744423
Dart Island (F)	D40	1/12/2006	56	533769	6744128
Dart Island (F)	D41	1/12/2006	56	533743	6744113
Dart Island (F)	D42	1/12/2006	56	533716	6744108
Dart Island (F)	D43	1/12/2006	56	533720	6744128
Dart Island (F)	D44	1/12/2006	56	533723	6744185
Dart Island (F)	D45	1/12/2006	56	533763	6744254
Dart Island (F)	D46	1/12/2006	56	533812	6744308
Dart Island (F)	D5	1/12/2006	56	533568	6744490
Dart Island (F)	D6	1/12/2006	56	533511	6744534
Dart Island (F)	D7	1/12/2006	56	533481	6744533
Dart Island (F)	D8	1/12/2006	56	533519	6744437
Rabbit Island (F)	RL1	1/12/2006	56	532309	6745471

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Rabbit Island (F)	RL10	1/12/2006	56	532354	6745647
Rabbit Island (F)	RL11	1/12/2006	56	532449	6745599
Rabbit Island (F)	RL12	1/12/2006	56	532495	6745595
Rabbit Island (F)	RL14	1/12/2006	56	532491	6745648
Rabbit Island (F)	RL15	1/12/2006	56	532507	6745651
Rabbit Island (F)	RL16	1/12/2006	56	532551	6745587
Rabbit Island (F)	RL17	1/12/2006	56	532572	6745563
Rabbit Island (F)	RL18	1/12/2006	56	532593	6745529
Rabbit Island (F)	RL19	1/12/2006	56	532642	6745489
Rabbit Island (F)	RL2	1/12/2006	56	532257	6745499
Rabbit Island (F)	RL20	1/12/2006	56	532665	6745453
Rabbit Island (F)	RL21	1/12/2006	56	532695	6745433
Rabbit Island (F)	RL22	1/12/2006	56	532633	6745420
Rabbit Island (F)	RL23	1/12/2006	56	532551	6745423
Rabbit Island (F)	RL24	1/12/2006	56	532490	6745433
Rabbit Island (F)	RL25	1/12/2006	56	532433	6745429
Rabbit Island (F)	RL26	1/12/2006	56	532337	6745457
Rabbit Island (F)	RL3	1/12/2006	56	532198	6745539
Rabbit Island (F)	RL4	1/12/2006	56	532175	6745570
Rabbit Island (F)	RL6	1/12/2006	56	532167	6745654
Rabbit Island (F)	RL7	1/12/2006	56	532187	6745704
Rabbit Island (F)	RL8	1/12/2006	56	532282	6745685
Thorny Island (F)	T10	1/12/2006	56	530540	6745335
Thorny Island (F)	T11	1/12/2006	56	530556	6745342
Thorny Island (F)	T12	1/12/2006	56	530577	6745385
Thorny Island (F)	T13	1/12/2006	56	530621	6745445
Thorny Island (F)	T14	1/12/2006	56	530614	6745507
Thorny Island (F)	T15	1/12/2006	56	530599	6745521
Thorny Island (F)	T16	1/12/2006	56	530605	6745554
Thorny Island (F)	T17	1/12/2006	56	530710	6745577
Thorny Island (F)	T18	1/12/2006	56	530711	6745398
Thorny Island (F)	T19	1/12/2006	56	530673	6745290
Thorny Island (F)	T2	1/12/2006	56	530619	6745127
Thorny Island (F)	T20	1/12/2006	56	530653	6745226
Thorny Island (F)	T21	1/12/2006	56	530632	6745160
Thorny Island (F)	T22	1/12/2006	56	530658	6745173
Thorny Island (F)	T23	1/12/2006	56	530691	6745175
Thorny Island (F)	T24	1/12/2006	56	530712	6745193
Thorny Island (F)	T25	1/12/2006	56	530662	6745153
Thorny Island (F)	T3	1/12/2006	56	530533	6745087
Thorny Island (F)	T4	1/12/2006	56	530498	6745122
Thorny Island (F)	T5	1/12/2006	56	530488	6745175
Thorny Island (F)	T6	1/12/2006	56	530489	6745218
Thorny Island (F)	T7	1/12/2006	56	530511	6745281
Thorny Island (F)	T8	1/12/2006	56	530518	6745348
Thorny Island (F)	T9	1/12/2006	56	530522	6745361
Oyster Ch Bridge (F)	Z1	1/12/2006	56	530117	6744517
Oyster Ch Bridge (F)	Z10	1/12/2006	56	530072	6744290
Oyster Ch Bridge (F)	Z11	1/12/2006	56	530049	6744335

Site Name (Type)	Site Code	Date	Zone	Easting	Northing
Oyster Ch Bridge (F)	Z12	1/12/2006	56	530059	6744405
Oyster Ch Bridge (F)	Z13	1/12/2006	56	530118	6744492
Oyster Ch Bridge (F)	Z2	1/12/2006	56	530149	6744523
Oyster Ch Bridge (F)	Z3	1/12/2006	56	530163	6744513
Oyster Ch Bridge (F)	Z4	1/12/2006	56	530143	6744475
Oyster Ch Bridge (F)	Z5	1/12/2006	56	530098	6744412
Oyster Ch Bridge (F)	Z6	1/12/2006	56	530085	6744353
Oyster Ch Bridge (F)	Z7	1/12/2006	56	530101	6744326
Oyster Ch Bridge (F)	Z8	1/12/2006	56	530130	6744355
Oyster Ch Bridge (F)	Z9	1/12/2006	56	530130	6744268
