Fisherman Islands and Whyte Island

Mangrove Health Assessment

2008 – Volume 1

Prepared for:

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frc Ref: 080304

Document Control Summary

Project No.:	080304
Status:	Final Report
Project Manager:	Carol Conacher
Title:	Fisherman Islands and Whyte Island Mangrove Health Assessment: 2008
Project Team:	C. Conacher, C. Jones, K. McPherson, B. Moore, T. Napier-Munn, L. Thorburn, S. Walker
Client:	Port of Brisbane Corporation
Client Contact:	Scott McKinnon
Date:	November 2008
Edition:	080304ii
Checked by:	Carol Conacher _____
Issued by:	Kylie McPherson _____

Distribution Record

Port of Brisbane Corporation: 2 hard copies and 1 PDF copy on disc

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Executive Summary

frc environmental was commissioned by the Port of Brisbane Corporation (PBC) to assess the current health of mangrove communities at Fisherman Islands and Whyte Island, as part of their ongoing monitoring program which began in 1999. At both Fisherman and Whyte Islands there were large areas of dead mangroves, and mangroves in poor health, which were mostly associated with areas of bare saltpan / saltmarsh. This study was designed to:

- assess the current condition of the mangrove communities, using the established methodology
- assess the extent and nature of historical and on-going environmental impacts acting on the mangrove community
- collect and analyse sediments for contaminants, and
- investigate pore water salinity in areas of good, fair and poor health, and dieback.

Methods

In May and June 2008, using protocols established in previous surveys, we mapped the community composition and health of mangroves at Fisherman and Whyte Islands. In addition, we collected and analysed sediment samples for a range of contaminants (in accordance with the terms of reference provided by PBC), re-photographed mangrove communities at permanent photographic monitoring sites, and collected and analysed pore water samples for salinity levels at ten newly established transects.

Mangrove Community Structure and Health

Mangrove community structure at Fisherman and Whyte Islands was similar to that recorded in previous surveys, with the grey mangrove *Avicennia marina* var. *australasica* dominating forests. To facilitate mapping, Fishermans Islands were divided into two areas: the Coal Loader area, and the remainder of Fishermans Islands.

From 2006 to 2008, there was a decrease in overall mangrove health in all the areas surveyed. In the Coal Loader area, where mangroves have historically been in very good condition, except for along eroding shorelines, patches of mangroves were in poor condition. At Fisherman Islands (excluding the Coal Loader area) there was an increase in the area of dead mangroves on the eastern tip, and also in the western area, and a decrease in health in many other areas. At Whyte Island, the area of dead mangroves

had increased, forming a rim of recently dead trees around the central dead area. In ponded areas, and in the more landward mangroves, there were algal mats typical of nutrient rich waters and mangrove forests in poor ecological health. Algal mats can smother sediment and roots, decreasing oxygen uptake and negatively impacting mangrove condition.

Sediment nutrient concentrations were elevated at some Fisherman and Whyte Island sites. The concentrations of some heavy metals were also slightly elevated. There was no association between nutrient or heavy metal levels and mangrove dieback, with concentrations elevated in substrate from areas of good health, poor health and dieback.

Pore water salinity was significantly higher in the substrate of recently dead mangroves than healthier mangroves. Sediment pore water salinity, due to impoundment and lack of flushing, appears to be negatively impacting on mangrove health.

Processes Impacting the Mangrove Communities

Dieback in some relatively small areas appeared to be a direct consequence of erosion and sediment accretion primarily on exposed edges of communities, and wind damage. Of greater concern is the continuing, larger scale dieback in the middle of Fisherman and Whyte Islands.

Increased salinity levels, associated with low rainfall, have been implicated as the causal agent of dieback of *A. marina* mangrove communities in many cases worldwide. High salinity levels are associated with reduced leaf photosynthesis, leaf ion concentration and hydraulic conductivity, reduced mangrove growth, and mangrove death.

We hypothesise that colonisation and greater mangrove density in wet years changes the drainage patterns within existing mangrove forests, e.g. 1955 – 1998 in the Moreton Bay region. In dryer years these areas become hypersaline and mangroves adapted to fresher conditions die, e.g. 2005 – 2007 in Moreton Bay. Through a combination of root mass loss and changes to soil processes, the sediment level decreases. Water then ponds in these depressions after spring tides, and gradually evaporates, further increasing salinity levels. Mat forming algae bloom in the ponded water, and are likely to contribute to low dissolved oxygen levels, particularly at night. Water quality in the depressions generally appears to be poor. The high salinity levels and ponded water are unsuitable for either mangrove growth or recolonisation. This process may be exacerbated by anthropogenic changes to drainage patterns, toxicants and eutrophication. In some cases altered drainage or anthropogenic inputs may be the catalyst for change, rather than

increased salinity. This hypothesis is supported by the continued decrease in mangrove health at Fisherman and Whyte Islands between 2006 and 2008.

Conclusions and Recommendations

Ponding and its effect on water quality, particularly pore water salinity, appears to be associated with mangrove dieback at Fisherman and Whyte Islands. Ponding may be associated with a number of factors, including: previous unconfined deposition of dredge spoil material altering hydrology; seagrass and algal berms hindering drainage; sinking sediment due to root mass loss and changes to soil processes; and increased salinity associated with a period of low rainfall.

Continued monitoring is recommended, as both increases and decreases in rainfall are likely to impact mangrove health, and provide evidence to substantiate the hypothesis. Whilst monitoring to date has not pinpointed the cause of the widespread mangrove death, it has provided some insight into likely causes. This could be enhanced by some further investigations including:

- deployment of water depth loggers to confirm the period and frequency of ponding
- ongoing measurement of pore-water salinity in sediment from dieback and healthier areas, including further 'control' transects of healthy mangroves
- a dye run to establish which way the water flows out of the dieback areas, particularly in the new dieback area on Fisherman Islands
- laser survey or similar of dieback areas, to establish benchmark for sediment height, and
- measurement or logging of nutrients, salinity and dissolved oxygen levels in ponded areas, particularly after spring tides, and in the evening.

1 Introduction

The Port of Brisbane Corporation (PBC) is responsible for the operation and management of the Port of Brisbane, at the mouth of the Brisbane River. The PBC has a number of responsibilities, as defined in the Corporation's Environmental Policy and under the *Environment Protection Act 1994*, with respect to the impact of the Port's activities on the surrounding environment.

As part of these responsibilities, the PBC has a duty of care to ensure that the operation of the Port and associated activities do not adversely impact adjacent wetland areas. Presently, there are some areas of degraded mangroves surrounding the Port of Brisbane facilities. The Port of Brisbane was previously known as Fisherman Islands and Whyte Island, these names are used in this report to facilitate comparisons with monitoring in previous years.

The community structure and health of mangroves at Fisherman Islands were assessed and mapped in 1999 (WBM 2000), 2002 (WBM 2002a), 2004 (frc environmental 2004) and 2006 (frc environmental 2007a), and the potential causes of their degradation were discussed. In late 1999 / early 2000, permanent photographic monitoring stations were also established in this area. Photographs of the mangrove communities to the north, south, east and west of these points were taken in 1999/2000, 2001, 2002, 2004 and 2006. These were used to qualitatively examine change at these locations. In 2002, 2004 and 2006 the distribution and health of mangroves at Whyte Island were also mapped, and the potential causes of their degradation discussed (frc environmental 2007a, 2004, WBM 2002b).

The PBC commissioned the present study to determine the current health of mangrove communities in the Port of Brisbane, and to review this data in the context of previous studies. The objectives of this study were to:

- assess the current condition of the mangrove communities, using the established methodology
- assess the extent and nature of historical and on-going environmental impacts acting on the mangrove community
- collect and analyse sediments for contaminants, and
- investigate pore water salinity in areas of good, fair and poor health, and in dead areas.

In this study we:

- resurveyed and mapped the mangrove community structure, species composition and ecological health of mangroves at Fisherman and Whyte Islands using established survey techniques, taking particular care in identifying areas that appeared to be recently dead, or regrown
- rephotographed the permanent photographic monitoring sites using established techniques (sites 1, 2, 3, 4, 5, 6, 8, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23), and have described any changes at these sites
- collected and analysed sediment samples from 18 permanent sites (sites FI1, FI2, FI3, FI4, FI6, FI7, FI9, FI11, FI13, FI15, FI7, FI18, FI19, FI22, FI23, WI1, WI2, WI3)
- established permanent sediment pore water sites in areas of good, fair and poor health, and from dead areas, and collected sediment pore water samples from these sites
- describe the current distribution of mangroves and their health,
- report on the concentration of contaminants in mangrove sediments and compare them to previous years, and
- compare the distribution of mangroves to previous years, and discuss potential causes of any recent changes.

1.1 Background

Mangroves grow at the dynamic interface between the land and the sea, growing in extreme environments that other terrestrial plants cannot tolerate. The physiology and structure of mangroves enables them to cope with extreme conditions such as high and varying levels of salinity, water logged soils that inhibit oxygen uptake, and often high temperatures, strong winds and strong currents. Whilst mangroves are able to withstand many of these impacts, they are also easily affected by changes to their environment; for example, changes to inundation or drainage levels can rapidly cause mangrove dieback.

Of the 8 mangrove species in Moreton Bay, five are found in the study area:

- the grey mangrove *Avicennia marina* var. *australasica*
- the yellow mangrove *Ceriops tagal*
- the red mangrove *Rhizophora stylosa*
- the river mangrove *Aegiceras corniculatum,* and
- the orange mangrove *Bruguiera gymnorrhiza* (frc environmental 2007a, 2004, WBM 2002a, 2000).

A. marina var. *australasica* is the most dominant species, and community composition in the study area is typical of mangrove communities in the Moreton Bay region.

At both Fisherman Islands and Whyte Island there are large areas of dead mangroves, associated with saltpan / saltmarsh areas, surrounded by mangroves in poor condition.

2 Survey and Digital Mapping of the Distribution and Condition of Mangrove Communities

2.1 Methods

Study Sites

In May and June 2008 we assessed the community structure, composition and health of mangroves at Fisherman Islands. To facilitate mapping, the mangroves at Fisherman Islands were divided into two areas:

- the 'Coal Loader' area, which is adjacent to the Coal Loader at Fisherman Islands (to both the west and east of Port Drive) (Figure 2.1 & Figure 2.2)
- 'Fisherman Islands', the large area to the east of Lucinda Drive (Figure 2.1 & Figure 2.3). This was further sub-divided into:
  - the western area, which is the large area of mangroves to the south east of the PBC office
  - the eastern area, which is divided from the western area by a channel, and extends to the east in a long peninsula, and
  - the northern area, a smaller strip of mangroves adjacent to the mainland to the north east of the PBC office.

The mangroves on the eastern side of Whyte Island were surveyed at this time (Figure 2.1 & Figure 2.4).

Within each study area, aerial photography, previous monitoring reports, and discussions with officers from the PBC were used to target specific areas for field assessment. In particular, boundaries between health categories established in previous reports were targeted to see if there had been any substantial change to these areas. In addition, broad transects, usually running landward to seaward, were surveyed to determine the boundaries of health and community composition categories. Survey points were established at regular intervals, or when a change in mangrove community structure or health was noted. The position of each survey point was recorded using GPS (accurate to ±4 m) (Figure 2.2 – Figure 2.4).

At each survey point, we assessed the community composition, structure and health of the mangroves in the immediate vicinity.

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	Figure 2.1 Study areas.
	November 2008

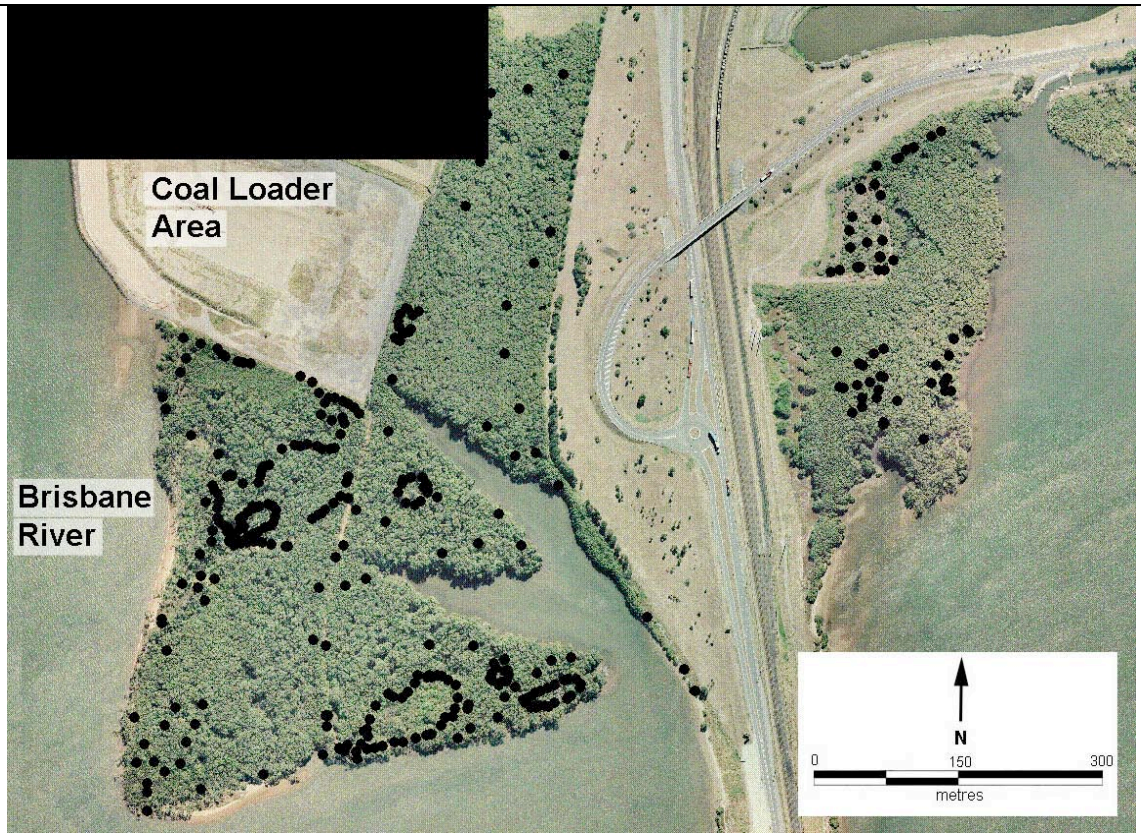

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	Figure 2.2 Survey points in the Coal Loader area at Fisherman Islands.
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	Figure 2.3 Survey points at Fisherman Islands.
	November 2008

frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.4 Survey points at Whyte Island.
	November 2008

Description of Community Composition and Structure

At each survey point, species composition (% cover of each species), canopy height (m), canopy cover (%), and the structural formation of the mangroves were recorded.

For structural formation, we followed the classification system used by the Queensland Herbarium (Dowling & Stephens 2001), which is based on the classifications given in Appendix D. Using this methodology, no Tall Forests were identified, as canopy height did not reach 30 m. Therefore, what may have been referred to as Tall Open / Closed Forests in earlier monitoring events (WBM 2000; 2002a, b) are described as Open or Closed Forests in this study. We have also referred to the yellow mangrove as *Ceriops tagal* as opposed to *Ceriops australis*, as this is the name used for this species by the Queensland Herbarium, and in the Flora of Australia (McCusker 1984; QLD Herbarium pers. comm. 2004; Jessup 2002).

Description of Mangrove Health

At each survey point, the ecological health of the mangroves was determined using the classification system developed in previous surveys (Table 2.1, Figure 2.5 – Figure 2.10). In addition, in this survey, we divided the 'dead' category into 'recently dead' and 'dead' and mapped them separately to illustrate new areas of mangrove dieback. However, in order to make meaningful comparisons with the dead area from previous years, dead and recently dead areas have been combined in Figure 2.15.

Table 2.1 Criteria for visual assessments of mangrove health.

Mangrove Health Category	Criteria
Good (1)	Green leaves with no yellowing, curling etc. and little evidence of damage by insects. No abnormal leaf loss.
Fair (2)	Mainly green leaves with < 20% of the canopy affected by yellowing / curling or damage by insects. Some epicormic growth.
Poor (3)	Many yellowing / curled leaves, reduced canopy cover, high insect damage. Abundant epicormic growth.
Recently Dead (4)	Leaves brown or absent with no new growth.
Dead (5)	No leaves or twigs, in some cases there are no small branches. Trees have been dead for years.
Regrowth (6)	Canopy cover low but new trees evident, new growth shooting from the base or trunks of older trees. Previous disturbance event sometimes evident.

Figure 2.5

Mangroves in good health at Fisherman Islands.

Figure 2.6

Mangroves in fair health at Fisherman Islands, note there is some epicormic growth.

Figure 2.7

Mangroves in poor health at Fisherman Islands, note numerous dead branches, epicormic growth and yellowing leaves.

Figure 2.8

Recently dead mangroves at eastern Fisherman Islands (right). Mangroves in poor health (left) are showing signs of stress including epicormic growth.

Figure 2.9

Dead mangroves at Fisherman Islands.

Figure 2.10

Regrowth within the Coal Loader area.

We also visually assessed each survey point for signs of disturbance, such as: damage by insects; anthropogenic or natural disturbances such as clearing; the presence of drains or bunds, litter, incursion of exotic weeds; and erosion of the foreshore. The percent cover and depth of any seagrass wrack was also estimated.

The abundance of macroalgae, macrofauna and seedlings were also recorded at each survey point, as they can also be indicative of mangrove health.

Macroalgae

Macroalgae are a common component of mangrove ecosystems. Some species such as *Bostrychia* spp., *Caloglossa leprieurii* and *Catenella nipae* are commonly found on the trunks and exposed roots of mangroves in south east Queensland, and are an important source of primary production in mangrove ecosystems (Karsten et al. 2000). These

species are frequently more abundant in well flushed, seaward communities (Karsten et al. 2000), and are consequently an indication of a 'healthy' mangrove environment (Figure 2.11).

Figure 2.11

Epiphytic algae growing on mangrove pneumatophores, in a well flushed area.

The abundance of algal epiphytes on pneumatophores was assessed using the methodology developed in earlier surveys (Table 2.2).

Table 2.2 Epiphytic macroalgae abundance categories.

Category	**Abundance of Epiphytic Macroalgae**
Very abundant (1)	> 75% cover of macroalgae on pneumatophores (heavy coating).
Abundant (2)	50 – 75% cover of macroalgae on pneumatophores (easily visible).
Common (3)	10 – 50% cover of macroalgae on pneumatophores (some algae visible).
Rare (4)	< 10% cover of macroalgae on pneumatophores.

In contrast, other types of algae, such as *Ulva lactuca*, *Microcoleus chthonoplastes*, *Cladophora* and *Enteromorpha intestinalis,* and some cyanobacteria such as *Lyngbya* sp., rapidly respond to increased nutrient availability. In mangrove forests, these species can form mats over the sediment and roots, decreasing oxygen uptake and negatively impacting mangrove condition (Figure 2.12). They are typical of mangrove forests in poor ecological health.

Figure 2.12

Mat algae growing in a poorly flushed area.

The abundance of mat algae was also assessed using the categories in Table 2.3.

Table 2.3 Mat-forming algae abundance categories.

Category	Density and Abundance of Macroalgae Mats
Very abundant (1)	> 75% of the sediment covered by macroalgae (heavy coating / carpet).
Abundant (2)	50 – 75% of the sediment covered by macroalgae (easily visible).
Common (3)	10 – 50% of the sediment covered by macroalgae (some algae visible).
Rare (4)	< 10% of the sediment covered by macroalgae.

Macrofauna

Whilst macrofaunal abundance may not give a good indication of mangrove health *per se*, it can give an indication of the suitability of the mangrove community as a faunal habitat. This can have implications for the importance of the site as a fisheries habitat. Crabs are considered to be a 'keystone' species in the intertidal zone (Saintilan & Mazumder 2004); the abundance of crabs or crab burrows was therefore used as an indicator of the ability of the site to support marine fauna. We also noted the abundance of molluscs and other macrofauna. Macrofaunal abundance was ranked based on the density of crab holes, and the visible abundance of fauna (Table 2.4).

Table 2.4 Macrofauna abundance categories.

Category	Macrofauna Abundance
Very abundant (1)	> 50% of the substrate covered by crab holes.
Abundant (2)	25 – 50% of the substrate covered by crab holes.
Common (3)	< 25% of the substrate covered by crab holes.
Rare (4)	No macrofauna or crab holes evident.

Seedling Density

The abundance and species of seedlings were recorded at each site using the classifications given in Table 2.5.

Table 2.5 Seedling abundance categories.

Category	Seedling Abundance
Very abundant (1)	Available space is 100% covered with seedlings, seedlings form a dense carpet with few (if any) gaps.
Abundant (2)	Most of the available space is covered with seedlings, however there are some gaps.
Common (3)	Seedlings are common, but do not form a carpet.
Sparse (4)	Less than 1 seedling per square metre.
Absent (5)	No seedlings present.

Mapping and Assessment of Mangrove Health and Community Structure

Field survey data was mapped using GIS software (MapInfo). Data points and field survey data were overlain onto rectified aerial photographs taken by Fugro Spatial Solutions in April 2007. Maps were created for both species composition and mangrove health, based on field data, and interpretation of the aerial photography. The area of each community and health category was then calculated and compared to previous surveys. Each of the communities were described, based on the field data. Field data was also summarised and compared to previous surveys.

2.2 Community Composition, Structure and Health of Mangrove Communities at Fisherman Islands (Excluding the Coal Loader Area)

Community Structure

Mangrove community structure at Fisherman Islands was similar to that recorded in previous surveys of the area, with the grey mangrove *Avicennia marina* subsp. *australasica* dominating forests (frc environmental 2004, WBM 2000, 2002a, Dowling & Stephens 1999). Other mangroves recorded during the survey included the river mangrove *Aegiceras corniculatum*, the red mangrove *Rhizophora stylosa* and the yellow mangrove *Ceriops tagal*. *C. tagal* was more prevalent in the south western corner of Fisherman Islands (Figure 2.13) and along the southern edge of the peninsula (Figure 2.14), dominating communities in parts of these areas.

As in previous years, low closed forests dominated the landward areas and around dead patches, with open forests in more seaward locations (Figure 2.14).

Figure 2.13

Ceriops tagal is the dominant species in the south western corner of the Fisherman Islands mangrove forest.

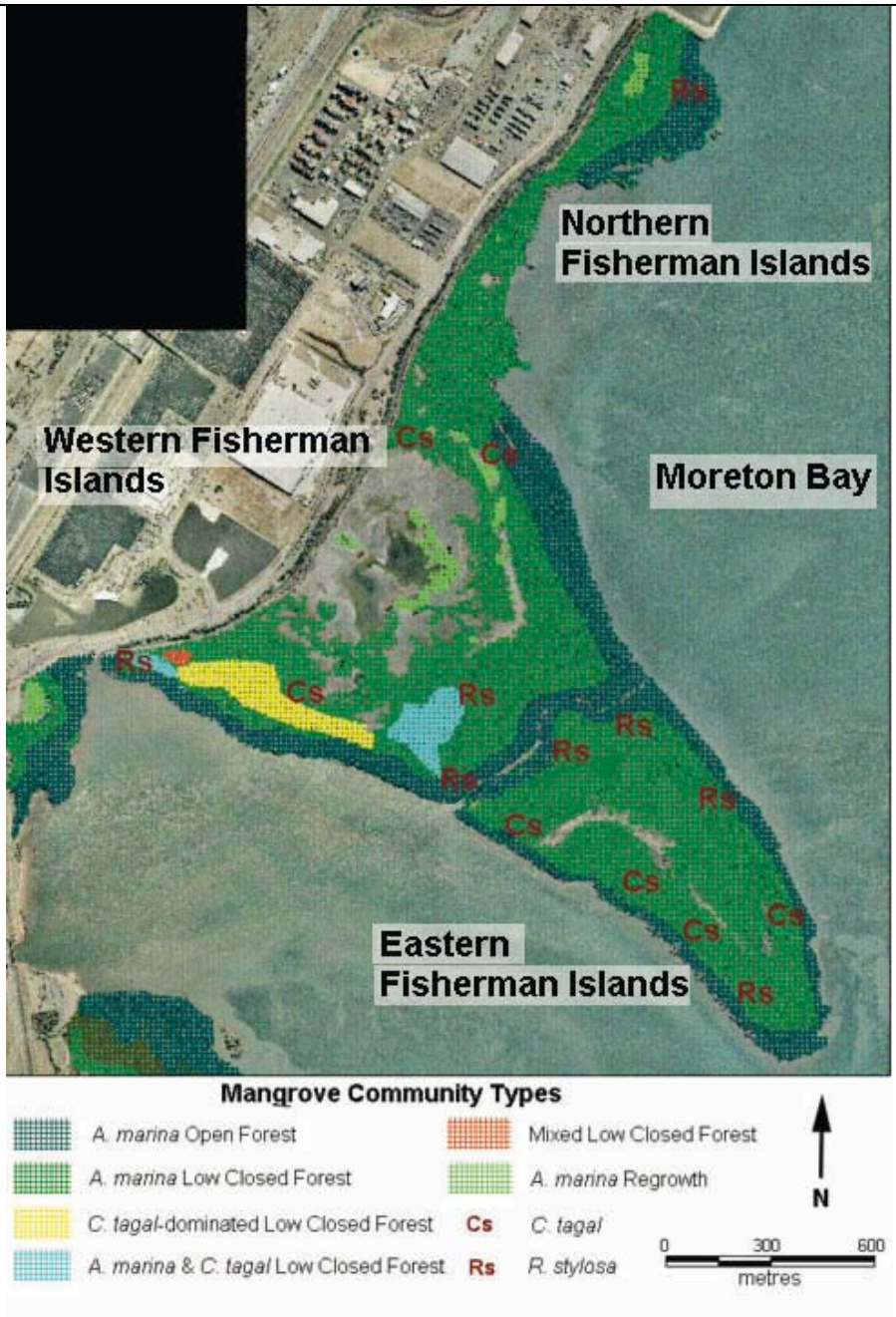

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	Figure 2.14 Mangrove community structure and species composition, Fisherman Islands 2008.
	November 2008

Saltmarsh communities on the eastern section of Fisherman Islands were dominated by *Suaeda australis* and *S. arbusculoides* (seablite), *Sarcocornia quinqueflora* (samphire) and *Enchylaena tomentosa* (ruby saltbush). Some other coastal species were also present along the landward margin of the claypan area, these included: *Sesuvium portulacastrum* (sea purslane), *Carpobrotus glaucescens* (coastal pigface) and *Ipomoea pes-caprae* subsp. *brasiliensis* (beach morning glory).

Mangrove Health

The overall health of mangroves has declined since 1999, with a steady increase in the area of dead mangroves and mangroves in poor health since 2004. In 2008 there was less regrowth than in previous years (Figure 2.15).

Between 2004 and 2008, the area of dead mangroves and mangroves in poor health steadily increased from 21 ha to 27 ha (Figure 2.15). In 2008, 1.6 ha (6%) of the dead area had died recently. Prior to this, the area of dead mangroves was relatively stable, with 24 ha in 1999 and 23 ha in 2002. The area of mangroves in poor health was relatively stable between 1999 (43 ha) and 2002 (42 ha) before falling to 14 ha in 2004, then rising to 18 ha in 2006 and 17 ha in 2008.

For ease of discussion, we have sub-divided the mangroves of Fisherman Islands into three areas:

- the western area, the large area of mangroves to the south east of the PBC office
- the eastern area, which is divided from the western area by a channel, and extends to the east in a long peninsula, and
- the northern area, a smaller strip of mangroves adjacent to the mainland to the north east of the PBC office.

The health of the mangrove communities in each survey is illustrated in Figure 2.15 to Figure 2.20.

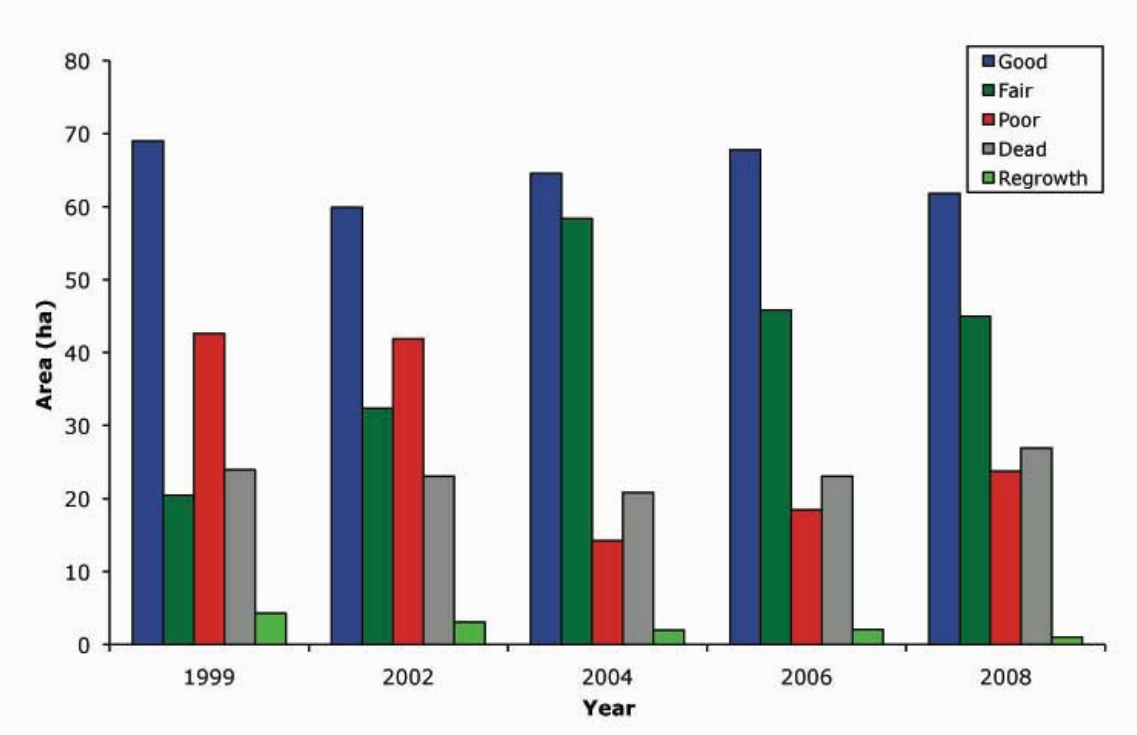
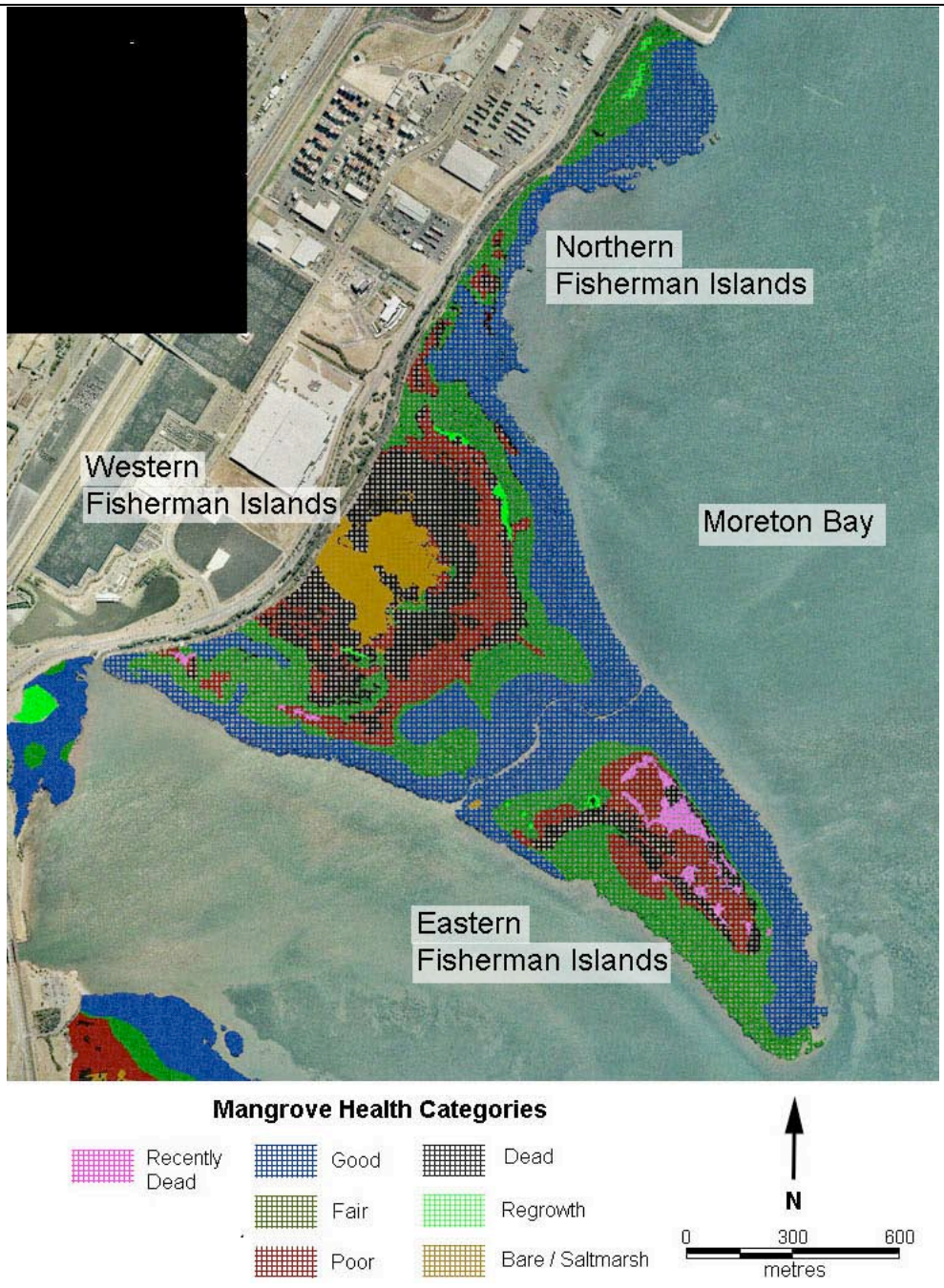


Figure 2.15 Area of mangroves in each health category at Fisherman Islands (excluding the Coal Loader area) 1999 – 2008.



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.16 Mangrove health Fisherman Islands, 2008.
	November 2008

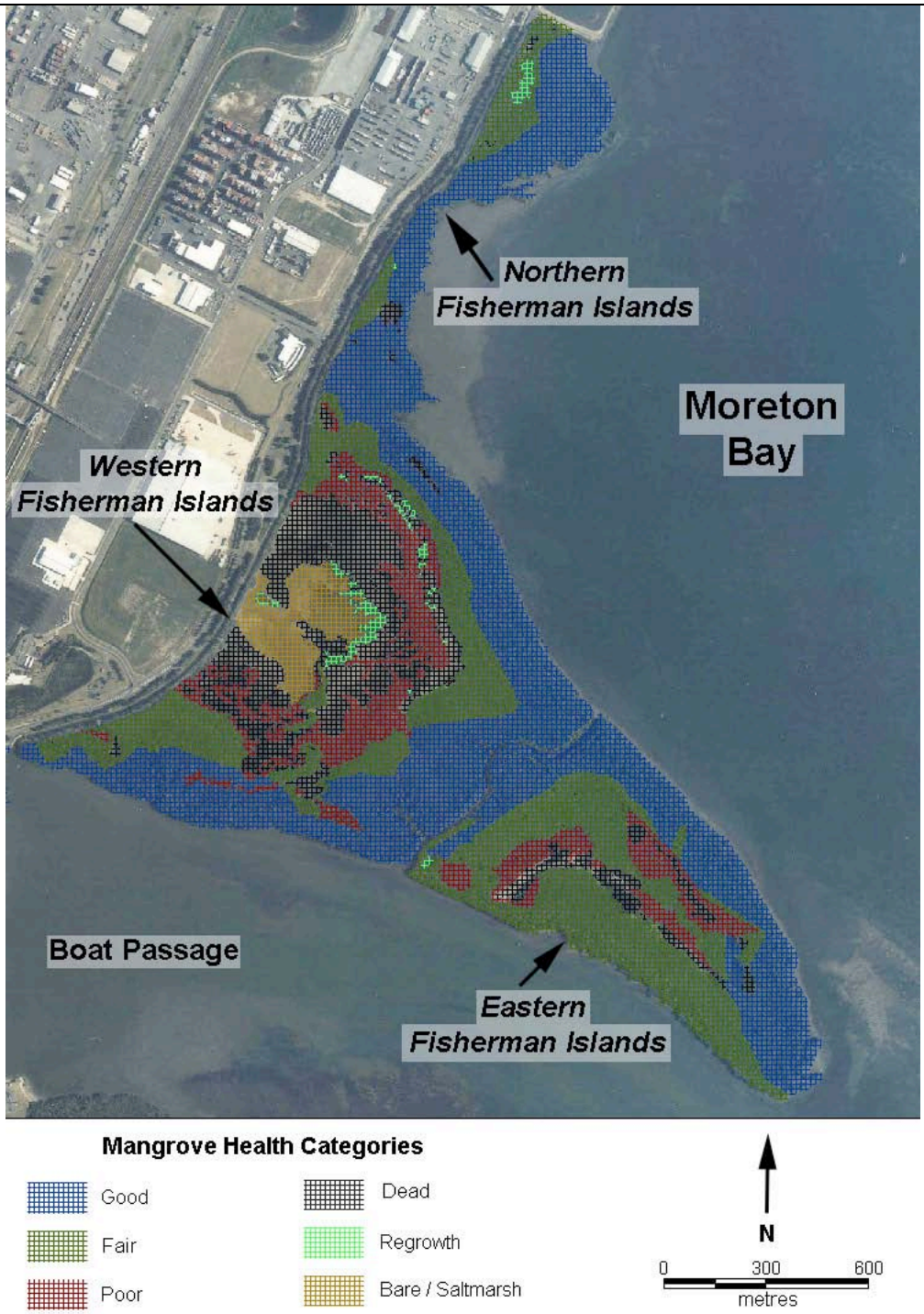


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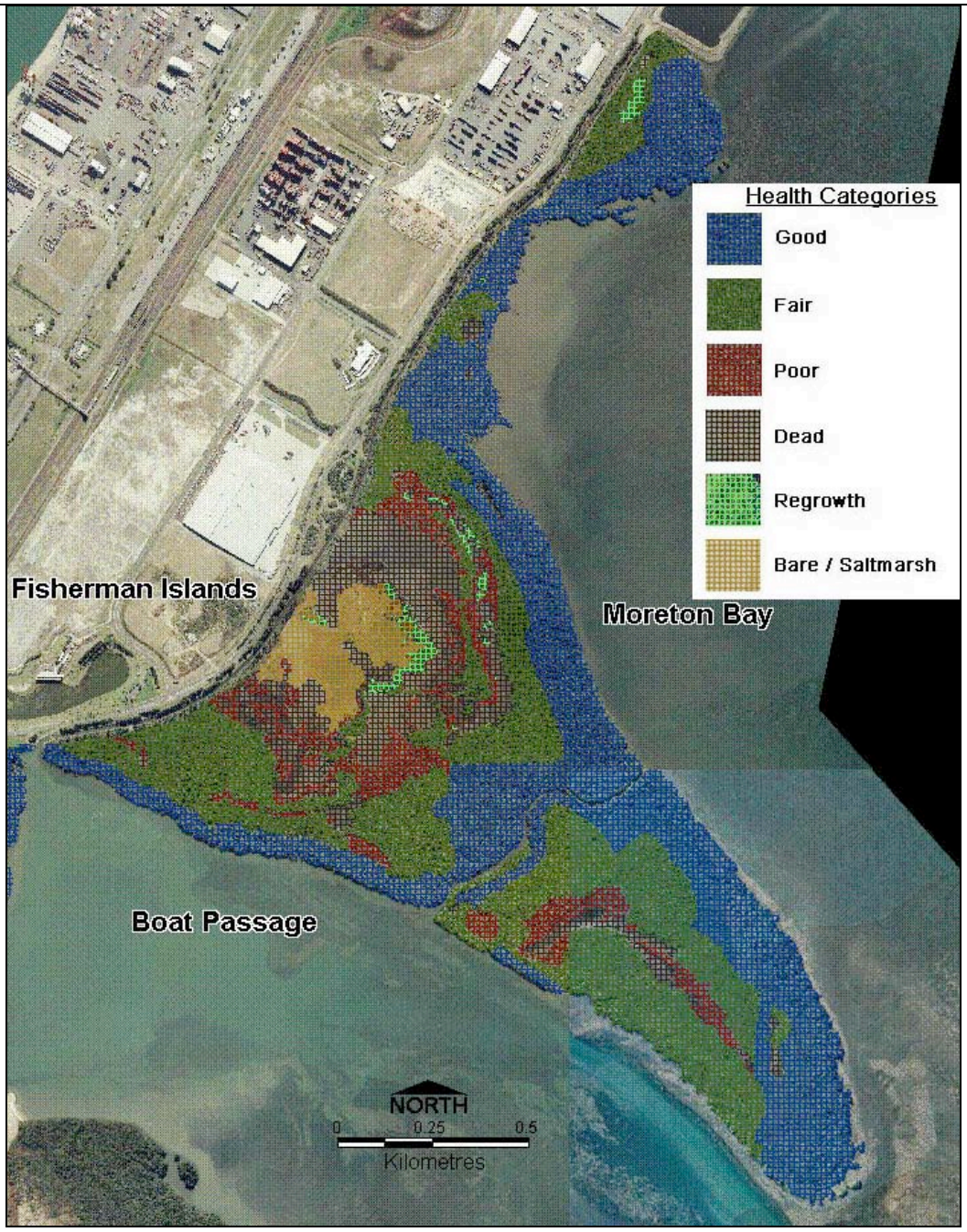
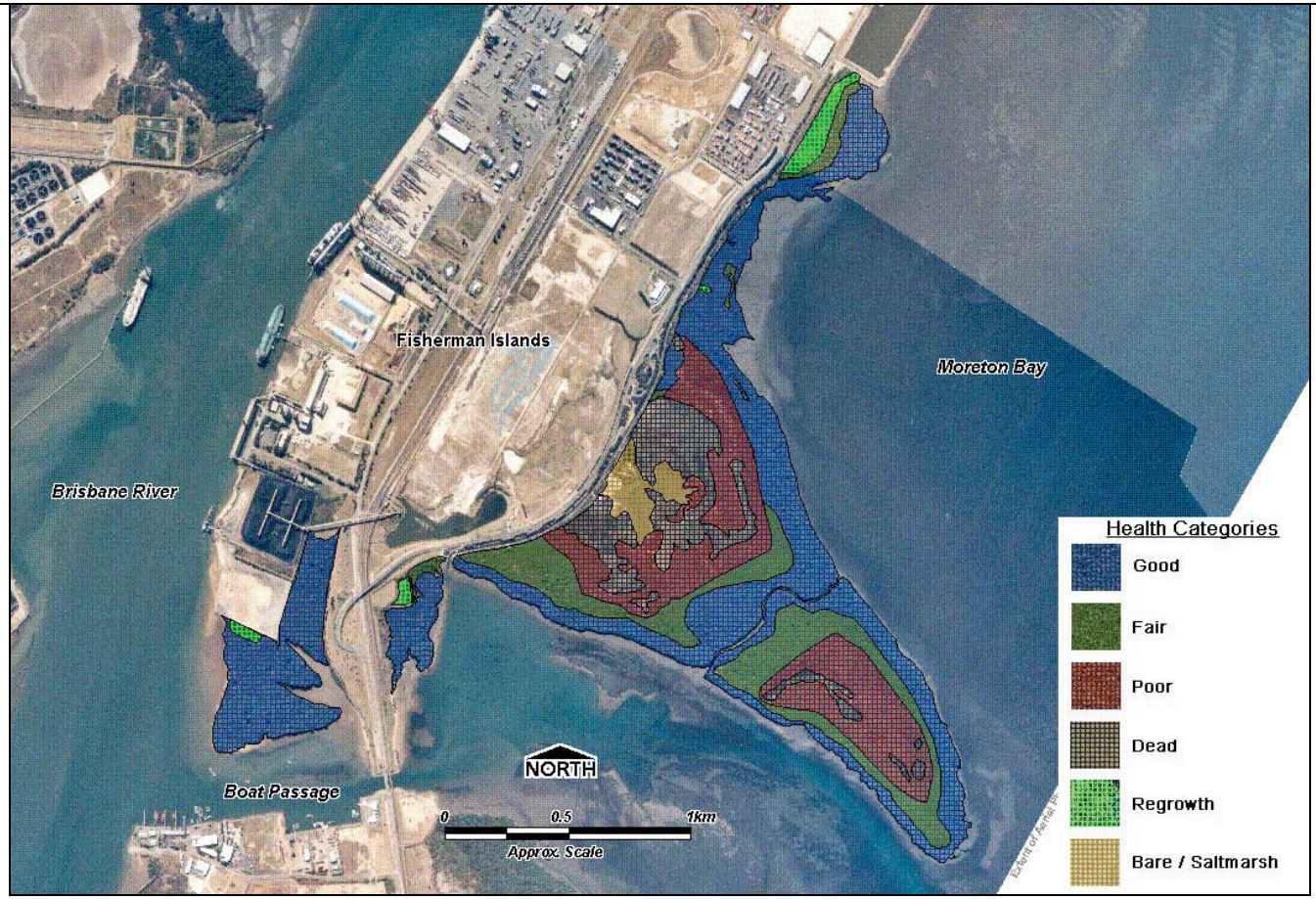
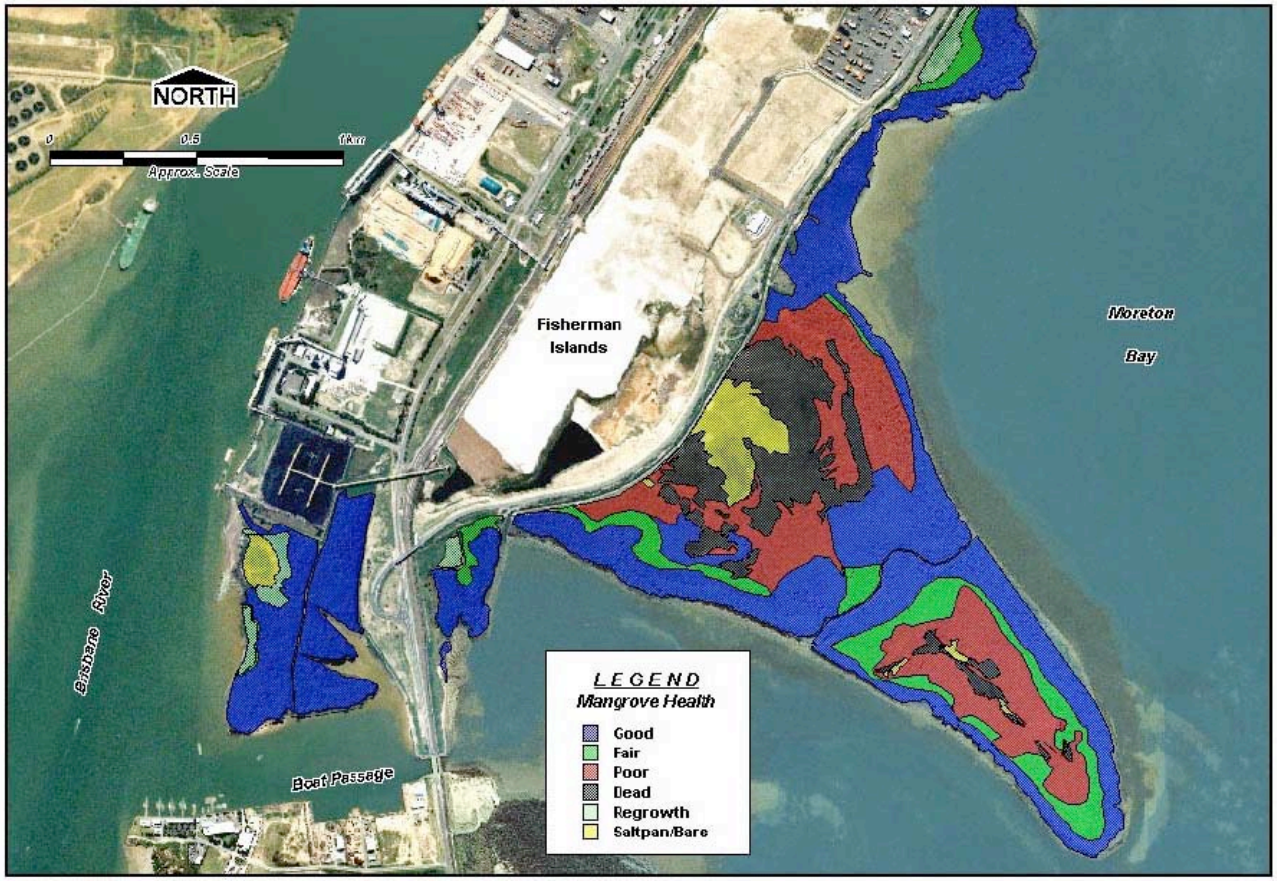
	Figure 2.17 Mangrove health Fisherman Islands, 2006.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.18 Mangrove health Fisherman Islands, 2004.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.19 Mangrove health at Fisherman Islands, including the Coal Loader area in 2002 (WBM 2002a).
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.20 Mangrove health at Fisherman Islands , including the Coal Loader area in 1999 (WBM 2000).
	November 2008

Western Area

Mangroves in good health in the western area of Fisherman Islands were predominantly along the well-flushed seaward edges, and near the cross channel that divided the western and eastern areas. Inside this outer band of healthy mangroves, there are bands of mangroves in fair and poor health, with dead mangroves and bare saltpan / saltmarsh areas in the middle.

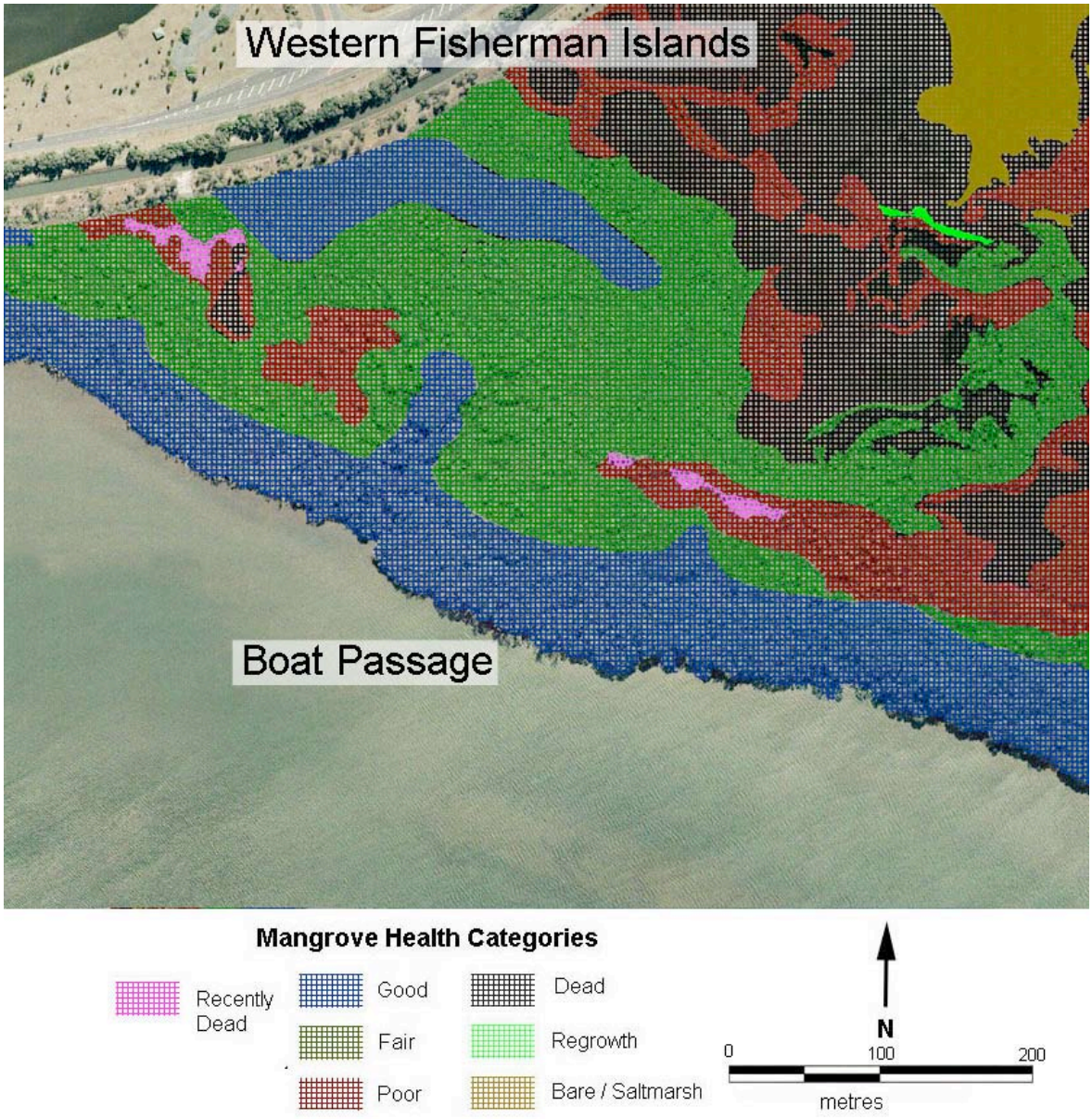
The main change between 1999 and 2002 was a decline in health of a relatively large area of mangroves west of the cross channel from good, to fair or poor (Figure 2.19 & Figure 2.20). Between 2002 and 2004, there was little change in the area of mangroves in good health, or in the area of dead mangroves (Figure 2.18 & Figure 2.19). However, some areas classed as poor in 2002 improved in health to fair.

Between 2004 and 2006 there was an increase in the area of mangroves in good health, particularly near the cross channel and along the southern foreshore (Figure 2.16 & Figure 2.17). In 2006 trees here had fewer yellowing leaves, and less damage by insects than in 2004. However, there was a reduction in mangrove health from fair to poor around the claypan / dead area; predominantly *A. marina* trees. These trees had a higher proportion of yellowing / dead leaves and more epicormic growth in 2006 than in 2004, and there were some dead trees (Figure 2.17).

In 2008 the area of mangroves in good health was smaller; in particular large tracts of mangroves in the south had declined from good health in 2006 to fair health in 2008 (Figure 2.16). Changes included a decrease in canopy cover and higher proportion of yellowing leaves. Between 2006 and 2008, the area of mangroves in poor health also increased in this area, with the centres of some of these patches dieing (Figure 2.22 & Figure 2.23).

In 2008, many of the previous regrowth areas (Figure 2.22) had not survived or were in poor or fair health (Figure 2.23). Most regrowth in 2008 was confined to the north; there was less regrowth in the central area than in 2006.

As in previous years, large pieces of debris had accumulated along the landward edge of the dieback area in 2008 (Figure 2.24). This indicates that there is strong water movement through the area at times.



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.21 Mangrove health in the south western area of Fisherman Islands in 2008, showing areas of recent dieback.
	November 2008

Figure 2.22

Regrowth in western dieback area of Fisherman Islands, note recolonisation by saltmarsh plants (2006).

Figure 2.23

Recently dead *Ceriops tagal* in the south western area of Fisherman Islands.

Figure 2.24

Debris, western Fisherman Islands.

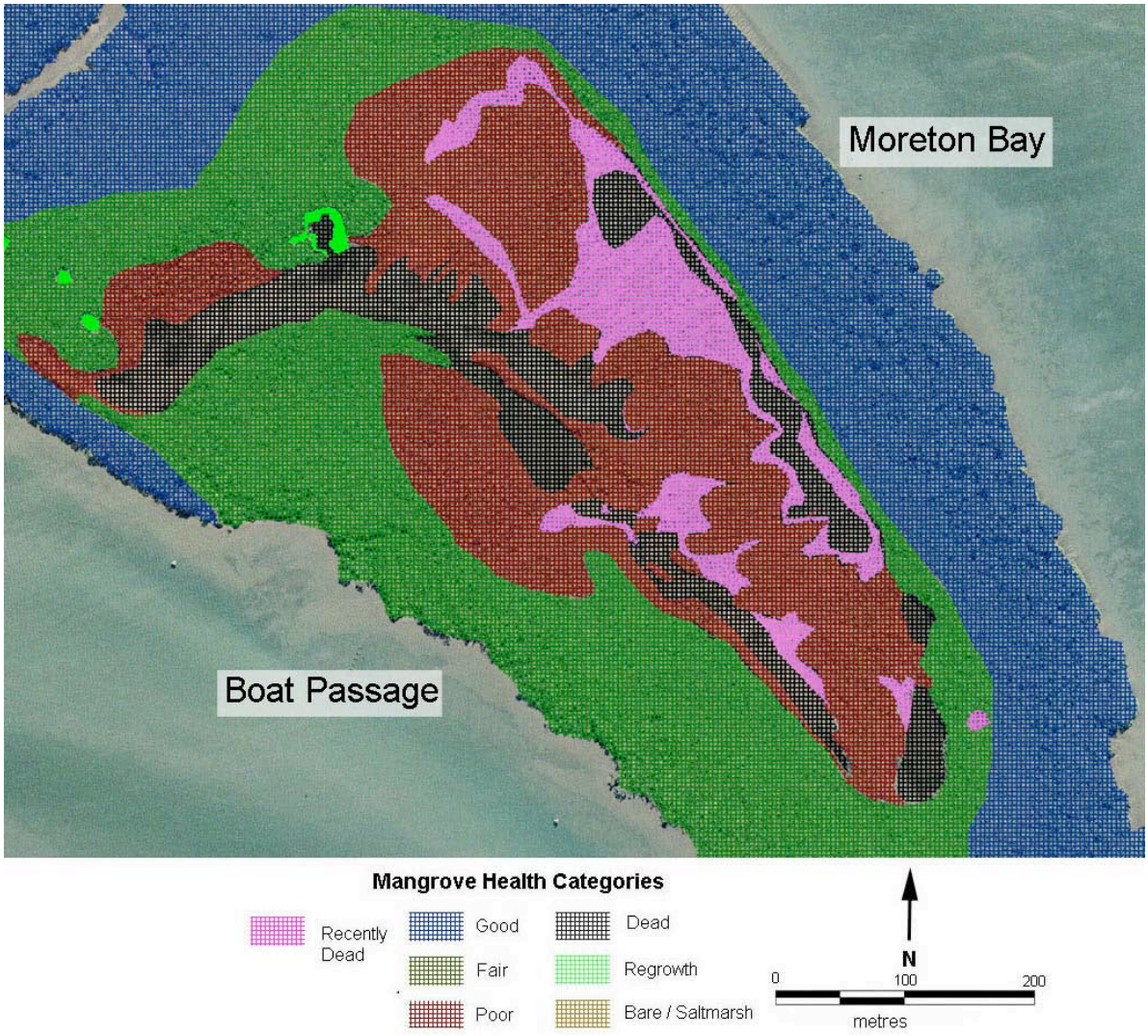
Eastern Area

In 1999 and 2002, the mangroves around the foreshore of eastern Fisherman Islands (including the foreshore of the cross channel) were in good health. Inside these mangroves, there was a ring of mangroves in fair health, and a ring in poor health, with a strip of dead mangroves in the middle (Figure 2.19 & Figure 2.20).

In 2004, mangroves along the southern foreshore had declined in health, as shore erosion undermined them. In some areas, the outer zone of *A. marina* trees were completely eroded away, exposing a zone of *C. tagal* growing on higher ground. Also, the health of most of the mangroves in the middle of the eastern area had improved from poor to fair, with only those mangroves close to the dead areas in poor health (Figure 2.18).

In 2006, there was a new area of dieback on the eastern end of Fisherman Islands, surrounded by an area in poor health.

In 2008, the greatest area of new dieback was on this eastern end of Fisherman Islands (Figure 2.25 & Figure 2.26), with the area of dieback increasing substantially from 2006 to 2008, as it spread between the northern and southern parallel dead areas along a series of tracts. There were also two long, slender extensions of dead mangroves; one heading north west from the southern dead area, and the other heading south west from the northern dead area. The northern boundary of the dieback was bordered by a very thin strip of mangroves in fair health, followed by an area of good health extending all the way to the northern foreshore (Figure 2.27).



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.25 Mangrove health in the eastern area of Fisherman Islands in 2008, showing recently dead areas.
	November 2008

Figure 2.26

The large area of dieback area in the eastern part of Fisherman Islands.

Figure 2.27

A thin band of mangroves in fair health surrounds the northern dieback area.

In 2008, there were still brown curled leaves on the trees on the outer edges of the dieback area indicating this area had died recently (Figure 2.28). New growth, including seedlings, epicormic growth and leaves at the tips of branches, were most susceptible to die-off (leaf curl and browning). In 2004, this area was in fair health and in 2002, it was in poor health.

Figure 2.28

Newly dead and dying trees displaying epicormic growth in the eastern area of Fisherman Islands.

This eastern area of dieback is periodically ponded, particularly after high spring tides. Water stays in the mangrove area even at low tide, and stagnates. On the 11th of June 2008 as in previous surveys following spring tides, the area was submerged during all stages of the tide. In 2006, it was visited twice; on the 22nd of February, after a high tide of 1.91 m and on the 29th of March, after a high tide of 2.8 m. On the 22nd of February, the ground was dry and cracking and the area did not appear to have been inundated for some time. On the 29th of March, the area was under water approximately 5 hours after the high tide and did not appear to be draining (even though water was flowing out at the same time in areas to the west and the seaward mangroves to the north east were dry).

In 2008, ponded water was observed to be deeper than in 2006. Pneumatophores around the edge of the dieback area were slightly elongated, and some were deformed (bifurcating and bent) (Figure 2.29). Floating algae was also common (Figure 2.30).

Figure 2.29

Pneumatophores around older ponded areas were deformed.

Figure 2.30

Dense floating algae in ponded dead areas.

In 2008 there were small accumulations of seagrass wrack on the substrate to the north east of the dieback area, although accumulation was less than in 2006 (Figure 2.31). During 2006, seagrass wrack littered the lower branches of the mangroves on the north eastern and eastern shoreline (Figure 2.32) and formed berms up to 0.5 m high to the south west of the dieback (Figure 2.33). These berms of seagrass wrack were consolidated and likely to have severely impeded tidal drainage.

Figure 2.31

Small accumulations of seagrass to the north east of the new dieback area in 2008.

Figure 2.32

Seagrass wrack suspended in the trees, 1 – 1.5 m off the ground (2006).

Figure 2.33

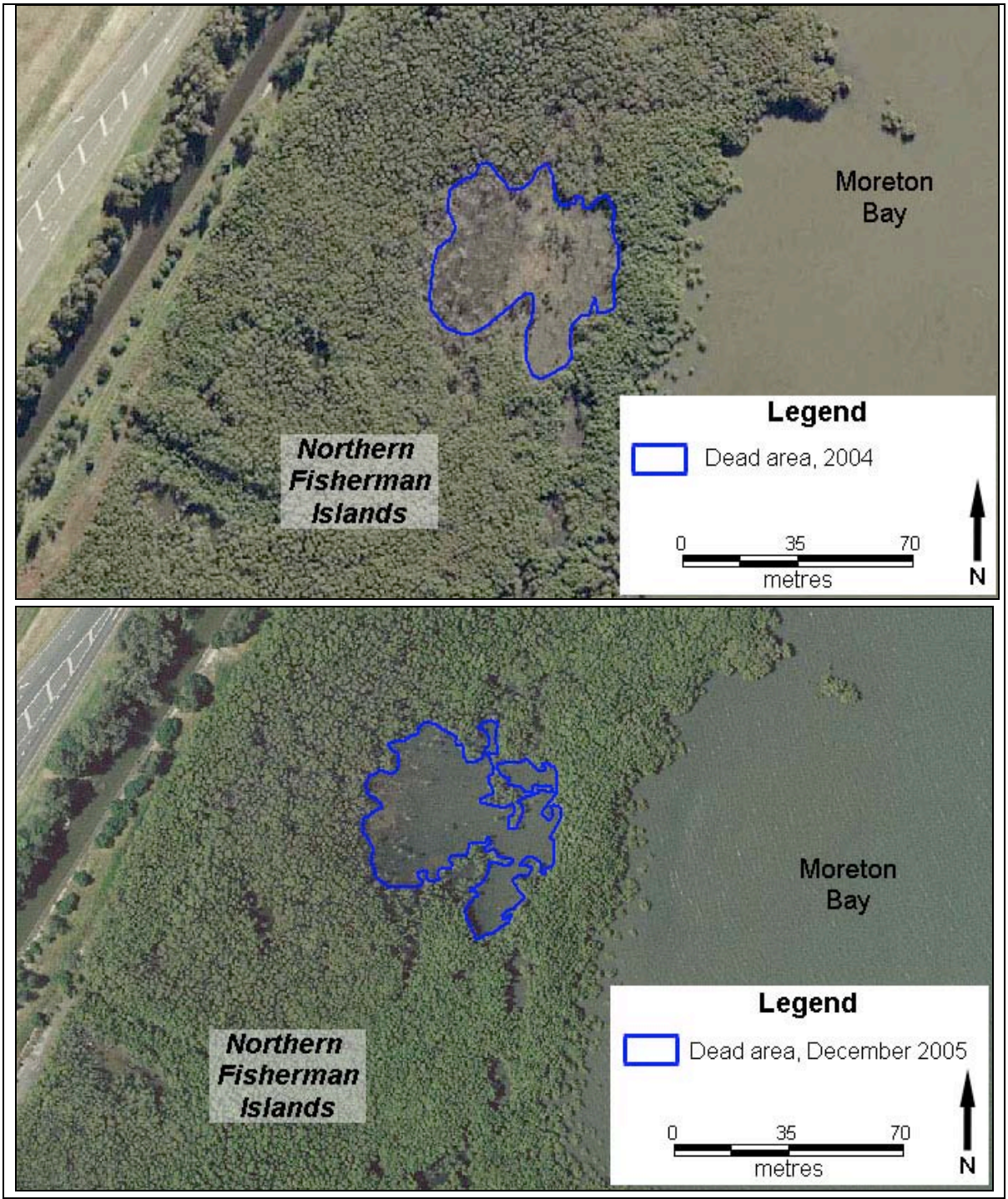
Large banks of *Zostera muelleri*[1] wrack on the southern shore of the Fisherman Islands peninsula (2006).

Northern Foreshore

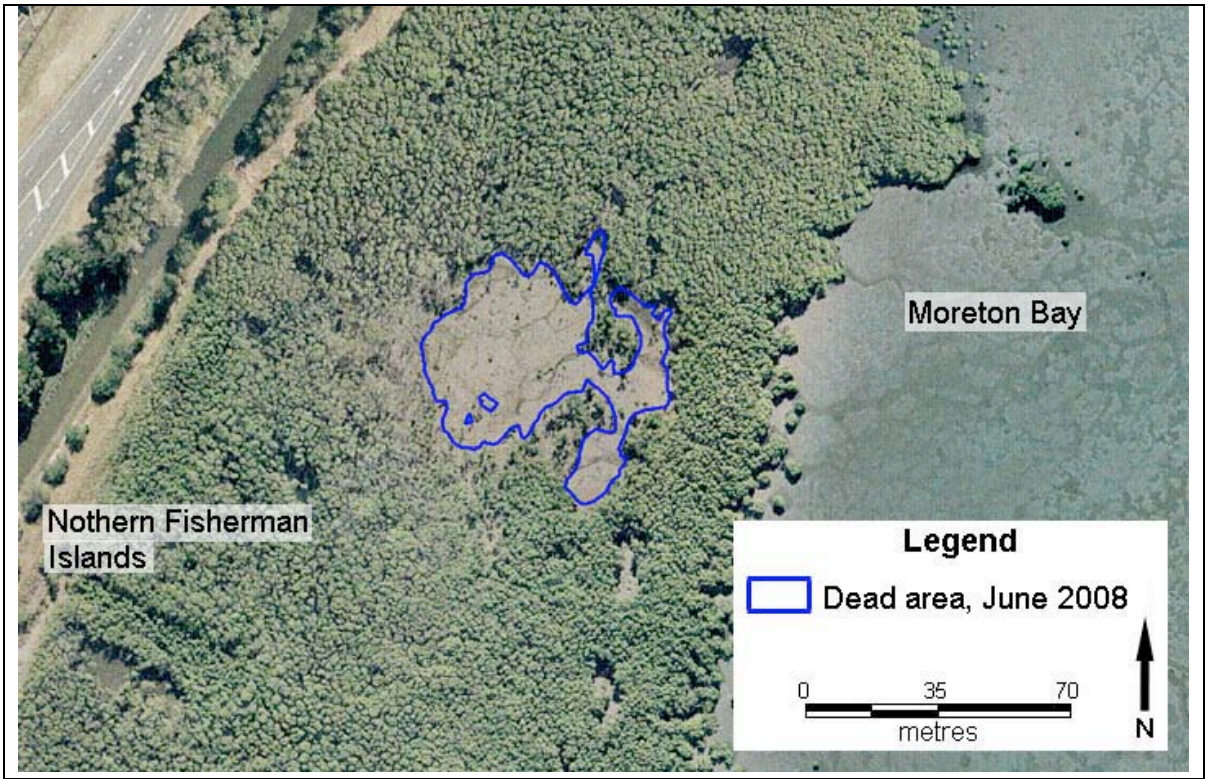
In 1999 and 2002, most of the mangroves at northern Fisherman Islands were in good health, with an area of fair health and regrowth parallel to the shore in the extreme north (Figure 2.19 & Figure 2.20). By 2004, one of the regrowth areas to the north of Sandpiper Drive had died and an area of fair health had developed inshore. In 2006, the dead area was of a similar size and the dead trees (visible in the 2004 aerial photographs) had fallen over, leaving a clear ponded area (Figure 2.34). In 2008, this dead patch was similar in size to 2006, but the health of the surrounding forest, particularly to the west, had declined substantially and was in poor health (Figure 2.35).

Sediments in the northern foreshore area are particularly soft, and provide little support for the mangrove trees. The pneumatophores and roots of the mangroves on the seaward edge of the mangroves form a tight clump around the base of the tree, rather than spreading out. Firmer banks of pneumatophores are colonised by seedlings separated by deep holes of mud. The combination of soft sediments and smaller root bases may make these trees less stable and more susceptible to wind damage, particularly those near the outer edge. It is possible that trees falling over in strong winds formed this dead patch. Once a patch is formed, the trees around the edge may become more susceptible to wind damage. Fine sediments in the area are also likely to move easily, which may have also contributed to the dieback.

[1] Until recently, and in previous reports, this species was known as *Zostera capricorni*.



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.34 Dead patch in the northern area 2004 – 2006.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008	
	Figure 2.35	Dead patch and surrounding health in the northern area in 2008.
		November 2008

Sub-lethal Indicators of Mangrove Health

Macroalgae

Algae covering the roots and pneumatophores of mangroves were common on the seaward mangrove communities. In these areas, the pneumatophores of *A. marina* were covered by the red algae *B. moritiziana* and *C. nipae*. The abundance of epiphytic algae was consistently highest in the healthiest areas of mangroves, particularly on the seaward edges of the forests.

Mangroves in landward areas, including those of poor or fair health, usually did not have epiphytic algae covering their pneumatophores. However, algal mats were common in these areas, especially where water was ponded. As in 2006 and 2004, these mats consisted of cyanobacteria such as *Lyngbya* sp. (not *Lyngbya majuscula*) and *M.*

chthonoplastes Gomont; and green filamentous algae such as *E. intestinalis* (frc environmental 2004).

Insect Damage

Damage by insects was common throughout the mangrove communities at Fisherman Islands. It was most common on new growth in areas of fair or poor health, with leaves on tree tops and epicormic growth particularly susceptible. Damage was typical of lepidopteron caterpillars.

Seedling Density

Patterns in seedling density at Fisherman Islands were similar to those recorded in 2006 and 2004. Seedling densities were sparse in regrowth areas, Low Closed Forests and bordering the dead areas. Seedlings were denser in areas of Open Forest, with seedling density increasing from landward to seaward areas of these forests.

Abundance of Macrofauna

In general, macrofauna abundance, as indicated by crab hole abundance, was higher in the more seaward mangroves of Fisherman Islands. No fauna was recorded in ponded areas, except for the occasional marine snail. Similarly, few crab burrows or fauna were found in areas where a thick algal mat covered the substrate. Anoxic sediment conditions in the poor health and dead areas at Fisherman Islands are likely to render these areas unsuitable habitat for fauna (especially burrowing species).

2.3 Community Composition, Structure and Health of Mangroves in the Coal Loader Area of Fishermans Islands

Community Structure

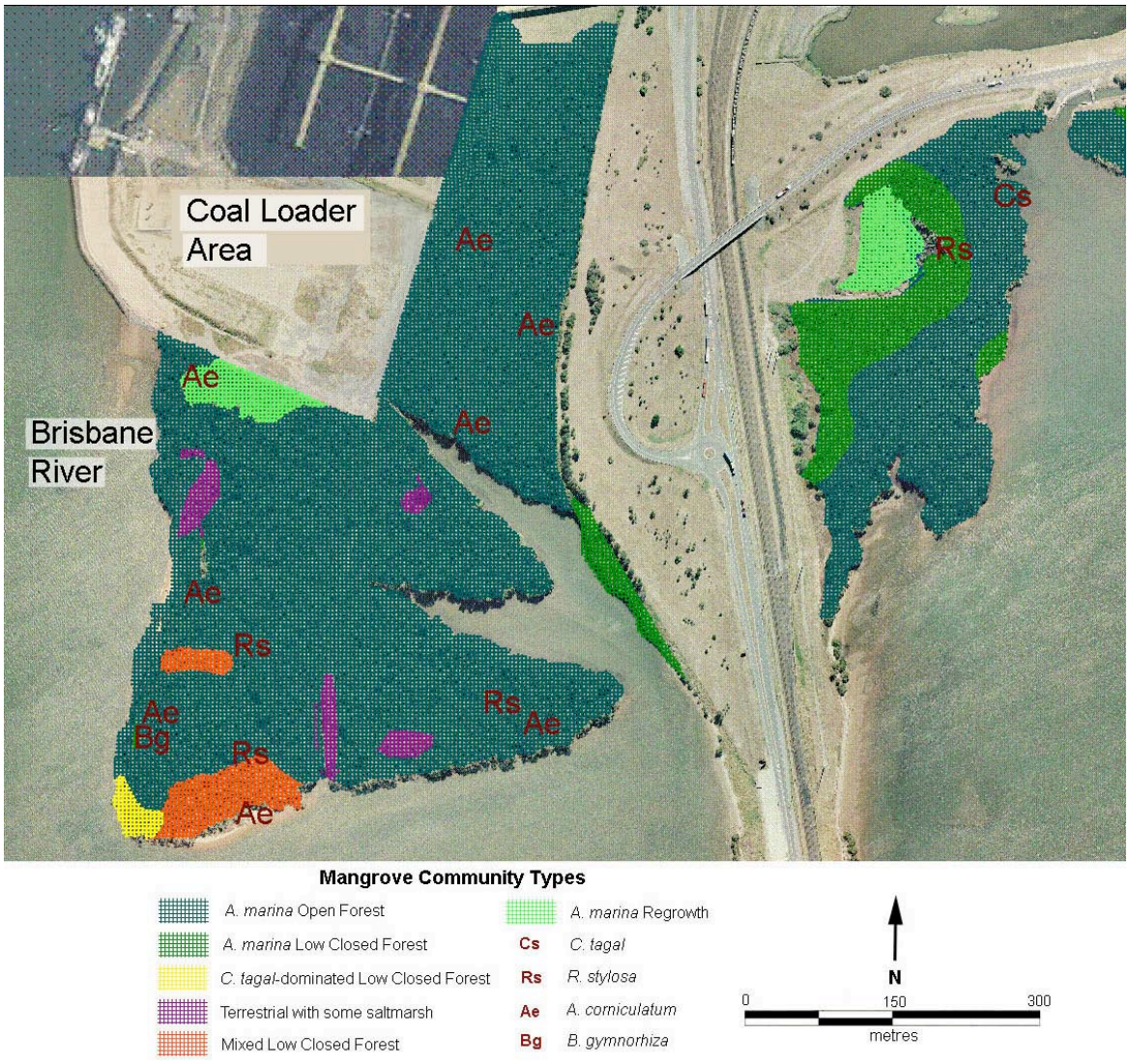
The Coal Loader area to the west of Port Drive was dominated by an open forest of *A. marina*, with small areas of regrowth, mixed low closed mangrove forest, *Ceriops*-dominated low closed forest, and saltmarsh / terrestrial communities. All of the mangrove species recorded in the eastern area of Fisherman Islands were also recorded in the Coal Loader area; in addition, *Bruguiera gymnorrhiza* was recorded in this area (Figure 2.37).

The mixed low closed mangrove forest was composed of *A. marina, C. tagal, R. stylosa* and *B. gymnorrhiza* in varying compositions. The terrestrial communities were composed of predominantly coastal species including: *Casuarina glauca* (swamp oak); *Carpobrotus glaucescens* (pigface); *Hibiscus tiliaceus* (coastal hibiscus); and *Ipomoea pes-caprae*. Saltmarsh species included *S. australis*, *S. arbusculoides*, *S. quinqueflora*, *E. tomentosa* and *S. portulacastrum*. These coastal and saltmarsh species predominantly grew on raised sand ridges in this area, with the saltmarsh on the lower, more frequently inundated areas (Figure 2.36). On these ridges, there were also a number of introduced species such as *Schinus terebinthifolius* (broad-leaf pepper tree) and *Ipomoea cairica* (mile-a-minute). The green algae (exotic) *Caulerpa taxifolia,* red algae *Gracilaria* spp. and seagrass *Z. muelleri* grew in the drain bisecting the southern section. Macrophytes such as these had not previously been recorded from the drain.

In the Coal Loader area to the east of Port Drive, the mangroves were also dominated by *A. marina* forest, with an area of regrowth along the landward boundary.

Figure 2.36

Mangrove forest adjacent to drain, Coal Loader area. Note bank with coastal / terrestrial community to right of drain.



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.37 Mangrove community structure and species composition within the Coal Loader area.
	November 2008

Mangrove Health

Mangrove health at the Coal Loader area has remained largely unchanged since 2004 (Figure 2.38 – Figure 2.41). Most of the mangrove communities were in good health, however erosion and deposition of sediment in the south west (primarily adjacent to the Brisbane River) reduced health scores in 2008 (Figure 2.42 & Figure 2.43). There were also a few small circular areas of dead mangroves, which appear to be the result of mature trees falling over (Figure 2.44); many of these areas are being colonised by seedlings. In 2008, an area of poor health had developed in the south east section. There had been recent minor anthropogenic disturbance throughout the Coal Loader area by a Police training exercise (Figure 2.45).

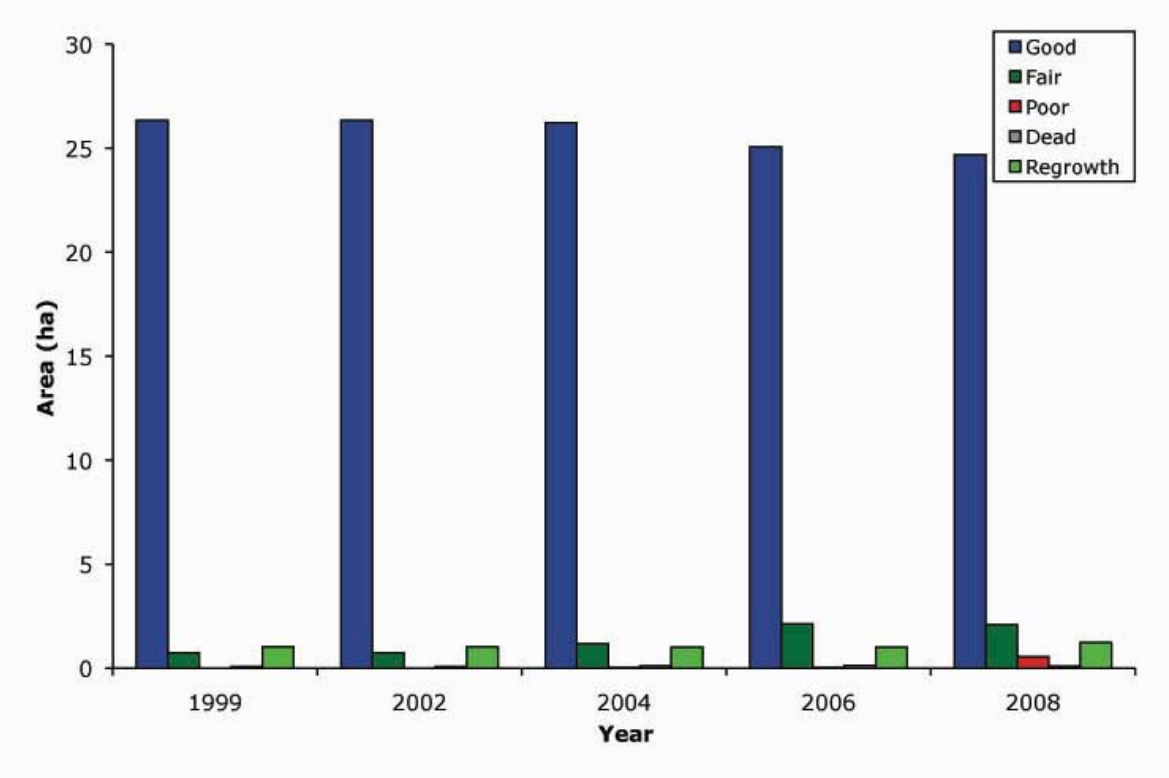
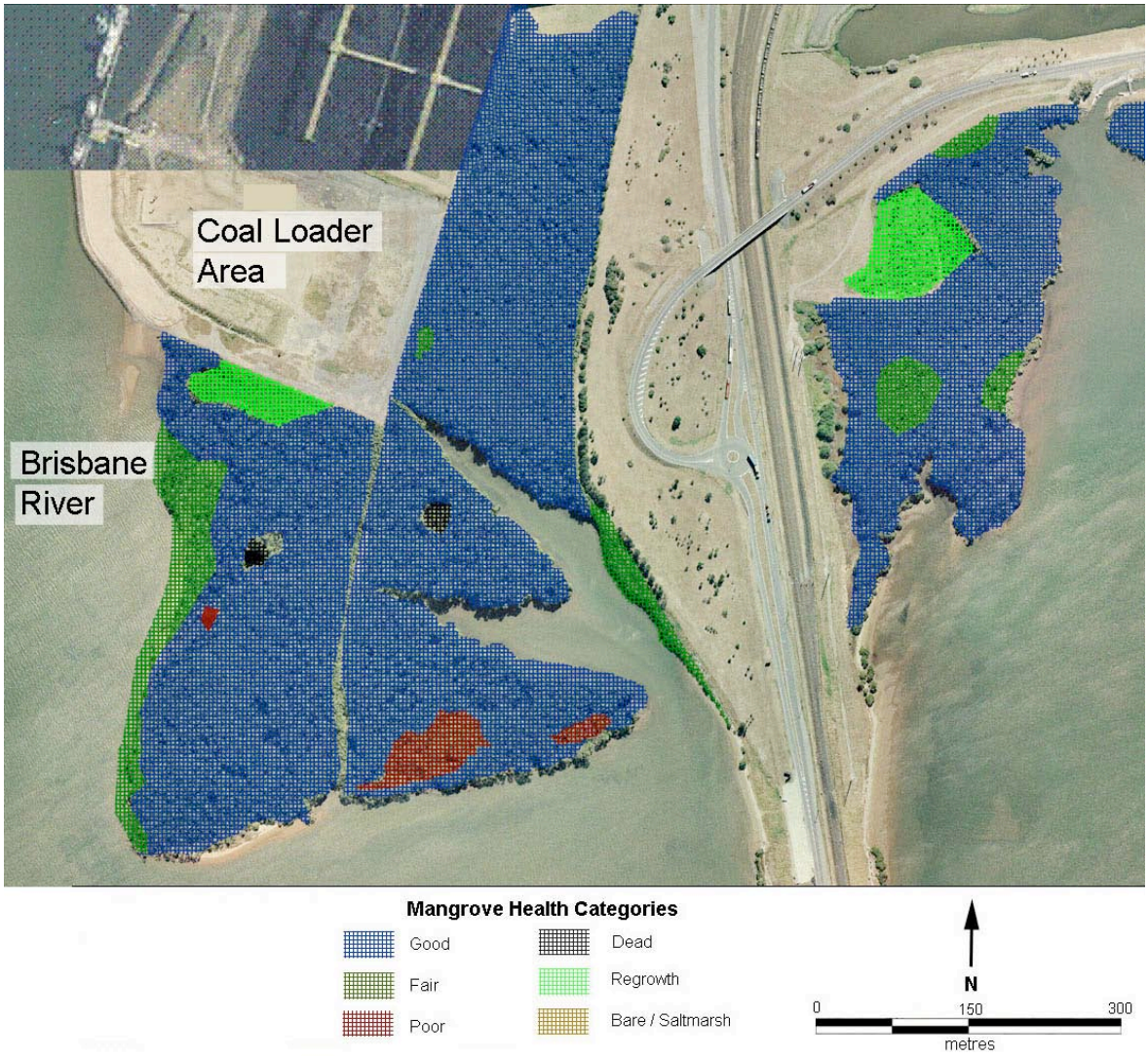
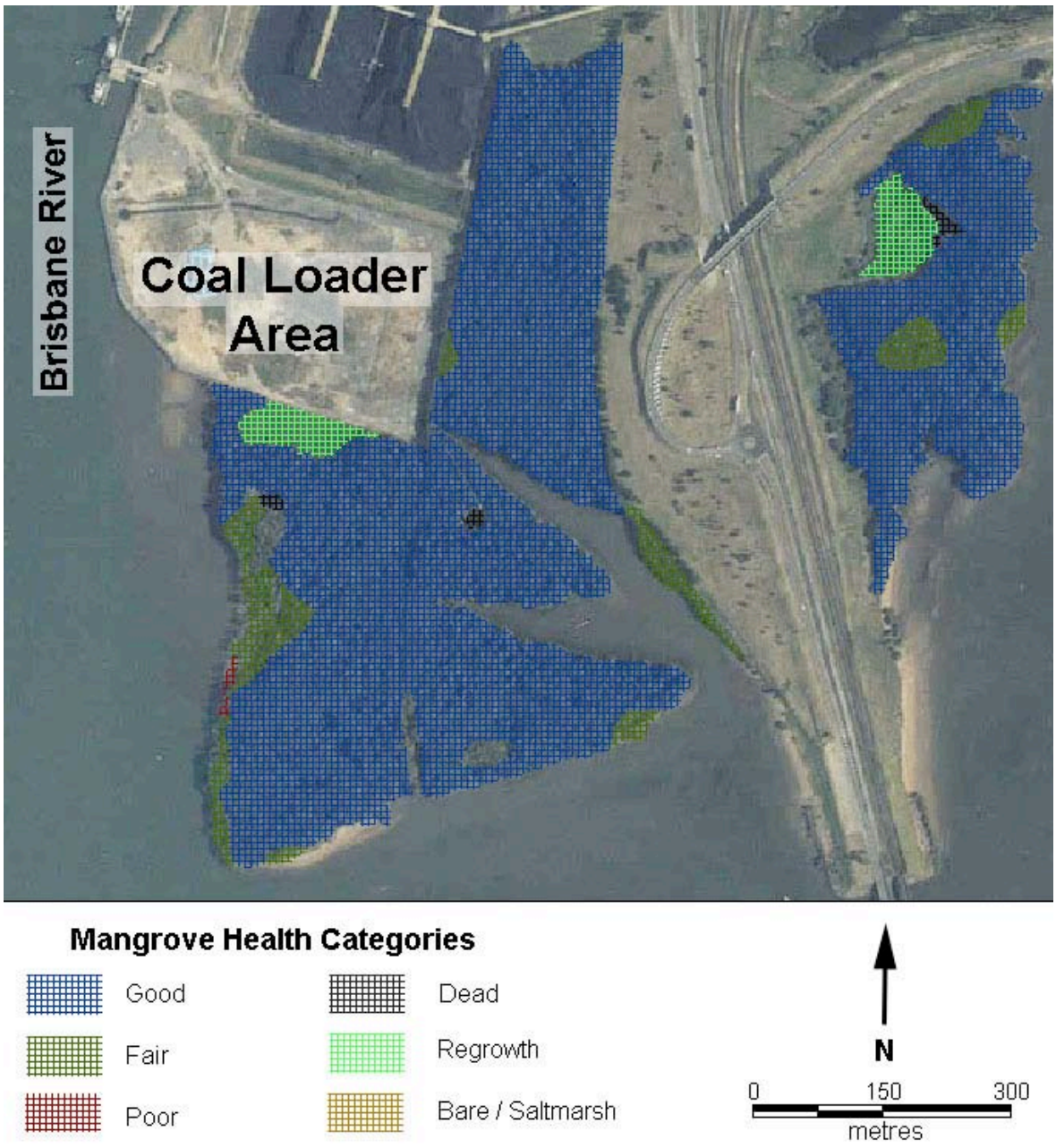


Figure 2.38 Area of mangroves in each health category in the Coal Loader area 1999-2008[2]

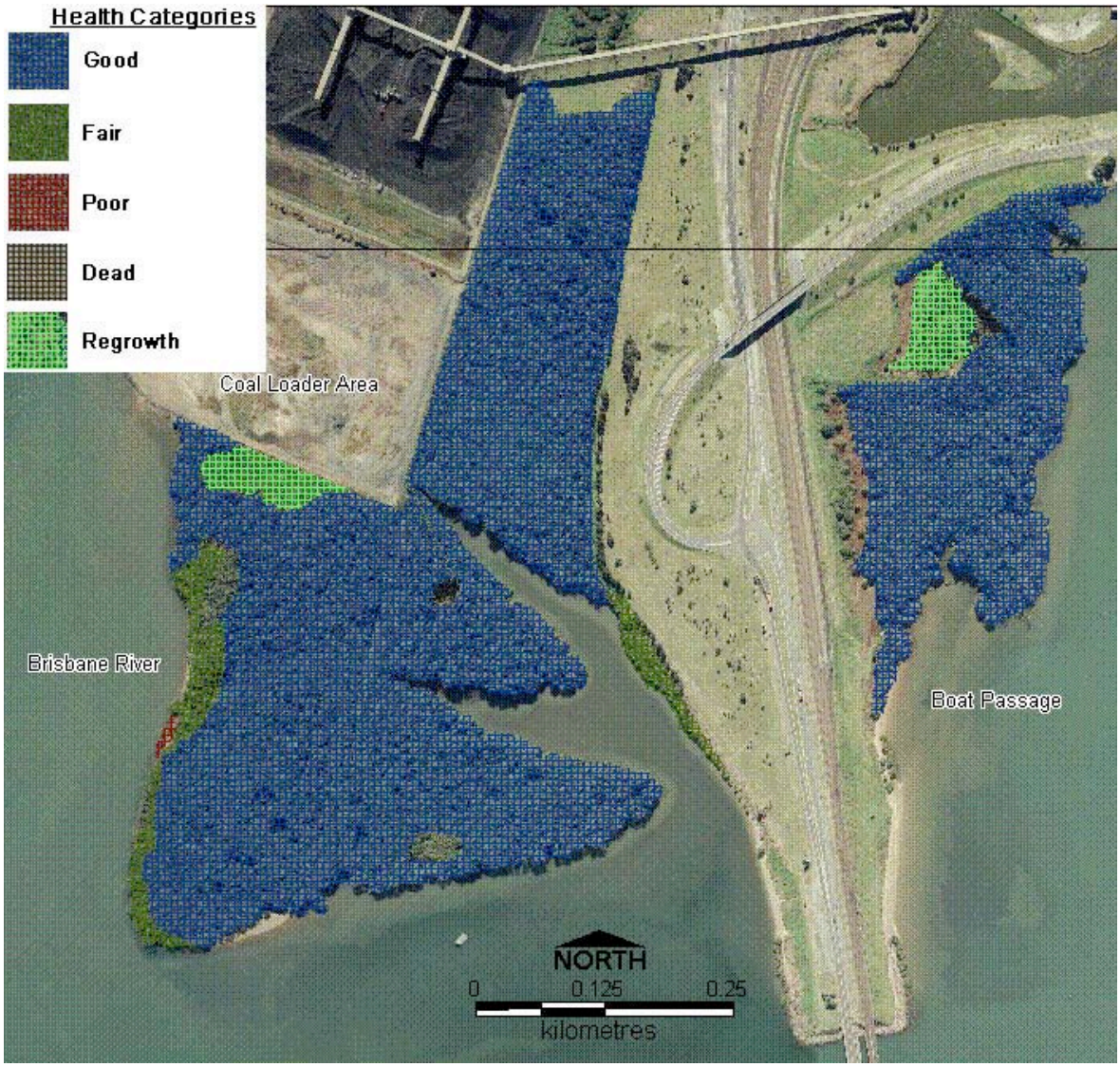
[2] Mapping files not available for 1999, so 1999 values based on the values for the Coal Loader Area from 2002 (as mapping of the Coal Loader Area did not significantly change between 1999 and 2002).



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.39 Mangrove health in the Coal Loader area of Fisherman Islands in 2008.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.40 Mangrove health in the Coal Loader area of Fisherman Islands in 2006.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008	
	Figure 2.41 Mangrove health in the Coal Loader area of Fisherman Islands in 2004.	
		November 2008

Figure 2.42

Sand deposition across mangroves in the Coal Loader area.

Figure 2.43

Erosion along south western foreshore, Coal Loader area.

Figure 2.44

A small area of dead mangroves being colonised by seedlings.

Figure 2.45

Recent anthropogenic disturbance at the Coal Loader area.

Sub-lethal Indicators of Mangrove Health

Macroalgae

Algae, dominated by *B. moritiziana* and *C. nipae* covered the roots and pneumatophores of most *A. marina* mangroves in the Coal Loader area, particularly on the seaward margins. There were no algal mats on the sediment.

Insect Damage

There was little or no damage by insects in the mangroves in the Coal Loader area. In the patch of mangroves to the east of Port Drive, the mangroves were in generally good condition with little insect damage, however there were some small patches that were severely damaged by insects. These patches were too small to map.

Seedling Density

A. marina seedlings were moderately dense in the Coal Loader area, with some patches of very dense seedlings, particularly in canopy gaps (e.g. Figure 2.44). In the mangroves to the east of Port Drive, seedlings were most abundant towards the seaward side, with seedling species predominantly *A. marina.*

Abundance of Macrofauna

In general, macrofauna abundance, as indicated by crab hole abundance, was high throughout most of the Coal Loader area, with abundances lower in more elevated areas, such as the *Ceriops* forest and saltmarsh area.

2.4 Community Composition, Structure and Health of Mangroves at Whyte Island

Community Structure

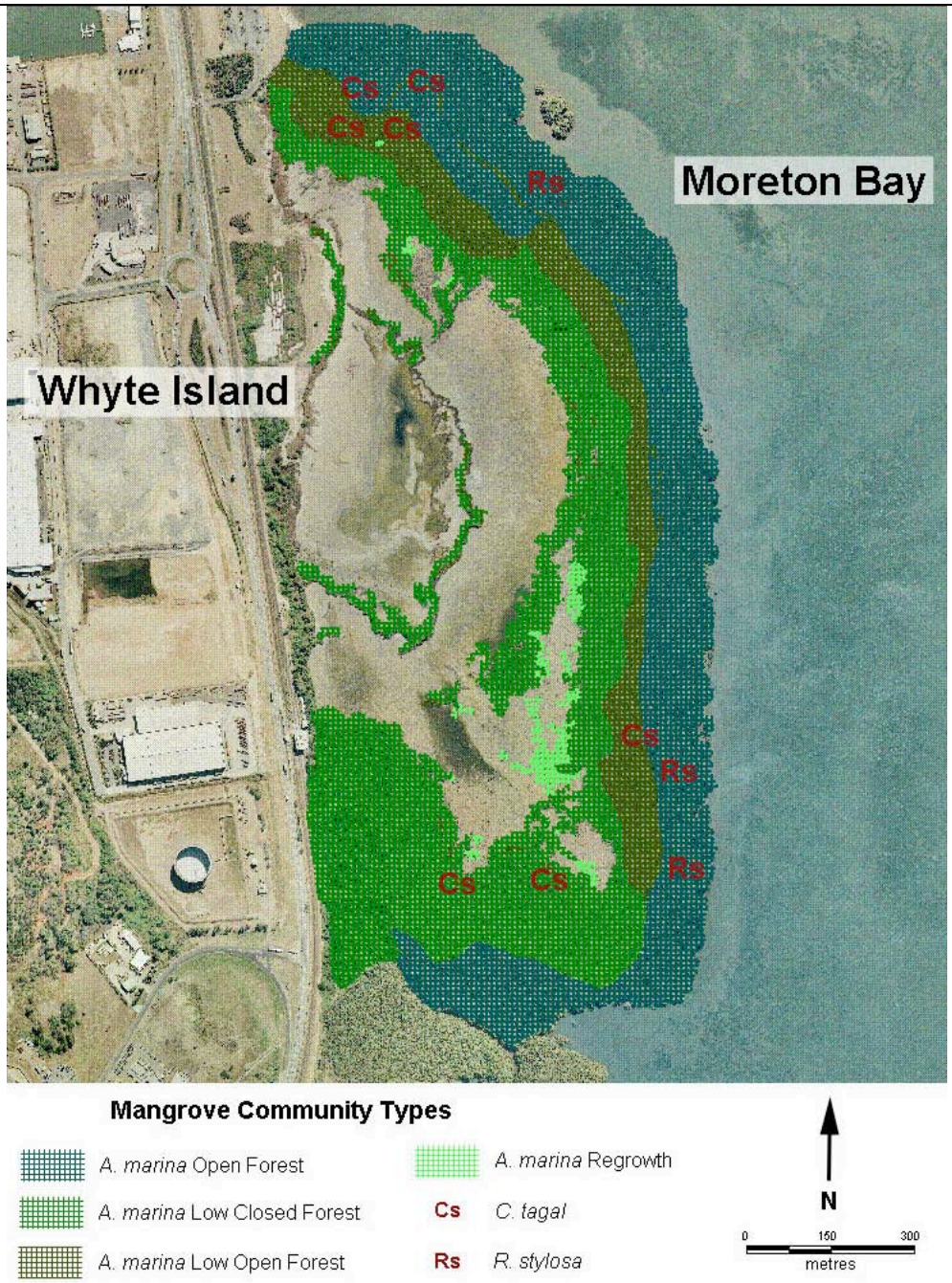
Mangrove communities at Whyte Island were similar to Fisherman Islands, and were dominated by *A. marina*. There were also some isolated *C. tagal* trees (Figure 2.46), and some *R. stylosa* trees in the open forests. Community type was similar to previous years, with low closed forests dominating the area, and open forests along the seaward margin (Figure 2.46). There were also some areas of low open forest seaward of the closed forests.

Saltmarsh communities at Whyte Island were similar to those at Fisherman Islands, and were dominated by *S. australis*, *S. arbusculoides*, *S. quinqueflora* and *E. tomentosa*.

Mangrove Health

At Whyte Island there is a healthy band of mangroves on the seaward edge, with concentric bands of mangroves in fair health and poor health. Centrally, there is a large dieback area and bare saltpan / saltmarsh area. In places there are thin sections of recent dieback along the edge of the large dead area (Figure 2.48).

Mangrove health at Whyte Island has declined since 2002, with a decrease in the area of mangroves in good health, and an increase in the area of fair, poor and dead mangroves. The most notable changes have occurred in the south, where an area in good health in 2002 and 2004 declined to fair health in 2006 and 2008 (Figure 2.48 – Figure 2.51). The large dead patch in the south east, that was isolated from the primary dead patch by a band of mangroves in fair health in 2002, has expanded to become a part of the larger dead area to the north.



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.46 Mangrove community structure and species composition at Whyte Island.
	November 2008

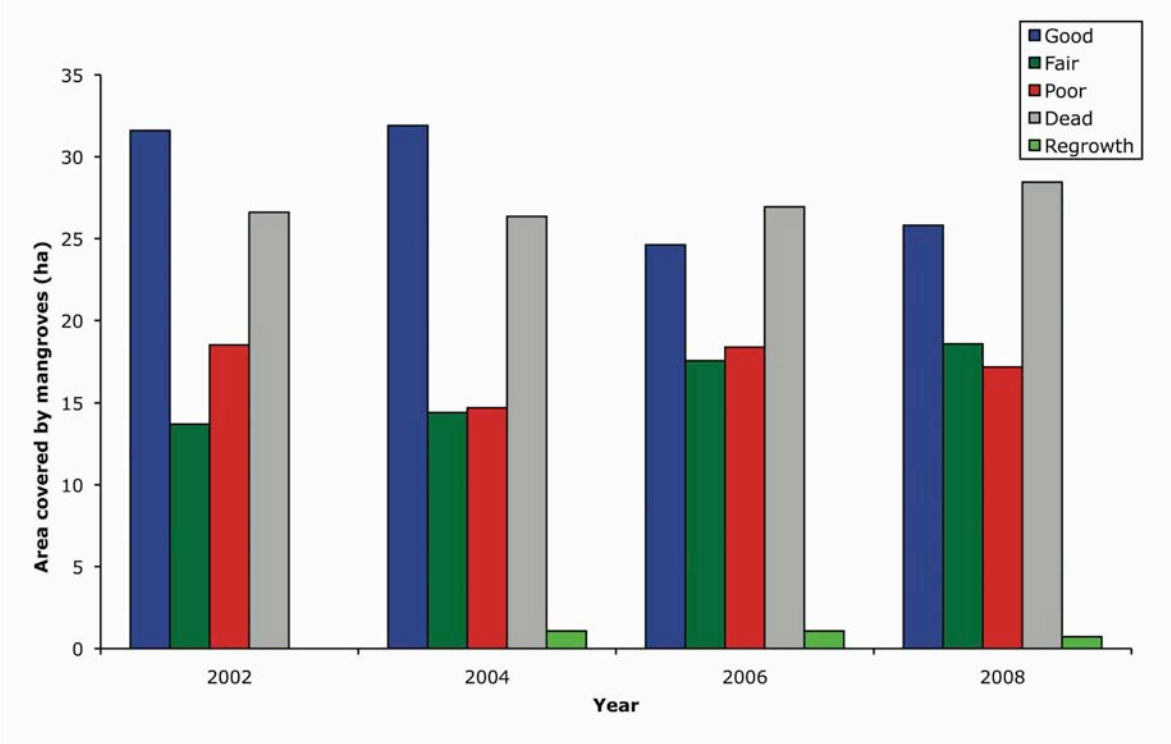


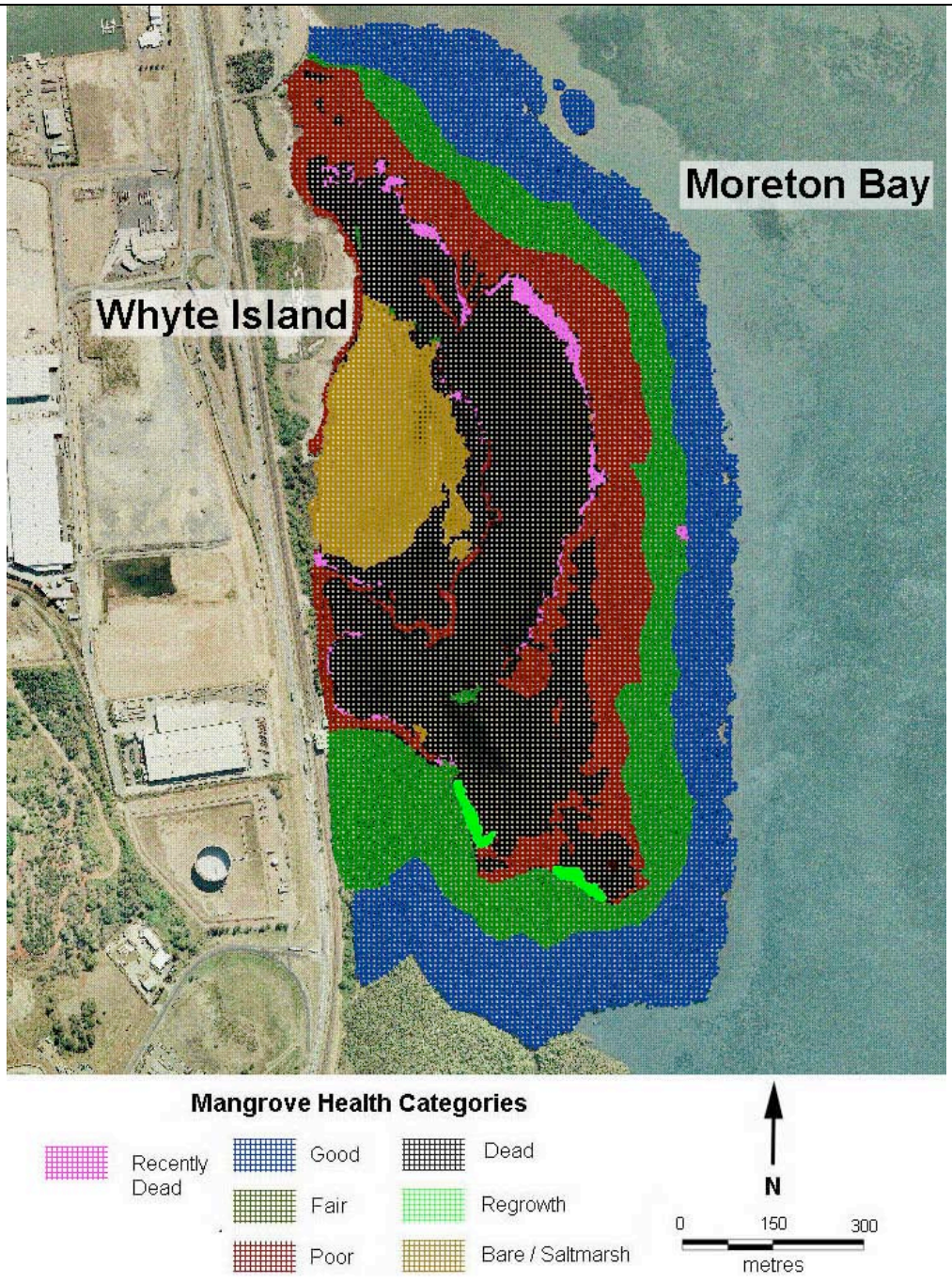
Figure 2.47 Extent of mangroves in each health category at Whyte Island from 2002 – 2008.

Since 2002, the central area in poor health has expanded and the trees have thinned and become more patchy. Between 2006 and 2008, there was, however, some transition of poor areas to fair along the south western part of the poor area.

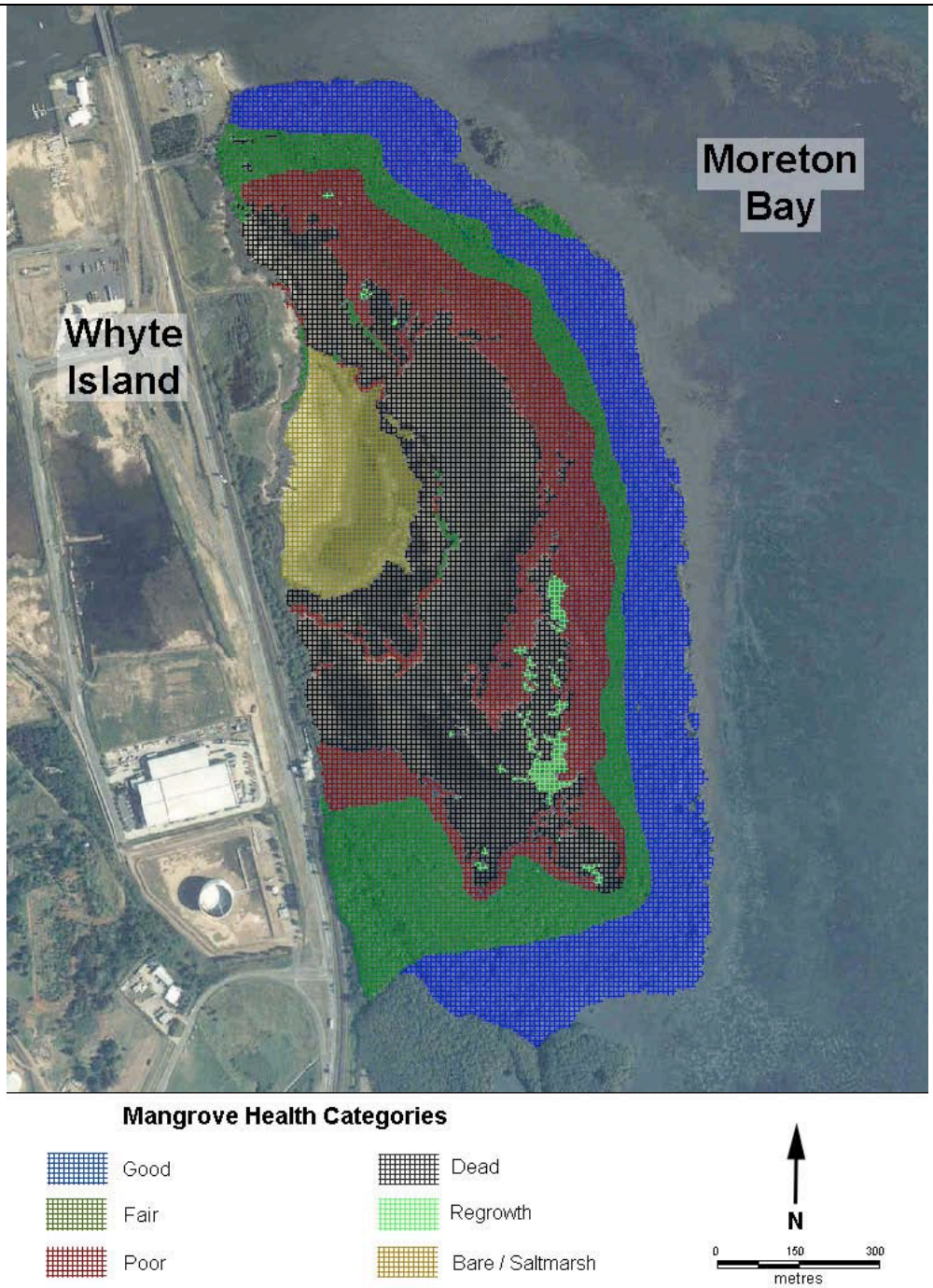
By 2008, much of the southern regrowth recorded in 2006 had not survived, or was in poor health. In 2008, regrowth was confined to two small areas at the far southern end of the main dieback area. There has been no improvement in health in areas previously damaged by insects in 2004, with much of this area in fair or poor health in 2008.

Between 2006 and 2008, the area of dead mangroves in the middle of Whyte Island increased in size, with recently dead mangroves forming a rim around the edge (Figure 2.48).

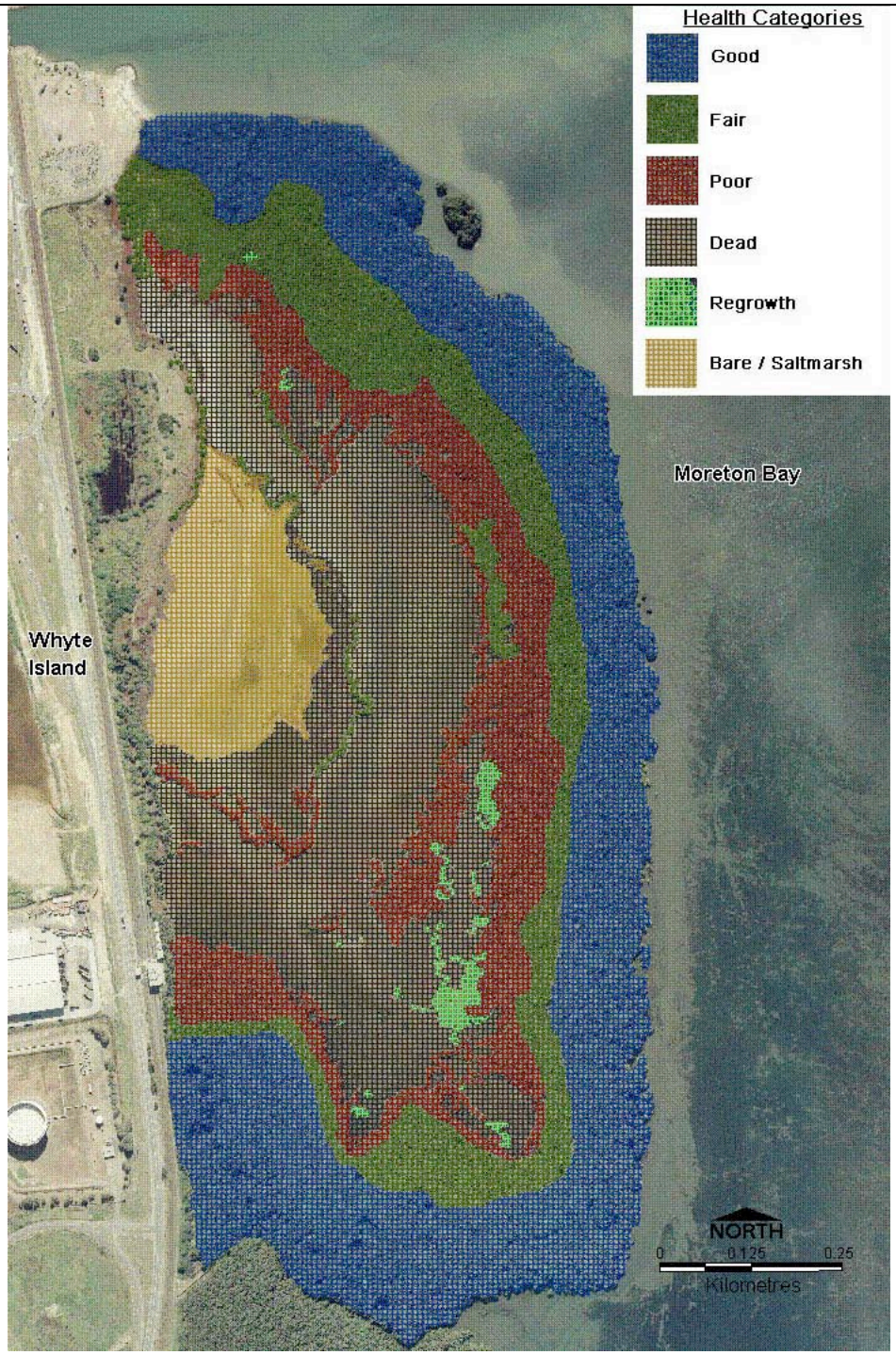
During the 2006 survey, which included a high tide of 2.01 m, there was no substantial ponding of water on Whyte Island. However, during the 2008 survey the saltmarsh / bare area was submerged at all stages of the tide.



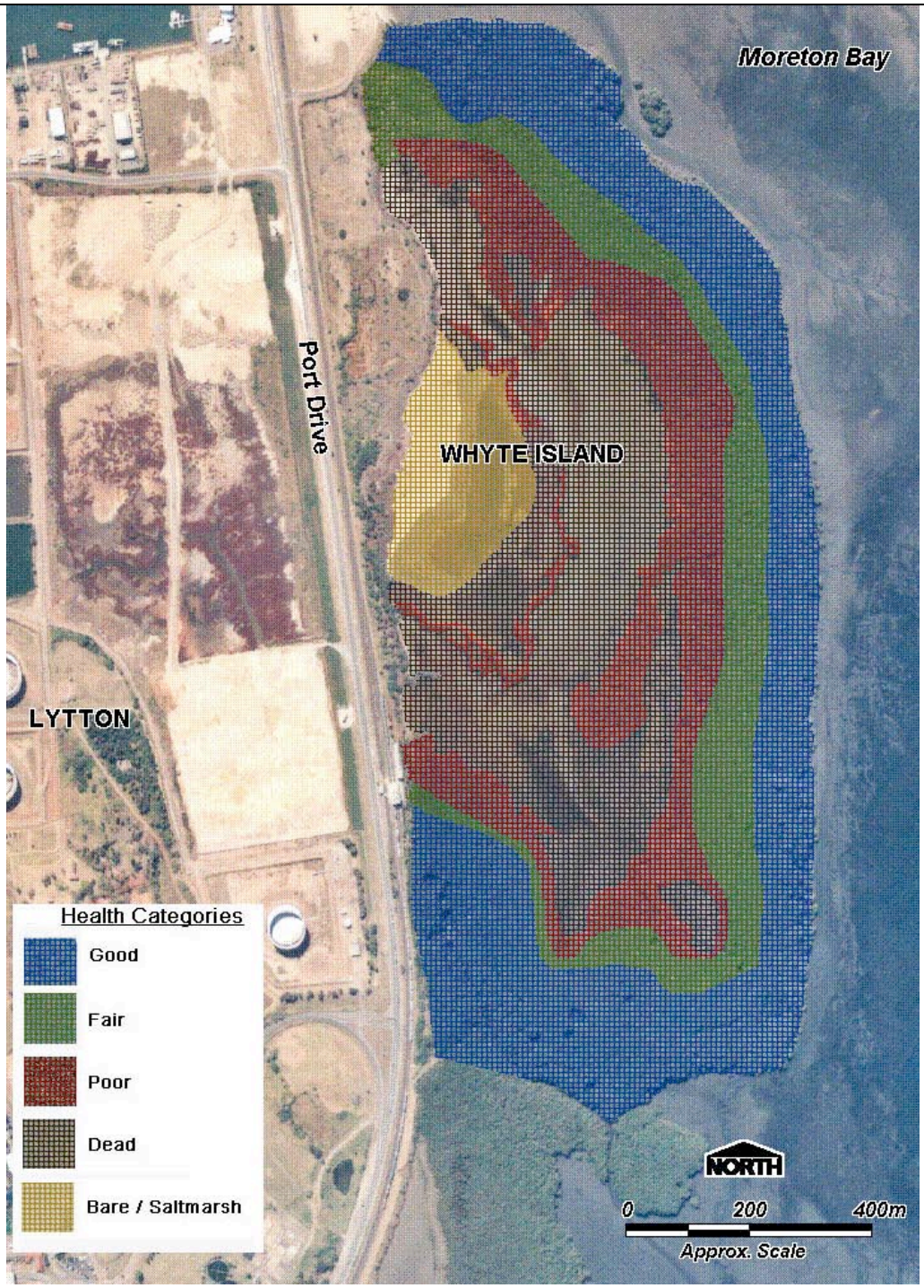
frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.48 Mangrove Health at Whyte Island in 2008.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.49 Mangrove Health at Whyte Island in 2006.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.50 Mangrove Health at Whyte Island in 2004.
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 2.51 Mangrove Health at Whyte Island in 2002 (WBM 2002b).
	November 2008

Sub-lethal Indicators of Mangrove Health

Macroalgae

Epiphytic algae such as *B. moritiziana* only grew on *A. marina* pneumatophores in the open forests of Whyte Island. In places, particularly in the areas of dead mangroves, and mangroves in poor health, there were thick algal mats growing over the sediment (Figure 2.52).

Figure 2.52

Thick algal mat in the dead area at Whyte Island.

Insect Damage

As in 2004 and 2006, there was damage by insects in many areas at Whyte Island. Insect damage was highest in the south and south east of the island, in areas of poor health and regrowth.

Seedling Density

As in 2004 and 2006, seedling density was highest in areas of open forest around the edge of the island. There were also some seedlings in the dead areas, and in the areas of poor health in the middle of Whyte Island. In 2008, seedlings were dense around the open forests surrounding the edge of the island, but few seedlings were observed in the central dead area.

Abundance of Macrofauna

In general, macrofauna abundance, as indicated by crab hole abundance, was higher in the more seaward mangroves of Whyte Island. Very little fauna was recorded in ponded areas; a few snails inhabited some areas. Anoxic sediment conditions in the poor health and dead areas are likely to render these areas unsuitable habitat for fauna (especially burrowing species).

3 Photographic Monitoring

3.1 Methods

In 1999/2000, 19 permanent photographic monitoring sites were established in the mangrove communities of Fisherman Islands, including the Coal Loader area (Figure 3.1 & Figure 3.2). Sites were marked with a plastic star picket, their co-ordinates recorded using a GPS, and digital photographs taken in each cardinal direction (WBM 2001). These sites were re-photographed in 2000-2001 (WBM 2001), 2002 (WBM 2002c), 2004 (frc environmental 2004), 2006 (frc environmental 2007a) and in the present 2008 survey.

The GPS location of each site is listed in Appendix F.

PVC pipes were used as a reference point in each photo; different numbers of coloured tape were used to indicate the direction in which the photo was taken. Data on the mangrove communities at each of the permanent marks was recorded and incorporated into the mapping described in Section 2.

Photographs were downloaded to a computer and visually assessed for differences between surveys.

frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 3.1 Photographic monitoring sites at the Coal Loader area at southern Fisherman Islands
	November 2008

frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008	
	Figure 3.2	Photographic monitoring sites at Fisherman Islands
		November 2008

3.2 Results

Photographs for each site in 2006 and 2008 are presented in Appendix A. A brief summary of community structure at each of the sites, and changes since the previous monitoring events, are given in Table 3.1.

Table 3.1 Description of mangrove communities surrounding each photographic monitoring sites, and differences observed in the photos compared to those taken in previous monitoring events

Site	Current Description	Observations
1	Open *Ceriops tagal* forest with an *Avicennia marina* understorey. Mangroves are growing on firm sand but there is bank erosion. Fair health due to bare *A. marina* branches and mangroves falling into the water due to erosion.	Sand incursion was visible to the south and west of the marker in 2006. This incursion appeared to have progressed further in 2008, with deeper and more reticulated sand to the west. There were more pneumatophores west of the marker in 2008.
2	Mature *A. marina* forest in good health. Dense layer of *A. marina* seedlings and an area of regrowth nearby.	Seedling density to the south and east of the marker were slightly lower in 2008 than 2006, otherwise seedling density and size were similar. There had not been any significant change in the elevated area to the west, which was dominated by terrestrial and saltmarsh species.
3	Mature, open *A. marina* forest with some *Aegiceras corniculatum* present. Good health although there is a little epicormic growth.	The distribution of mangroves, foliage cover and seedling numbers in 2008 were very similar to 2006.
4	Mature open *A. marina* forest with some *A. corniculatum* and *Rhizophora stylosa* present. Good health.	The density of seedlings was slightly less in 2008 than 2006, most noticeably to the south. The size and location of the sand bank to the south had not changed. *Permanent marker is missing.*
5	Fringe of *A. marina* shrubs along the beach to the south of the Coal Loader area. Fair condition.	The distribution of mangroves was very similar between 2006 and 2008. Pneumatophores not present in 2004 were observed in 2006 and 2008. *Permanent marker is missing.*

Site	Current Description	Observations
6	Low *A. marina* closed forest with a ground cover of saltmarsh species. Good health with some regrowth and thin saplings present.	The health of this area was similar in 2006 and 2008, although there were fewer seedlings in 2008.
8	*A. marina* low closed forest with good health.	Seedling density was lower in 2008 than 2006. There were similar numbers of fallen branches, except south of marker where there were more fallen branches.
10	Low *C. tagal* closed forest with *A. marina* nearby. Good health.	The site was very similar in 2004, 2006 and 2008.
11	Low *C. tagal* closed forest with *A. marina* present. Fair health due to soil erosion and leaf colour.	The trees appeared to have slightly less foliage and lighter leaf colour in 2008 than 2006.
13	Middle of saltpan – Fisherman Islands, with dead mangroves surrounding it.	Saltmarsh distribution, on the flats, is similar in 2006 and 2008. In 2008 the area was ponded but in 2006 it was very dry.
14	Dead area with a low closed forest of *A, marina*, in poor health, nearby.	The area was dry in 2004 and 2006, and covered predominantly by cyanobacterial mats, but in 2008 it was inundated. There was more saltmarsh in 2008 than 2006.
15	Low open forest of *A. marina*, poor health due to epicormic growth and damage by insects.	Regrowth vegetation at this site was similar between 2006 and 2008. Trees to the north and east of the marker had grown slightly.
16	Tall open *A. marina* forest with fair health. Seagrass wrack, litter and dead mangrove material all present.	There were fewer seedlings in 2008 than 2006, but similar amounts of debris (e.g. refuse and logs) on the forest floor in both years. West of the marker, the foliage in the foreground had thinned considerably.
17	Mature tall open *A. marina* forest. Good health.	The site was similar in appearance and health in both 2006 and 2008.

Site	Current Description	Observations
18	Mature open *A. marina* forest in good health with some *R. stylosa*. Seagrass wrack present.	Mangrove health and distribution has not changed. Frequent human traffic to the east of the marker had created a track devoid of pneumatophores.
19	Dead area with no regrowth.	In 2006 the area was dry but in 2008 it was inundated. In 2008, the saltmarsh was thicker and there was further mangrove dieback, except to the north.
20	*A. marina* forest in good health. Some *R. stylosa* present.	The site was similar in appearance and health in both years.
22	Dead area in the middle of an *A. marina* forest. Saltmarsh species present.	In 2006 the site was dry and covered with cyanobacterial mats. In 2008, it was inundated and there was substantial dieback. West of the marker, mangroves have thinned in the distance; south of marker the closer mangroves now are dead; east and north of marker there were substantial reductions in foliage cover, continuing the trend previously observed (foliage cover was greatest in 1999/2000).
23	*A. marina* forest in poor health with some *C. tagal* present.	This site has remained similar between 2006 and 2008, although in 2008 there was more epicormic growth east of the marker than in 2006.

4 Sediment Quality

4.1 Methods

Sediment sampling sites were established and sampled at Fisherman Islands in 1999/2000 (WBM 2000, Figure 4.1, Appendix F) and resampled in 2002 (WBM 2002a), 2004 (frc environmental 2004) and 2006 (frc environmental 2007a). Sediment sampling sites were established at Whyte Island in 2002 (WBM 2002b, Figure 4.3, Appendix F) and resampled in 2004 and 2006. In this 2008 survey, sediments were resampled from these sites and analysed for heavy metals, total petroleum hydrocarbons (TPH), BTEX, organochlorine pesticides and nutrients. As in the previous surveys, samples were collected from the surface sediments (up to 10 cm deep).

frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008	
	Figure 4.1 Sediment sampling sites in the Coal Loader area of Fisherman Islands.	
		November 2008

frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 4.2 Sediment sampling sites, Fisherman Islands.
	November 2008

frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 4.3 Sediment sampling sites at Whyte Island.
	November 2008

Sediment samples from the Coal Loader area and northern Fisherman Islands (sites 17 and 18) were collected on 14th of May 2008. The remaining Fisherman Islands samples and all Whyte Island samples were collected from the 11th – 13th of June 2008.

Samples were refrigerated and forwarded to Simmonds & Bristow laboratories within 48 hours of collection, and analysed for:

- heavy metals (Cu, Pb, Zn, Cr, Cd, As, Ni, Hg)
- total petroleum hydrocarbons (TPH)
- BTEX (benzene, toluene, ethylene & xylene)
- organochlorine pesticides (total chlordane, oxychlordane, dieldrin, aldrin, heptachlor, heptachlor epoxide, methoxychlor, endrin, DDD, DDE, DDT, alpha and beta BHC, lindane, endosulfan (total alpha, beta and sulfate) and hexachlorobenzene), and
- nutrients (nitrogen oxides, total Kjeldahl nitrogen, total nitrogen and total phosphorus).

Table 4.1 lists the parameters analysed for each site.

Any results less than the Practical Quantification Limit (PQL) were entered as half the PQL, for analytical purposes (Environment Australia 2002).

Table 4.1 Sediment analysis schedule for Fisherman Islands and Whyte Island in 2008.

Site	Moisture Content	OC Pesticides	Heavy Metals	Nutrients	TPH & BTEX
Fisherman Islands					
FI 1	✓	–	✓	✓	✓
FI 2	✓	–	–	–	✓
FI 3	✓	–	✓	✓	✓
FI 4	✓	–	–	–	✓
FI 6	✓	–	✓	✓	✓
FI 7	✓	–	–	–	✓
FI 9	✓	✓	✓	✓	✓
FI 11	✓	–	✓	✓	✓
FI 13	✓	–	✓	✓	✓
FI 15	✓	–	✓	✓	✓
FI 17	✓	–	✓	✓	✓
FI 18	✓	–	✓	✓	✓
FI 19	✓	✓	✓	✓	✓
FI 22	✓	–	–	–	✓
FI 23	✓	✓	✓	✓	✓
Whyte Island					
WI 1	✓	✓	✓	✓	✓
WI 2	✓	✓	✓	✓	✓
WI 3	✓	✓	✓	✓	✓

4.2 Results and Discussion

Nutrients

Fisherman Islands

In 2008 total nitrogen concentrations in the sediment at Fisherman Islands ranged from 700 mg/kg at site 1 to 13,000 mg/kg at site 23 (Table 4.2). Concentrations at sites 13, 15 and 23 were substantially higher than previous surveys (Table 4.3 – Table 4.5). At site 6, total nitrogen concentrations in 2008 were also high, but similar to concentrations in 2006.

Total nitrogen concentrations at sites 9, 17 and 19 were lower than 2006 values and similar to 2002 and 1999 values (Table 4.3 – Table 4.5).

Total nitrogen concentrations in the substrate of mangroves in good health (sites 3, 6, 11, 17 and 18) ranged from relatively low concentrations of ≤1,600 mg/kg at sites 11 and 17 to 9,200 mg/kg at site 6. In areas of fair health (sites 1, 9 and 23) concentrations were highly variable ranging from 700 mg/kg at site 1 to 13,000 mg/kg at site 23. In the poor area (site 15) total nitrogen concentration was 10,000 mg/kg. In the dead area (sites 19) total nitrogen concentration was 1,100 mg/kg. There were no clear trends linking total nitrogen concentrations in sediments to mangrove health.

Total phosphorous concentrations at Fisherman Islands in 2008 ranged from 350 mg/kg at site 17 to 1,100 mg/kg at site 3 (Table 4.2), and were comparable to 2006 concentrations at most sites (Table 4.4), but higher than 2002 and 1999 concentrations.

Whyte Island

Total nitrogen concentrations in sediment at Whyte Island ranged from 7,400 mg/kg at site 3 to 18,000 mg/kg at site 2 (Table 4.2). Concentrations at sites 1 and 2 have substantially increased since 2002, particularly from 2006 – 2008. At site 3, concentrations in 2008 were lower than in 2006.

Total phosphorous concentrations in sediment at Whyte Island ranged between 780 mg/kg at site 1 to 2,700 mg/kg at site 3 (Table 4.6). Concentrations at most sites had progressively increased since 2002.

Wynnum WWTP discharges into Moreton Bay via a discharge pipe near site 3 on Crabbe Creek on Whyte Island. Total nitrogen and phosphorus discharge has decreased since 2004. Total nitrogen discharge was 64,000 kg in 2005 – 5, 58,000 kg in 2005 – 6, and 57,700 kg in 2006 – 7 (NPI 2008). Total phosphorus discharge was 24,800 kg in 2004 – 5, 23,100 kg in 2005 – 6 and 22,500 kg in 2006 – 7 (NPI 2008). Effluent was observed during our 2004 field surveys.

The Wynnum WWTP was upgraded to include a water reclamation plant (WRP) in September 2007. The main aim of the upgrade was to improve the quality of the treated wastewater, particularly remove nitrogen (BWEA 2008). This may explain the reduction in total nitrogen concentrations at site 3 in 2008, compared to 2006.

Table 4.2 Nutrient concentrations (mg/kg) in sediments from Fisherman Islands in 2008.

	Fisherman Islands Sediment Sample Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	490	1,100	690	780	670	690	780	350	420	690	930
Total Kjeldahl Nitrogen	700	4,100	9,200	1,900	1,500	3,100	10,000	1,600	3,000	1,100	13,000
Nitrate & Nitrite – N	0.1	0.1	0.2	0.1	0.1	0.5	0.6	0.2	0.1	0.1	0.5
Total Nitrogen	700	4,100	9,200	1,900	1,500	3,100	10,000	1,600	3,000	1,100	13,000

Table 4.3 Nutrient concentrations (mg/kg) in sediments from Fisherman Islands in 2006.

	Fisherman Islands Sediment Sample Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	460	930	770	660	980	460	580	690	470	690	650
Total Kjeldahl Nitrogen	700	5,070	8,900	6,400	1,440	1,130	580	8,780	2,180	5,180	8,960
Nitrate – N	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5
Nitrite – N	<0.5	<0.5	0.5	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Nitrogen	700	5,070	8,900	6,400	1,440	1,130	580	8,780	2,180	5,180	8,960

Table 4.4 Nutrient concentrations (mg/kg) in sediments from Fisherman Islands in 2002 (WBM 2002a).

	Fisherman Islands Sediment Sample Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	494	555	348	223	338	526	449	219	87	444	139
Total Kjeldahl Nitrogen	993	2,320	2,490	1,890	1,310	1,320	573	1,020	635	772	1,670
Nitrite and Nitrate – N	2.2	4.7	0.4	9.1	0.2	0.6	0.8	0.2	<0.2	0.3	0.4
Total Nitrogen	995	2,320	2,490	1,890	1,310	1,320	573	1,020	635	772	1,670

Table 4.5 Nutrient concentrations (mg/kg) in sediments from Fisherman Islands in 1999 (WBM 2000).

	Fisherman Islands Sediment Sample Site										
	1	**3**	**6**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**23**
Phosphorus	410	460	170	150	430	360	400	290	380	500	230
Total Kjeldahl Nitrogen	600	1,800	260	430	1,890	1,570	540	1,110	1,580	740	2,540
Nitrite and Nitrate – N	0.15	0.5	0.15	<0.05	0.2	1.2	<0.05	0.1	0.3	0.35	0.15
Total Nitrogen	600	1,800	260	430	1,900	1,570	540	1,110	1,580	740	2,540

Table 4.6 Nutrient concentrations (mg/kg) recorded in sediments from Whyte Island in 2002, 2006 and 2008.

	Whyte Island Sediment Sample Site								
	1			2			3		
	2002	2006	2008	2002	2006	2008	2002	2006	2008
Phosphorus	216	920	780	134	610	1,000	1,080	1,200	2,700
Total Kjeldahl Nitrogen	3,230	4,520	10,000	2,520	7,050	18,000	2,590	11,900	7,400
Nitrate – N	2*	<0.5	0.2*	2.8*	8.5	0.7*	6.1*	<0.5	0.7*
Nitrite – N		<0.5			<0.5			<0.5	
Total Nitrogen	3,320	4,520	10,000	2,520	7,060	18,000	2,590	11,900	7,400

*Nitrate and nitrite N

Regional Perspective

Concentrations of total extractable nitrogen in mangrove sediments vary with sediment type, with higher levels in finer deposits (Alongi et al. 1982). Total nitrogen concentrations in mangrove sediment usually range from 600 – 2,000 mg/kg (Clough et al. 1983) and total phosphorous from 100 – 1,600 mg/kg (Alongi et al. 1992). In Queensland, a range of concentrations have been recorded (Table 4.7) with relatively high values recorded near the Luggage Point Wastewater Treatment Plant (WWTP) (WBM 2000).

Table 4.7 Nutrient concentrations (mg/kg) recorded in mangrove sediments in Queensland.

	Luggage Pt*[1]	**Wellington Pt[1]**	**Victoria Pt[1]**	**Deception Bay[1]**	**Qld Estuaries[2]**	**North Qld[3]**
Phosphorus	1,367	656	526	250	100 – 700	50 – 450
Total Nitrogen	8,606	2,566	3,000	1,043	200 – 4,000	1,000 – 4,000

* Near sewage discharge
[1] Average of 3 values (WBM 2000)
[2] Alongi et al 1992
[3] Average of 15 values from 9 sites (Kaly et al 1997)

Nutrient concentrations of several sites at Fisherman and Whyte Islands in 2008 were higher than other Queensland locations (Table 4.2 & Table 4.6). Concentrations were similar to those at Luggage Point in 1999, in the vicinity of the Luggage Point WWTP (WBM 2000) (Table 4.7).

At Fisherman Islands, total nitrogen concentrations exceeded Queensland sites, excluding Luggage Point, at site 3; sites 6, 15 and 23 exceeded concentrations measured at Luggage Point. At Fisherman Islands, total phosphorus concentrations exceeded Queensland sites, excluding Luggage Point, at site 3, 9, 15 and 23, although sites 6, 11, 13 and 19 were < 30 mg/kg below the maximum measured at these Queensland sites. Total phosphorus concentrations did not exceed concentrations at Luggage Point.

At Whyte Island, total nitrogen and total phosphorus concentrations were highest at site, near the WWTP discharge and exceeded concentrations measured at Luggage Point here. Concentrations were also elevated at sites 1 and 2, exceeding other recordings from Queensland, excluding Luggage Point. Nutrient concentrations were generally higher at Whyte Island than Fisherman Islands. High nutrient levels at Whyte Island were likely caused by discharge from the Wynnum WWTP.

Petroleum Hydrocarbons and BTEX

Petroleum hydrocarbons are assessed in fractions: petrol is in the C6 – C9 fraction, kerosene in the C10 – C18 fraction, diesel in C12 – C18 and lubricating oils above C18 (DPIW&E 2002). BTEX (benzene, toluene, ethylene and xylene) are aromatic hydrocarbons, which are commonly highly toxic to aquatic organisms (Connell 1995). Naturally occurring hydrocarbons are also picked up in the analyses, for example sequiturpenoids in mangrove leaves and roots are in the C10 – C28 fraction.

Fisherman Islands

In 2008, total petroleum hydrocarbon (TPH) and BTEX concentrations at Fisherman Islands were generally below the Practical Quantitation Limits (PQLs) (Table 4.8). TPH and BTEX concentrations in 2008 were substantially lower than previous surveys for most of the contaminants (Table 4.9 – Table 4.11).

Whyte Island

In 2008, THP and BTEX concentrations at Whyte Island were generally below the PQLs. THP and BTEX concentrations in 2008 were lower or substantially lower, than previous surveys for all of the contaminants (Table 4.12).

Table 4.8 TPH and BTEX concentrations (mg/kg) in sediments from Fisherman Islands in 2008.

	Fisherman Islands Sediment Sample Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons[1]															
C6 – C9	<1	1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C10 – C14	<5	<5	<5	<5	<5	<5	<2	<2	<2	<2	<5	<5	<2	<2	<2
C15 – C28	<10	<10	<10	<10	<10	<10	<4	<4	<4	<4	<10	<10	<4	<4	<4
C29 – C36	<5	<5	<5	<5	<5	<5	<2	<2	<2	<2	<5	<5	<2	<2	<2
BTEX															
Benzene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0019
Toluene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ethyl Benzene	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
m+p xylenes	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-xylem	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total BTEX	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004

[1]Sites sampled during the second event (9, 11, 13, 15, 19, 22 and 23) have lower PQLs for the TPH fractions C10 – C14, C15 – C28 and C29 – C36 because the analytical laboratory refined their technique since the first event was processed (T. Lawlor [Simmonds & Bristow] 2008, pers. comm., 11th of July).

Table 4.9 TPH and BTEX concentrations (mg/kg) in sediments from Fisherman Islands in March 2006.

	Fisherman Islands Sediment Sample Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6 – C9	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
C10 – C14	<10	<10	13	<10	54	<10	12	<10	<10	<10	15	<10	<10	<10	22
C15 – C28	58	330	280	100	160	62	150	80	<50	<50	420	100	50	52	120
C29 – C36	65	440	250	110	220	91	150	50	<50	<50	400	130	99	68	230
BTEX															
Benzene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Toluene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Ethyl Benzene	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
m+p xylenes	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
o–xylem	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Total BTEX	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2

Table 4.10 TPH and BTEX concentrations (mg/kg) sediments from Fisherman Islands in 2002 (WBM 2002a).

	Fisherman Islands Sediment Sample Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6 – C9	<2	<4	<4	<4	<4	<2	<4	<2	<2	<2	<4	<4	<2	<4	<4
C10 – C14	<50	<100	<100	<100	<100	<50	<100	<50	<50	<50	<100	<100	<50	<100	<100
C15 – C28	<100	<200	<200	<200	<200	<100	<200	<100	<100	<100	<200	<200	<100	<200	<200
C29 – C36	<100	<200	<200	<200	<200	<100	<200	<100	<100	<100	<200	<200	<100	<200	<200
BTEX															
Benzene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
Toluene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
Ethyl Benzene	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
m+p xylenes	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4
o–xylem	<0.2	<0.4	<0.4	<0.4	<0.4	<0.2	<0.4	<0.2	<0.2	<0.2	<0.4	<0.4	<0.2	<0.4	<0.4

Table 4.11 TPH and BTEX concentrations (mg/kg) sediments from Fisherman Islands in 1999 (WBM 2000).

	Fisherman Islands Sediment Sample Site														
	1	**2**	**3**	**4**	**6**	**7**	**9**	**11**	**13**	**15**	**17**	**18**	**19**	**22**	**23**
Total Petroleum Hydrocarbons															
C6 – C9	<2	<5	<5	<5	<2	<2	<2	<2	<5	<2	<5	<5	<2	<5	<5
C10 – C14	<50	<125	<125	<125	<50	<50	<50	<50	<125	<50	<125	<125	<50	<125	<125
C15 – C28	<100	<250	<250	<250	<100	<100	<100	<100	<250	<100	<250	<250	<100	<250	435
C29 – C36	<100	<250	<250	<250	<100	<100	<100	<100	<250	<100	<250	<250	<100	<250	565
BTEX															
Benzene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
Toluene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
Ethyl Benzene	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
m+p xylenes	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5
o–xylem	<0.2	<0.5	<0.5	<0.5	<0.2	<0.2	<0.2	<0.2	<0.5	<0.2	<0.5	<0.5	<0.2	<0.5	<0.5

Table 4.12 TPH and BTEX concentrations (mg/kg) in sediments from Whyte Island in 2002, 2006 and 2008.

	Whyte Island Sediment Sample Site								
	1			2			3		
	2002	2006	2008	2002	2006	2008	2002	2006	2008
Total Petroleum Hydrocarbons									
C6 – C9	<4	<10	<1	<4	<10	<1	<4	<10	<1
C10 – C14	<100	14	<5	1,030	24	<5	332	15	<5
C15 – C28	<200	130	<10	2,600	210	<10	1,580	320	<10
C29 – C36	<200	91	<5	3,190	140	<5	1,610	210	<5
BTEX									
Benzene	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001
Toluene	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001
Ethyl Benzene	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001
m+p xylenes	<0.4	<0.4	<0.002	<0.4	<0.4	<0.002	<0.4	<0.4	<0.002
o–xylem	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001	<0.4	<0.2	<0.001
TOTAL BTEX	<1.0	<0.6	<0.003	<1.0	<0.6	<0.003	<1.0	<0.6	<0.003

Heavy Metals

Fisherman Islands

In 2008, most heavy metal concentrations at the Fisherman Islands sites were comparable to 2006 concentrations and within reported Queensland background levels (DoE 1998) (Table 4.13).

In 2008, arsenic concentrations at sites 13, 15 and 23 exceeded background levels, ANZECC Ecological Investigation Levels (EILs, ANZECC & ARMCANZ 2000), National Ocean Disposal (NOD) Screening Levels (ENVIRONMENT AUSTRALIA 2002) and Queensland Contaminated Land EILs (DoE 1998). At sites 11 and 19, arsenic concentrations exceeded NOD Maximum Levels (rather than Screening Levels) and DoE background levels, ANZECC EILs and DoE EILs. In 2006, arsenic concentrations at site 11 also exceeded NOD Screening Levels and DoE background levels, ANZECC EILs and DoE EILs (Table 4.14).

In 2008, nickel concentrations at site 13 slightly exceeded the NOD Screening Level but were still within the background range. In 2006 nickel concentrations marginally exceeded NOD Screening Level, but were still within the background range, at sites 6, 13 and 19.

Sites that were in good health (sites 9, 17 and 18) did not exceed heavy metal guidelines. Sites that exceeded guidelines included mangroves in fair health (site 11, 15 and 23) and recently dead areas (site 13 and 19). Site 22 was the exception as concentrations were within guidelines and the site was within a dieback area.

Whyte Island

At Whyte Island in 2008 most heavy metal concentrations were within background levels at most sites (Table 4.17). Mercury concentrations exceeded background levels and ANZECC EILs, NOD Maximum Levels and Queensland Contaminated Land EILs (DoE 1998) at site 1 and 2 in 2008. Mercury concentrations also exceeded guidelines at these sites in 2002 and levels have continued to increase since 2002.

The Whyte Island site in good health (site 3) did not exceed heavy metal guidelines, whereas sites that exceeded guidelines were in dieback areas (sites 1 and 2).

Oganochlorine Pesticides

As in previous surveys, all organochlorine pesticides concentrations at Fisherman Islands and Whyte Island were below PQLs (Table 4.18 – Table 4.20). Organochlorides are unlikely to be associated with the large dieback areas.

Table 4.13 Heavy metal concentrations (mg/kg) in sediments from Fisherman Islands in 2008.

	Background Levels[3b]	EILs[1]	NOD[2]		DoE[3]	Fisherman Islands Sediment Sample Site										
			SL[2a]	ML[2b]		1	3	6	9	11	13	15	17	18	19	23
Arsenic	0.2 – 30	20	20	70	20	2.8	2.5	2.2	8.5	83	51	58	3.2	3.1	72	40
Cadmium	0.04 – 2	3	1.5	10	3	0.50	0.50	0.50	<0.50	<0.50	<0.50	<0.50	0.50	0.50	<0.50	<0.50
Chromium	0.5 – 110	400*	80	370	50	8.9	14	10	26	20	36	22	9.4	9.5	37	27
Copper	1 – 190	100	65	270	60	5.3	11	8.3	25	14	28	13	4.6	4.5	22	20
Mercury	0.001 – 0.1	1	0.15	1	1	0.060	0.10	0.080	<0.010	0.060	0.030	0.080	0.040	0.050	0.060	<0.010
Nickel	2 – 400	60	21	52	60	4.7	7.0	5.6	13	9.9	22	13	5.3	5.4	19	14
Lead	<2 – 200	600	50	220	300	4.0	8.6	4.7	11	8.9	14	11	3.0	3.0	15	15
Zinc	2 - 180	200	200	410	200	20	32	26	44	36	73	52	19	22	66	45

[1] ANZECC guidelines on Investigation Levels for Soil and Groundwater Ecological Investigation Levels (EILs), interim EILs for urban setting (ANZECC & ARMCANZ 2000).
[2] National Ocean Disposal (NOD) Guidelines for Dredged Material (Environment Australia 2000).
[2a] NOD Screening Level
[2b] NOD Maximum Level
[3] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Environmental Investigation Levels (DoE 1998).
[3b] DoE guidelines for Background levels found in sediment (DoE 1998).
* Levels from Chromium III used. Chromium VI EIL is 1. Further testing would be required to determine if Chromium VI levels were exceeded.

Table 4.14 Heavy metal concentrations (mg/kg) in sediments from Fisherman Islands in March 2006.

	Background Levels[3b]	EILs[1]	NOD[2]		DoE[3]	Fisherman Islands Sediment Sample Site										
			SL[2a]	ML[2b]		1	3	6	9	11	13	15	17	18	19	23
Arsenic	0.2 – 30	20	20	70	20	5	5.8	6.1	2.8	24	6.4	6.7	9.6	7.7	10	3.6
Cadmium	0.04 – 2	3	1.5	10	3	<0.1	<0.1	0.41	<0.1	0.15	<0.1	<0.1	0.15	<0.1	0.1	<0.1
Chromium	0.5 – 110	400*	80	370	50	22	37	43	21	36	46	29	34	30	49	34
Copper	1 – 190	100	65	270	60	11	28	20	13	11	23	12	19	13	27	17
Mercury	0.001 – 0.1	1	0.15	1	1	0.03	0.05	0.08	0.08	0.04	0.05	0.04	0.05	0.02	0.05	0.04
Nickel	2 – 400	60	21	52	60	11	18	22	11	16	25	16	19	16	26	17
Lead	<2 – 200	600	50	220	300	8.7	20	15	11	10	11	8.6	13	10	15	18
Zinc	2 - 180	200	200	410	200	43	76	78	39	54	64	49	72	60	72	52

[1] ANZECC guidelines on Investigation Levels for Soil and Groundwater Ecological Investigation Levels (EILs), interim EILs for urban setting (ANZECC & ARMCANZ 2000).
[2] National Ocean Disposal (NOD) Guidelines for Dredged Material (Environment Australia 2000).
[2a] NOD Screening Level
[2b] NOD Maximum Level
[3] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Environmental Investigation Levels (DoE 1998).
[3b] DoE guidelines for Background levels found in sediment (DoE 1998).
* Levels from Chromium III used. Chromium VI EIL is 1. Further testing would be required to determine if Chromium VI levels were exceeded.

Table 4.15 Heavy metal concentrations (mg/kg) in sediments from Fisherman Islands in 2002 (WBM 2002a).

	Background Levels[3b]	EILs[1]	NOD[2]		DoE[3]	Fisherman Islands Sediment Sample Sites										
			SL[2a]	ML[2b]		1	3	6	9	11	13	15	17	18	19	23
Arsenic	0.2 – 30	20	20	70	20	7.4	7.5	10.1	5.7	11.5	8.4	11.3	17.5	8.6	7.3	5.3
Cadmium	0.04 – 2	3	1.5	10	3	<0.01	<0.2	<0.2	0.3	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.2
Chromium	0.5 – 110	400*	80	370	50	25.4	37.8	28.6	20.0	18.5	44.2	33.7	23.1	17.9	43.1	33.9
Copper	1 – 190	100	65	270	60	12.6	28.3	26.0	14.7	7.4	21.6	12.9	12.2	7.2	20.1	17.7
Mercury	0.001 – 0.1	1	0.15	1	1	<0.1	<0.2	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	0.6	0.4	1.1
Nickel	2 – 400	60	21	52	60	12.3	18.4	16.4	10.0	7.9	25.7	20.9	14.7	10.8	22.5	16.7
Lead	<2 – 200	600	50	220	300	11.9	24.6	15.4	11.2	8.7	14.4	11.5	8.7	6.4	13.3	21.6
Zinc	2 - 180	200	200	410	200	50.5	83.9	84.7	47.5	27.1	73.7	63.8	47.6	36.0	75.5	50.6

[1] ANZECC guidelines on Investigation Levels for Soil and Groundwater Ecological Investigation Levels (EILs), interim EILs for urban setting (ANZECC & ARMCANZ 2000).
[2] National Ocean Disposal (NOD) Guidelines for Dredged Material (Environment Australia 2000).
[2a] NOD Screening Level
[2b] NOD Maximum Level
[3] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Environmental Investigation Levels (DoE 1998).
[3b] DoE guidelines for Background levels found in sediment (DoE 1998).
* Levels from Chromium III used. Chromium VI EIL is 1. Further testing would be required to determine if Chromium VI levels were exceeded.

Table 4.16 Heavy metal concentrations (mg/kg) in sediments from Fisherman Islands in 1999 (WBM 2000).

	Background Levels[3b]	EILs[1]	NOD[2]		DoE[3]	Fisherman Islands Sediment Sample Sites										
			SL[2a]	ML[2b]		1	3	6	9	11	13	15	17	18	19	23
Arsenic	0.2 – 30	20	20	70	20	6.8	8.95	3.1	2.8	8.35	9.7	7.65	7.05	6	5.1	4.35
Cadmium	0.04 – 2	3	1.5	10	3	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.1	0.05	0.05	<0.05	0.1
Chromium	0.5 – 110	400*	80	370	50	57.7	59.8	93.1	86	56.4	44.6	39.4	77	57.9	40.7	43.8
Copper	1 – 190	100	65	270	60	13.7	24.7	5.65	8.2	13.8	19.6	13.6	13.2	9.65	17.6	20.5
Mercury	0.001 – 0.1	1	0.15	1	1	0.1	0.15	<0.05	<0.05	0.05	<0.05	0.1	0.05	0.05	<0.05	0.1
Nickel	2 – 400	60	21	52	60	12.4	16.6	9.65	7	13.6	18.6	17.4	15.4	12.8	23.1	19.9
Lead	<2 – 200	600	50	220	300	11.5	24.2	4.05	5.05	12.3	16.3	11	10.4	8.15	11.7	18.9
Zinc	2 - 180	200	200	410	200	48.3	68.4	23.8	30.2	48.3	65.3	53.8	52.3	43.3	63.3	58

[1] ANZECC guidelines on Investigation Levels for Soil and Groundwater Ecological Investigation Levels (EILs), interim EILs for urban setting (ANZECC & ARMCANZ 2000).
[2] National Ocean Disposal (NOD) Guidelines for Dredged Material (Environment Australia 2000).
[2a] NOD Screening Level
[2b] NOD Maximum Level
[3] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Environmental Investigation Levels (DoE 1998).
[3b] DoE guidelines for Background levels found in sediment (DoE 1998).
* Levels from Chromium III used. Chromium VI EIL is 1. Further testing would be required to determine if Chromium VI levels were exceeded.

Table 4.17 Heavy metal concentrations (mg/kg) in sediments from Whyte Island in 2002, 2006 and 2008

	Background Levels[3b]	EILs[1]	NOD[2]		DoE[3]	Whyte Island Sediment Sample Site								
			SL[2a]	ML[2b]		1			2			3		
						2002	2006	2008	2002	2006	2008	2002	2006	2008
Arsenic	0.2 – 30	20	20	70	20	13	10	2.6	3.1	1.5	3.5	9.2	5.3	5.0
Cadmium	0.04 – 2	3	1.5	10	3	<0.2	<0.1	<0.50	<0.5	<0.1	<0.50	0.2	0.11	<0.50
Chromium	0.5 – 110	400*	80	370	50	37.1	43	28	15.4	38	24	52.1	41	41
Copper	1 – 190	100	65	270	60	21.2	21	31	21.8	17	34	84.5	84	56
Mercury	0.001 – 0.1	1	0.15	1	1	1.7	0.06	2.7	1.7	0.07	2.4	1.2	0.17	<0.010
Nickel	2 – 400	60	21	52	60	17.4	20	18	10.3	17	15	21.2	19	20
Lead	<2 – 200	600	50	220	300	17	18	18	10.5	26	25	45.5	31	26
Zinc	2 - 180	200	200	410	200	63.2	68	91	29.6	55	76	212	120	120

[1] ANZECC guidelines on Investigation Levels for Soil and Groundwater Ecological Investigation Levels (EILs), interim EILs for urban setting (ANZECC & ARMCANZ 2000).
[2] National Ocean Disposal (NOD) Guidelines for Dredged Material (Environment Australia 2000).
[2a] NOD Screening Level
[2b] NOD Maximum Level
[3] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Environmental Investigation Levels (DoE 1998).
[3b] DoE guidelines for Background levels found in sediment (DoE 1998).
* Levels from Chromium III used. Chromium VI EIL is 1. Further testing would be required to determine if Chromium VI levels were exceeded.

Table 4.18 Organochlorine concentrations (μg/kg) in sediments from Fisherman Islands in 2008.

	NOD[2]		DoE[3]	Fisherman Islands Sediment Sample Site			
	SL[2a]	ML[2b]		9	19	22	23
Aldrin			0.2	<1	<1	<1	<1
alpha-BHC				<1	<1	<1	<1
beta-BHC				<1	<1	<1	<1
gamma-BHC (Lindane)				<1	<1	<1	<1
delta-BHC				<1	<1	<1	<1
cis-Chlordane	0.5	6		<1	<1	<1	<1
trans-Chlordane	0.5	6		<1	<1	<1	<1
p,p'-DDD	2	20	0.2	<1	<1	<1	<1
p,p'-DDE	2.2	27	0.2	<1	<1	<1	<1
p,p'-DDT	1.6	46	0.2	<1	<1	<1	<1
Dieldrin	0.02	8	0.2	<1	<1	<1	<1
alpha-Endosulfan				<1	<1	<1	<1
beta-Endosulfan				<1	<1	<1	<1
Endosulfan Sulphate				<1	<1	<1	<1
Endrin	0.02	8		<1	<1	<1	<1
Endrin ketone				–	–	–	–
Endrin aldehyde				–	–	–	–
Heptachlor				<1	<1	<1	<1
Heptachlor epoxide				<1	<1	<1	<1
Hexachlorobenzene				<1	<1	<1	<1
Methoxychlor				<1	<1	<1	<1

[2] National Ocean Disposal (NOD) Guidelines for Dredged Material (Environment Australia 2002)
[2a] NOD Screening Level
[2b] NOD Maximum Level
[3] Department of Environment Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Environmental Investigation Levels (DoE 1998)
* beta-BHC & gamma-BHC

Table 4.19 Organochlorine concentrations (μg/kg) in sediments from Fisherman Islands in 1999, 2002 and 2006.

	Fisherman Islands Sediment Sample Site								
	9			19			22	23	
	1999	2002	2006	1999	2002	2006	2002	1999	2006
Aldrin	<0.05	<0.05	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
alpha-BHC	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
beta-BHC	<0.1	<0.5*	<1	<0.1	<0.1*	<1	<0.3*	<0.3	<1
gamma-BHC (Lindane)	<0.1		<1	<0.1		<1		<0.3	<1
delta-BHC	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
cis-Chlordane	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
trans-Chlordane	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
p,p'-DDD	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
p,p'-DDE	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
p,p'-DDT	<0.2	<1.0	<1	<0.2	<0.2	<1	<0.5	<0.5	<1
Dieldrin	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
alpha-Endosulfan	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
beta-Endosulfan	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Endosulfan Sulphate	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Endrin	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Endrin ketone	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Endrin aldehyde	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Heptachlor	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Heptachlor epoxide	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Hexachlorobenzene	<0.05	<0.25	<1	<0.05	<0.05	<1	<0.10	<0.1	<1
Methoxychlor	<0.2	<0.1	<1	<0.2	<0.02	<1	<0.5	<0.5	<1

Table 4.20 Organochlorine concentrations (μg/kg) in sediments from Whyte Island in 2002, 2006 and 2008.

	Whyte Island Sediment Sample Site								
	1			2			3		
	2002	2006	2008	2002	2006	2008	2002	2006	2008
Aldrin	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
alpha-BHC	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
beta-BHC	<0.5	<1	<1	<0.5	<1	<1	<0.5	<1	<1
gamma-BHC (Lindane)	<0.5	<1	<1	<0.5	<1	<1	<0.5	<1	<1
delta-BHC	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
cis-Chlordane	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
trans-Chlordane	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
p,p'-DDD	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
p,p'-DDE	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
p,p'-DDT	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dieldrin	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
alpha-Endosulfan	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
beta-Endosulfan	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
Endosulfan Sulphate	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
Endrin	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
Endrin ketone	<0.25	<1	–	<0.25	<1	–	<0.25	<1	–
Endrin aldehyde	<0.25	<1	–	<0.25	<1	–	<0.25	<1	–
Heptachlor	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
Heptachlor epoxide	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
Hexachlorobenzene	<0.25	<1	<1	<0.25	<1	<1	<0.25	<1	<1
Methoxychlor	<1	<1	<1	<1	<1	<1	<1	<1	<1

5 Pore Water Salinity

5.1 Introduction

Worldwide studies of pore water salinity and *Avicennia marina* indicate stunted *Avicennia marina* (that is mature plants under approximately 2.5 m high) are often associated with sediments that have a high pore water salinity (up to 115 ppt), whilst taller forests are associated with lower pore water salinities (Lovelock, Adame & Amir [University of Queensland School of Integrative Biology] pers. comm. 2007, Naidoo 2006,). That is, stunting of *A. marina* is likely to be a response to high sediment pore water salinity.

Previous work on Whyte Island indicated that sediment pore water salinity was higher in areas of mangrove dieback, and in areas of poor health than in healthy tall forest; with salinities higher still in scrub forests and highest in the central areas with no mangroves and algal mats (Lovelock, Adame & Amir [University of Queensland School of Integrative Biology] pers. comm. 2007).

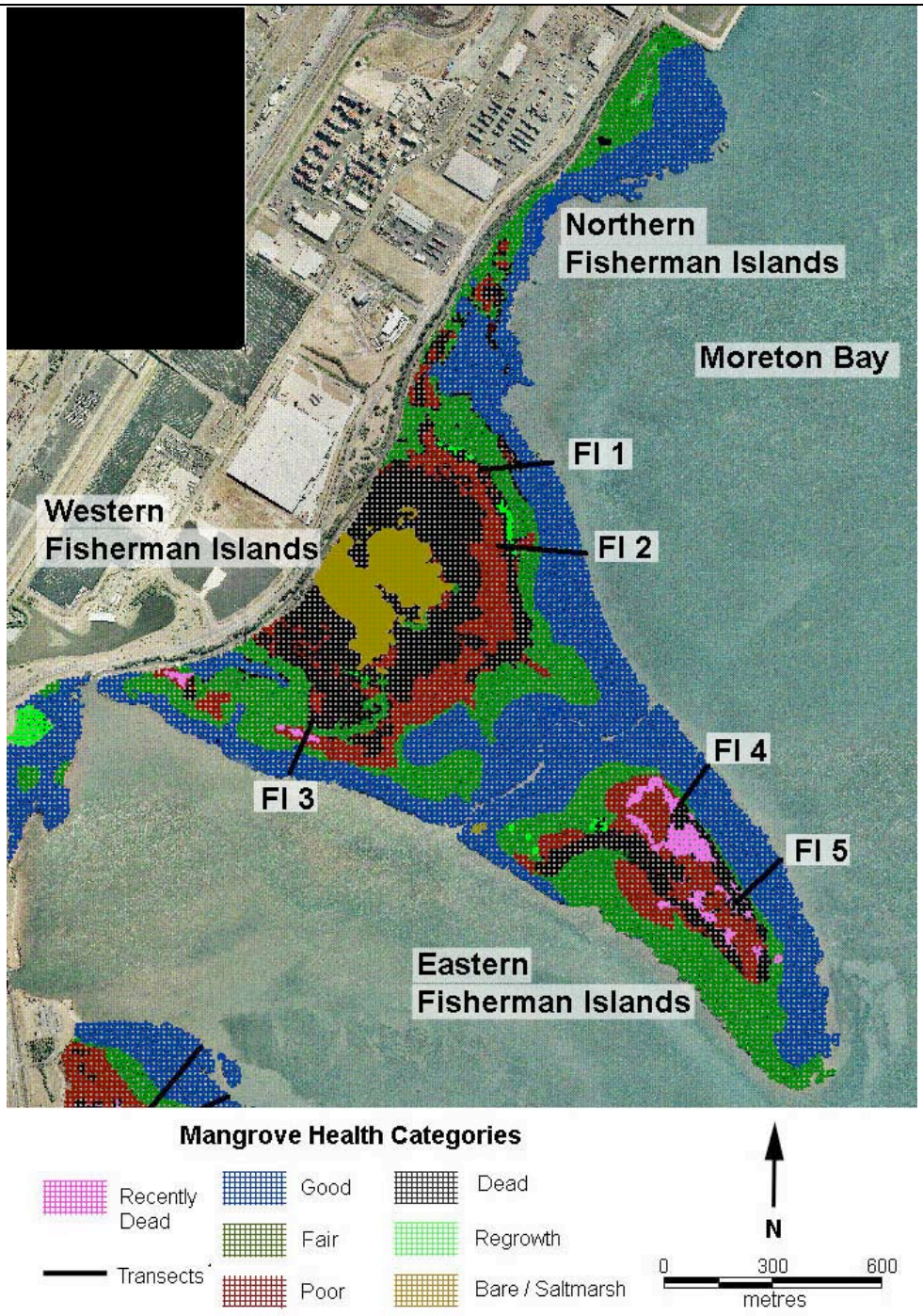
The growth of saltmarsh species, which are more tolerant of high salinities, in areas of dieback also suggests that soil salinities in these areas may have increased.

In this study we further investigated sediment poor water salinity and mangrove health.

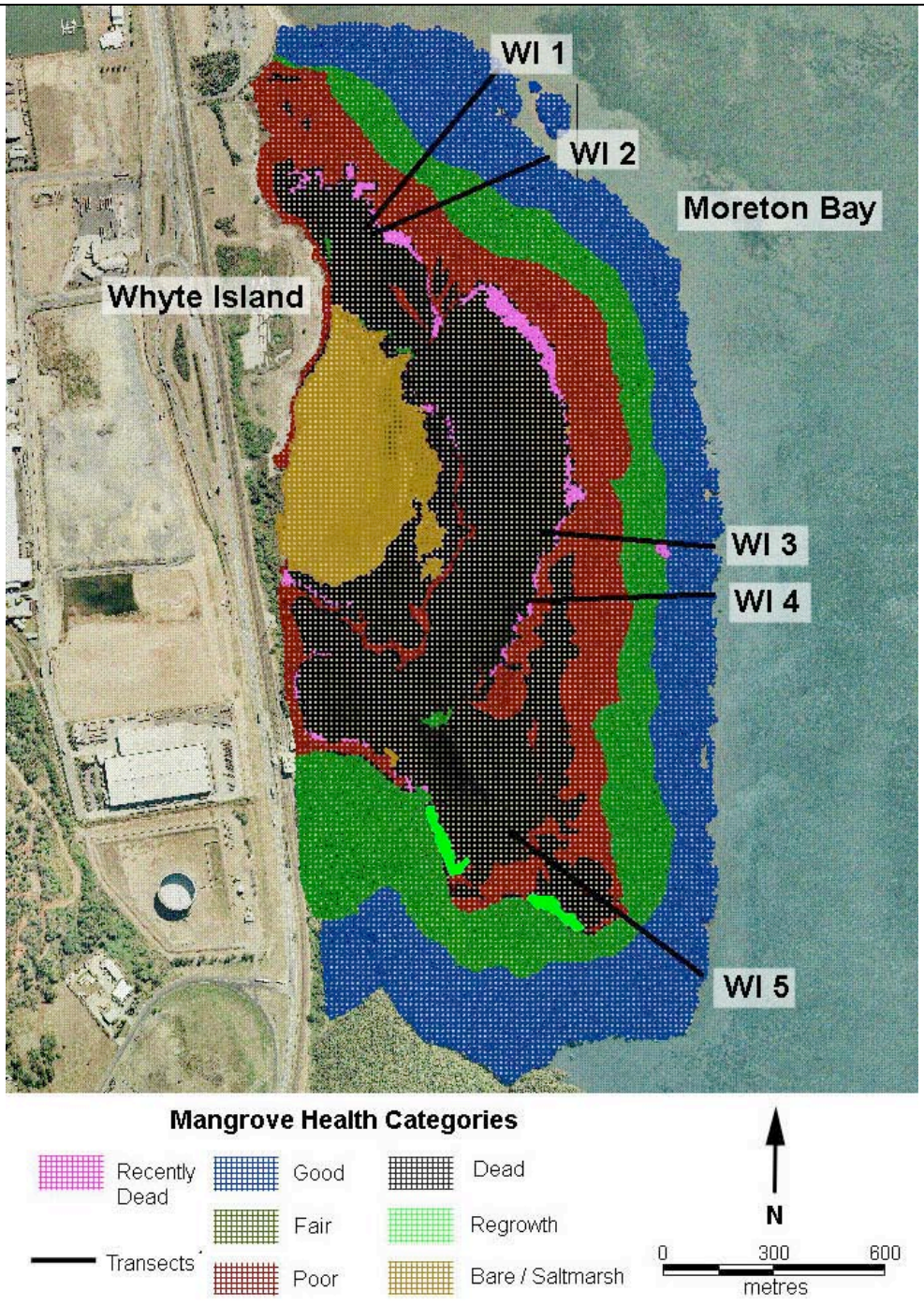
5.2 Methods

Pore water samples were collected from the sediment of recently dead mangroves and from mangroves in poor, fair and good condition on Fisherman and Whyte Islands. Five samples were collected from each of five transects on Fisherman Islands (Figure 5.1) and five samples from each of five transects on Whyte Island (Figure 5.2). A total of 50 samples were collected.

Pore water samples were collected using an apparatus based on McKee et al. (1988). The apparatus consisted of an outer rigid plastic tube (15 mm diameter and sealed at the lower end) and an inner plastic tube (5 mm diameter), both of which were perforated by small holes and connected to a 50 mL syringe (Figure 5.3). The plastic tube was inserted into the sediment, adjacent to mangrove roots, to a depth of approximately 20 cm. The perforated section of the outer tube was buried at least 3 cm below the sediment surface to prevent surface water entering the apparatus. Suction was applied using the syringe. Salinity of the pore water was measured in parts per thousand (ppt) using a TPFWP81 water quality meter in the laboratory.



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment 2008
	Figure 5.1 Location of pore water salinity transects on Fisherman Islands
	November 2008



frc environmental deep thinking. science.	Fisherman Islands and Whyte Island Mangrove Health Assessment
	Figure 5.2 Location of pore water salinity transects on Whyte Island.
	November 2008

Figure 5.3

The pore water sampling apparatus in use.

A two-way nested ANOVA was used to test for differences in pore water salinity between health categories and locations (Whyte Island and Fisherman Islands), with health categories nested in location. Pairwise comparisons were done using Tukey's HSD (p = 0.05) to distinguish differences between health categories at each location. The distribution and homogeneity of variance were checked using distribution plots and Cochran's Test, and data were log(x+1) transformed where required.

5.3 Results

Pore water salinity was significantly higher in the substrate of recently dead mangroves than the substrate of healthier mangroves (Figure 5.4, Table 5.1). Mean pore water salinity decreased from areas of recently dead mangroves (66.48 ppt) to areas of mangroves in poor (54.13 ppt), fair (45.21 ppt) and good (34.9 ppt) health. Pore water salinity was significantly higher in dieback areas of Whyte Island than Fisherman Islands (Tukey HSD test $p < 0.05$).

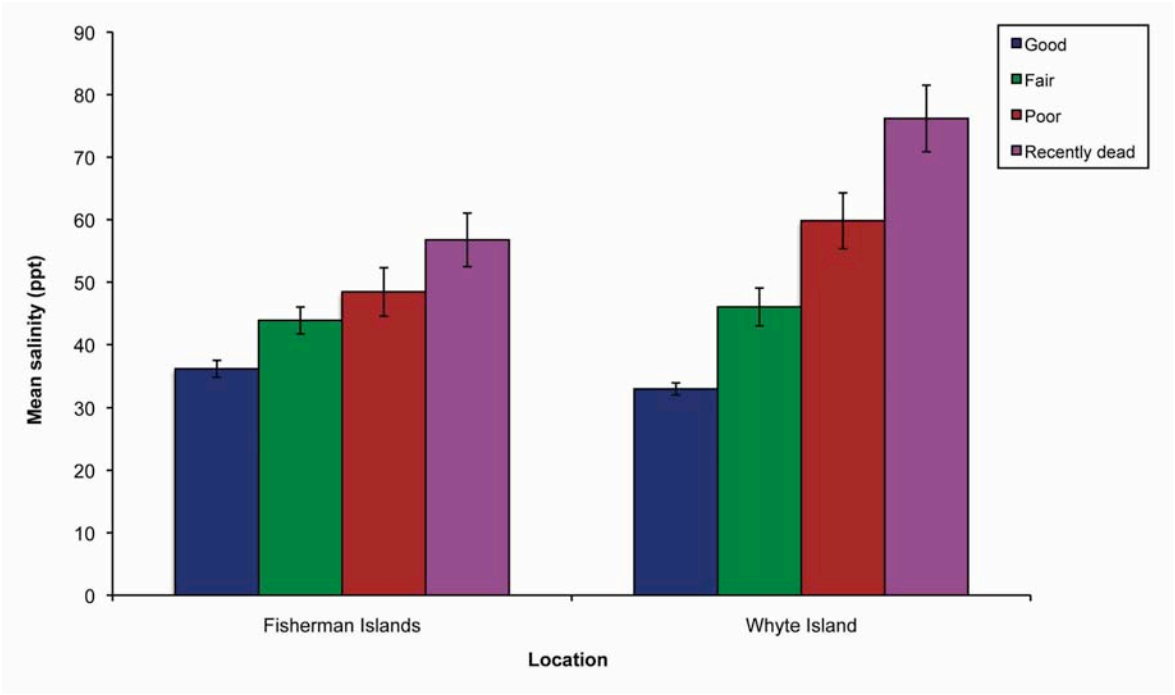


Figure 5.4 Mean pore water salinity at Whyte Island and Fisherman Islands (vertical bars denote standard error).

Table 5.1 Mean squares and p values for two-way nested ANOVA for pore water salinity (mangroves health categories nested in location).

	DF	Mean Squares	p Values
Location	1	0.1482	**0.015**
Health (Location)	6	0.4767	**<0.001**
Error	42	0.0230	

The differences in pore water salinity were far greater among health categories at Whyte Island than at Fisherman Islands (Figure 5.4, Table 5.1).

Fisherman Islands

At Fisherman Islands, pore water salinity was higher in the sediment of recently dead mangroves than in the substrate of mangroves in good health (Figure 5.4, Tukey HSD test $p < 0.05$). Pore water salinity was not significantly different between mangroves in poor

and fair health, and between mangroves in fair health and those that were recently dead (Tukey HSD test $p < 0.05$). Areas of good mangrove health had pore water salinity that was significantly lower than in areas of poor health and recently dead mangroves (Tukey HSD test $p < 0.05$).

Whyte Island

At Whyte Island, pore water salinity was significantly higher in the sediment of recently dead mangroves than in the substrate of mangroves in fair and good health (Figure 5.4, Tukey HSD test $p < 0.05$). Pore water salinity was not significantly different between mangroves in poor and fair health (Tukey HSD test $p < 0.05$). In areas of good mangrove health, pore water salinity was significantly lower than at all other measured health categories (i.e. fair health, poor health and recently dead mangroves) (Tukey HSD test $p < 0.05$).

5.4 Discussion and Recommendations

Sediment pore water salinity is consistently higher in dieback areas than in areas of good mangrove health, particularly at Whyte Island. We recommend continuation of pore water salinity measurements in future mangrove health assessments, including transects to control for the influence of distance to the seaward margin (which influences flushing and salinity levels in the sediment). Control transects should be establish perpendicular to the shoreline through mangroves in good health.

6 Historical Context

In the past 200 years, there have been major changes to coastal landscapes in south east Queensland, including significant changes to wetland communities. Historical changes to mangrove communities at Fisherman and Whyte Island are discussed in a previous report (frc environmental 2007a).

Observed changes to wetlands in the area include: direct and intended change, such as reclamation or intentional clearing for roads etc.; direct and unintended change, such as oils spills etc.; indirect and unintended changes such as increases in nutrient runoff and discharges or erosion due to boat wash; and not obviously human related impacts such as storm damage and climate change. Reclamation of tidal wetlands to make way for the construction of the Port of Brisbane began in 1958 (Duke et al 2003a).

Observed long and short term changes to mangrove communities in the vicinity of the Port of Brisbane are likely to be the cumulative response to a number of processes: there have been major changes to mangrove communities in the area resulting from reclamation and construction; nutrient loads have significantly increased; and sediment loads have significantly increased (Neil & Yu 1996 in Duke et al. 2003a). These anthropogenic changes have happened against a background of natural change associated with variations in climate and sea level, which also impact mangrove distribution.

The canopy cover of mangroves in the Coal Loader area, Fisherman Islands and Whyte Island all increased from the 1950s to the early 1970s, with mangroves also colonising new areas over this period.

From 1972 to 1978, mangroves were reclaimed to the west of the road at Fisherman Islands, with subsequent colonisation to the east due to unconfined dredge spoil deposition (WBM 2000). Between 1978 and 1987, unconfined spoil on the central saltpan area appeared to have moved north, killing the mangroves along the edge (WBM 2000). In 1991, there were dead mangroves in the vicinity of stockpiled dredge material near the access road on the southern end of Fisherman Islands (WBM 2000). By 1994, the area of bare mud, and of mangroves in poor health had increased, particularly around the periphery of the central salt pan area.

From 1972 to 2002, mangroves at Whyte Island decreased in area by 73 ha (WBM 2002b). Sixty percent of this was due to the intentional and authorised removal of mangroves due to construction of Port Drive in the late 1970s and subsequent development to the west of the road. The remaining loss was unintentional (WBM 2002b).

7 Potential Causes of Mangrove Dieback

Potential causes of the mangrove dieback observed at Fisherman and Whyte Island are discussed in our previous report (frc environmental 2007a).

From 2006 to 2008, there was a decrease in the overall health of mangroves in all the areas surveyed. At Fisherman Islands there was an increase in the area of dead mangroves on the eastern tip, and also in the western area, and a decrease in health in many areas. In the Coal Loader area, where mangroves have historically been in very good condition, except for along eroding shorelines, patches of mangroves are now in poor condition. At Whyte Island, the area of dead mangroves has increased, forming a rim of recently dead trees around the central dead area.

Whilst nutrient levels were high at many sites, there was no association between nutrient levels and mangrove dieback, with nutrient levels elevated in healthy areas, areas in poor condition, and in areas of dieback. Petroleum hydrocarbons and organochlorine pesticides were generally low. Whilst some heavy metals, in particular arsenic, were elevated there was no consistent pattern of elevation being associated with either dead mangrove areas, or with mangroves in poor health. That is, these factors alone do not appear to be responsible for the decrease in health of mangroves.

Dieback in both the eastern area of Fisherman Islands and Whyte Island was associated with the ponding of water. Further, pore water salinities were higher in dead mangroves and mangroves in poor health than in healthy mangroves.

Between 2006 and 2008, similar mangrove dieback has also been recorded in other areas of Moreton Bay, in particular Nudgee, Nundah and Burpengary Creeks (frc environmental 2007b, and frc environmental 2008 in prep.). Dieback in these areas was also frequently associated with the ponding of water.

Increased salinity levels associated with low rainfall have been implicated as the causal agent of dieback of *Avicennia marina* mangrove communities in many cases, including: the Embley estuary in far north Queensland, an area remote from human intervention (Conacher et al. 1996); the arid Pilbara coast of Western Australia (Gordon 1987); and commonly in West African mangrove ecosystems (Marius and Lucas 1991). High salinity levels are associated with reduced leaf photosynthesis (Sobrado 1999; Li et al 2008), reduced leaf ion concentration and hydraulic conductivity (Lovelock et al 2007), reduced mangrove growth (Cintron et al 1978; Ball 1988; Kahn & Aziz 2001; Naidoo 2006; Li et al 2008; Yan et al 2007), and mangrove death (Perdomo et al 1998).

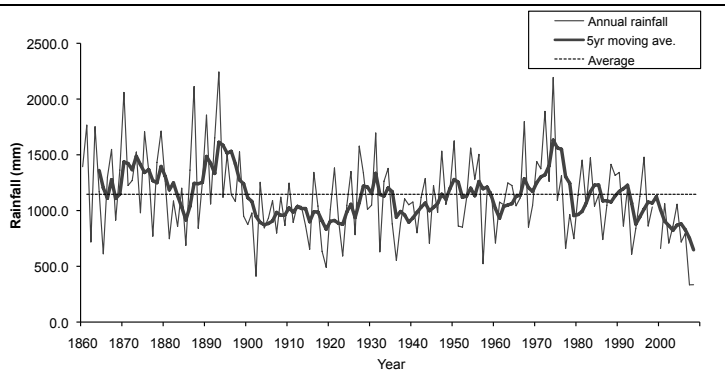
Between 1955 and 1998, the Moreton Bay region saw a net expansion of mangroves in the intertidal zone (frc environmental 2001). It has been suggested that this was due to wetter conditions in the region and increased sedimentation over this period (Duke et al. 2003a). Mangroves that colonised over this period would not need to adapt to high salt concentrations in the sediment. With decreasing rainfall, pore water salinity would rise, and these mangroves would have been under increasing stress. In contrast, stunted mangroves that developed in highly saline areas may have been able to survive.

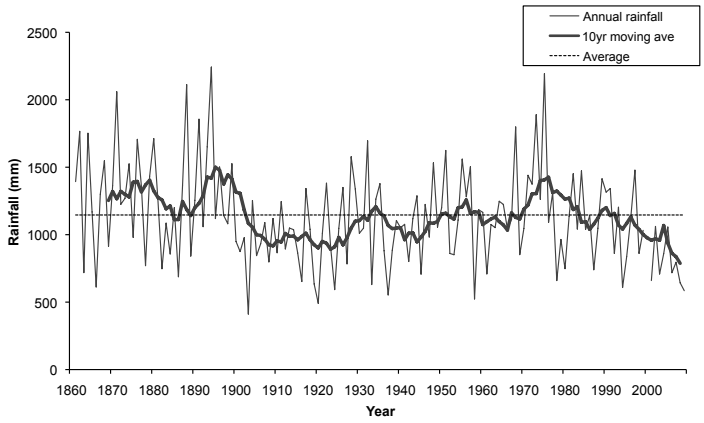
Since approximately 1990 there has been a steady decrease in annual rainfall in south east Queensland (Figure 7.1), with rainfall particularly low from 2005 – 2007. It is likely that this has increased soil salinity, particularly in marginal mangrove habitats, and increased physiological stress on the mangroves. Over this time, a number of areas of mangrove dieback have been recorded in Moreton Bay, including Whyte Island, Fisherman Islands, Luggage Point, the Caboolture River, Boondall Wetlands, (Pederson 2002, frc environmental 2007b), Cobby Cobby Island, Coombabah Lake, and Hayes Inlet.

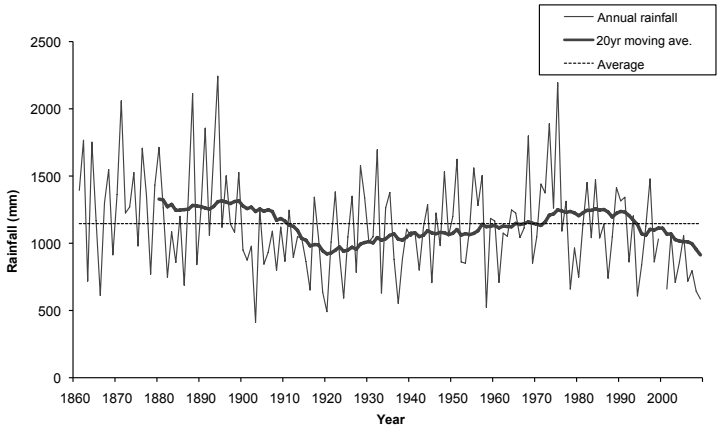
After mangrove death, the sediment level drops to create a basin, increasing the impoundment of water and exacerbating stressful conditions associated with hypersalinity and waterlogging. After particularly high tides (over approximately 2.0 m above lowest astronomical tide, LAT), water is retained in many of the areas of dead and poor health mangroves. Water in ponded mangrove dieback areas in Nundah and Nudgee Creeks was typically high in total ammonia and dissolved organic nitrogen, low in nitrate, highly saline (up to twice that of seawater), relatively warm, alkaline (pH of about 8.4) and super saturated with oxygen during the day, and hypoxic at night (WRM 2007). These water quality conditions were conducive to the growth of algal mats which further reduced water quality, can smother mangrove pneumatophores, and can block drainage lines, further impeding water movement (pers. obs.).

Further, anoxic sediments with low redox potentials can favour chemical transformations of a number of essential elements, in some cases improving their availability and in some cases restricting it. Extreme anaerobiosis can lead to the production of hydrogen sulphide (H_2S) and other compounds that are toxic to plants (Clough 1992).

Given these poor water quality conditions, and the decrease in sediment level, resulting in the ponding of water, mangroves are unlikely to recolonise these areas.







frc environmental deep thinking. science.	Port of Brisbane: Mangrove Health Assessment 2008.
	Figure 7.1 Average annual rainfall between 1860 and 2008, showing 5, 10 and 20 year moving (rolling) averages (updated from Duke 2003)[3].
	November 2008

[3] Note, rainfall for 2008 is only for 6 months: January to June 2008.

Factors contributing to the ponding of water may include:

- loss of biomass (roots) in the sediment
- physico-chemical changes to the sediment structure causing the sediment to sink
- the formation of temporary bunds of seagrass and algal wrack, which can be washed into the mangroves during high tides (particularly following strong winds) and block drainage lines
- mangroves on the outer edges accreting sediment, accretion rates from mangrove areas are variable, but commonly approach 0.5 cm/y (Saenger 2002) and
- sea level rise causing more frequent or severe inundation.

In addition at Fisherman Island, the unconfined deposition of sediment during construction works may have altered drainage patterns and exacerbated ponding.

We hypothesise that colonisation and greater mangrove density in wet years changes the drainage patterns within existing mangrove forests, e.g. 1955 – 1998 in the Moreton Bay region. In dryer years these areas become hypersaline and mangroves adapted to fresher conditions die, e.g. 2005 – 2007 in Moreton Bay. Through a combination of root mass loss and changes to soil processes, the sediment level decreases. Water then ponds in these depressions after spring tides, and gradually evaporates, further increasing salinity levels. Mat forming algae bloom in the ponded water, and are likely to contribute to low dissolved oxygen levels, particularly at night. Water quality in the depressions generally appears to be poor. The high salinity levels and ponded water are unsuitable for either mangrove growth or recolonisation. This process may be exacerbated by anthropogenic changes to drainage patterns, toxicants and eutrophication. In some cases altered drainage or anthropogenic inputs may be the catalyst for change, rather than increased salinity. This hypothesis is supported by the continued decrease in mangrove health at Fisherman and Whyte Islands between 2006 and 2008.

7.1 Conclusions and Recommendations

Ponding and its effect on water quality, particularly pore water salinity, appears to be associated with mangrove dieback at Fisherman and Whyte Islands. Ponding may be associated with a number of factors, including: previous unconfined deposition of dredge spoil material altering hydrology; seagrass and algal berms hindering drainage; and sinking sediment due to root mass loss and changes to soil processes.

High nutrient concentrations are also likely to play a role in the dieback of mangroves, impacting both growth of algal mats and sediment geochemistry. Other factors such as storm damage, high rates of herbivory and smothering by sand or seagrass wrack all probably have relatively minor impacts on mangrove health. However, interactions among all these factors may play a role in the onset of dieback.

Continued monitoring is recommended, as both increases and decreases in rainfall are likely to impact mangrove health. Whilst monitoring to date has not pinpointed the cause of the widespread mangrove death, it has provided some insight into likely causes. This could be enhanced by some further investigations including:

- deployment of water depth loggers to confirm the period and frequency of ponding
- ongoing measurement of pore water salinity in sediment from dieback and healthier areas, including further 'control' transects of healthy mangroves
- a dye run to establish which way the water flows out of the dieback areas, particularly in the new dieback area on Fisherman Islands
- laser survey or similar of dieback areas, to establish benchmark for sediment height, and
- measurement of nutrients, salinity and dissolved oxygen levels in ponded areas.

Replacement of missing star picket markers at sites 4 and 5 is also recommended.

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Fisherman Islands and Whyte Island

Mangrove Health Assessment: 2008 – Volume 2 - Appendices

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frc Ref: 080304

Document Control Summary

Project No.:	080304
Status:	Draft Report
Project Manager:	Kylie McPherson
Title:	Fisherman Islands and Whyte Island Mangrove Health Assessment: 2008
Project Team:	C. Conacher, C, Jones, K. McPherson, B Moore, T. Napier-Munn, L. Thorburn
Client:	Port of Brisbane Corporation
Client Contact:	Scott Mckinnon
Date:	November 2008
Edition:	080304ii
Checked by:	Carol Conacher _____
Issued by:	Kylie McPherson _____

Distribution Record

Port of Brisbane Corporation:	2 hard copies and 1 PDF copy on disc

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Appendix F: **Position of Photographic Monitoring Sites, Sediment Sites and Pore Water Salinity Transects**

Appendix A Photos From Each Photographic Monitoring Site

2006 **Site 1 West** **2008**

Site 1 South

Site 1 East

Site 1 North

2006 **Site 2 West** **2008**

Site 2 South

Site 2 East

Site 2 North

2006 **Site 3 West** **2008**

Site 3 South

Site 3 East

Site 3 North

2006 **Site 4 West** **2008**

Site 4 South

Site 4 East

Site 4 North

2006 **Site 5 West** **2008**

Site 5 South

Site 5 East

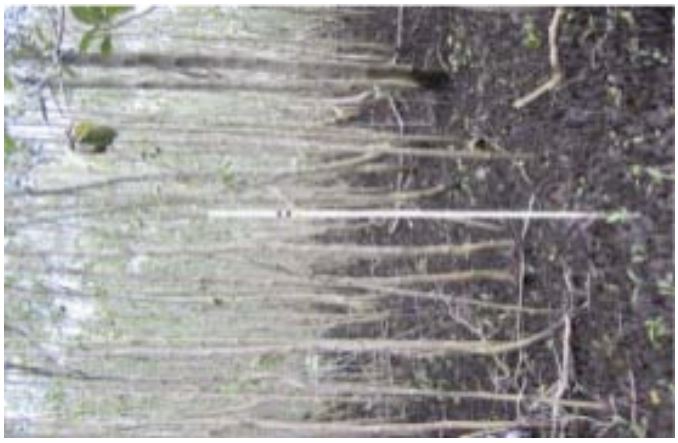
NA

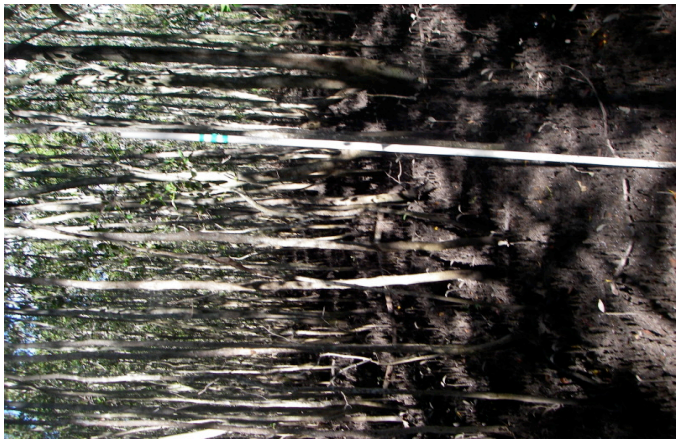
NA

Site 5 North

2006 **Site 6 West** **2008**

Site 6 South





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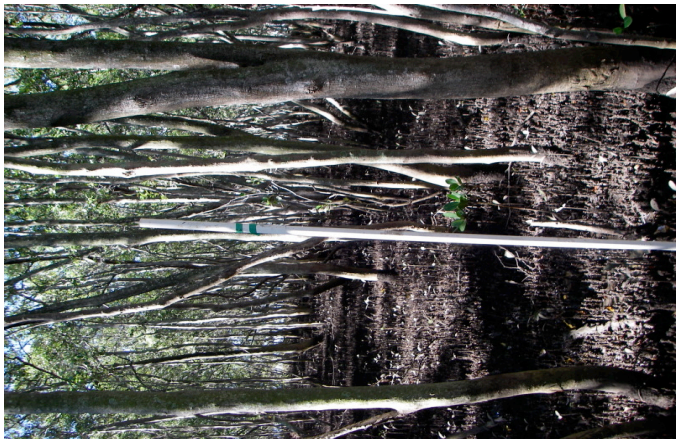
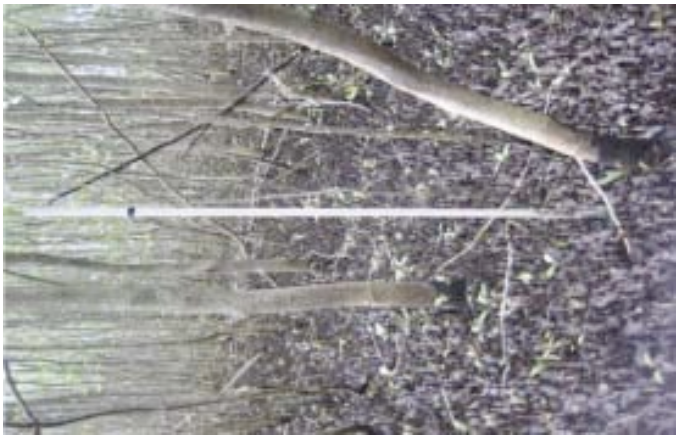


Site 6 North



2006 **Site 8 West** **2008**


Site 8 South


Site 8 East


Site 8 North


2006 **Site 10 West** **2008**


Site 10 South


Site 10 East


Site 10 North


2006 **Site 11 West** **2008**

Site 11 South

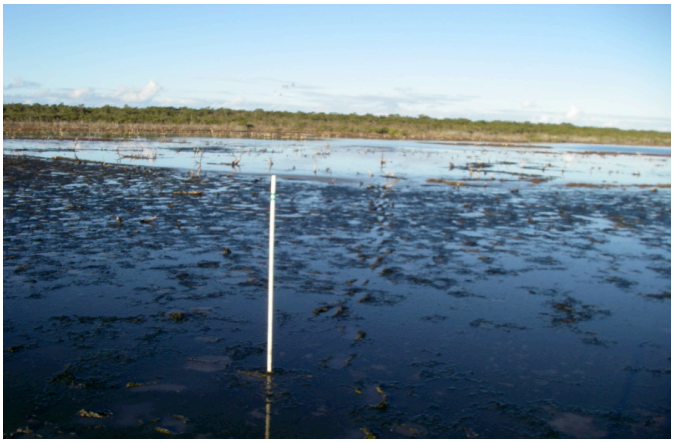
Site 11 East

Site 11 North

2006 **Site 13 West** **2008**

Site 13 South

Site 13 East



Site 13 North

2006 **Site 14 West** **2008**

Site 14 South

Site 14 East

Site 14 North

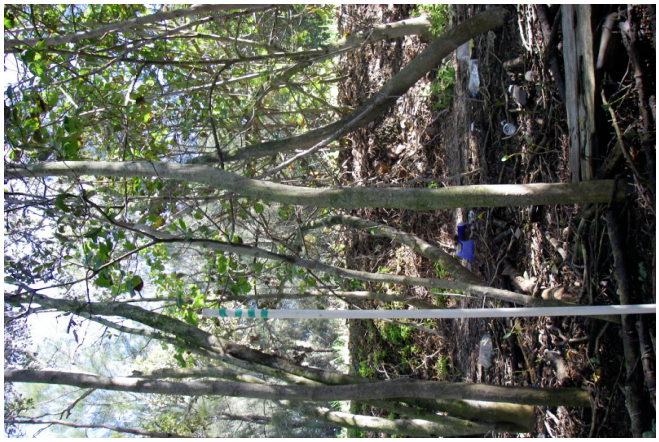
2006 **Site 15 West** **2008**

Site 15 South

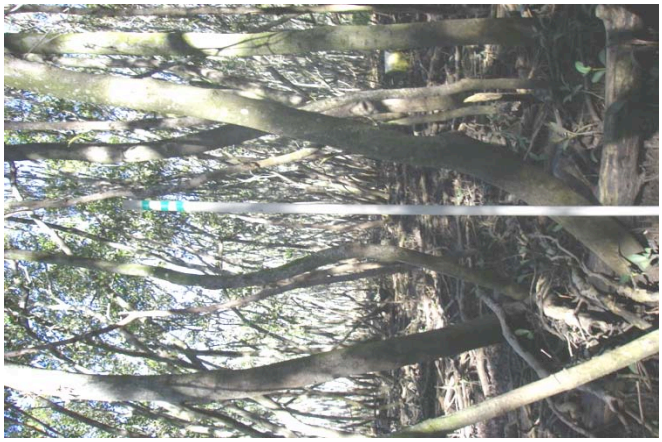
Site 15 East

Site 15 North

2006 **Site 16 West** **2008**



Site 16 South



Site 16 East

Site 16 North

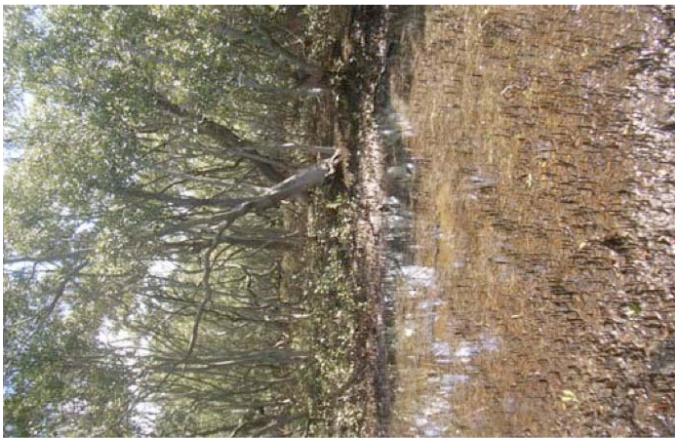
2006 **Site 17 West** **2008**

Site 17 South

Site 17 East

Site 17 North

2006 **Site 18 West** **2008**



Site 18 South

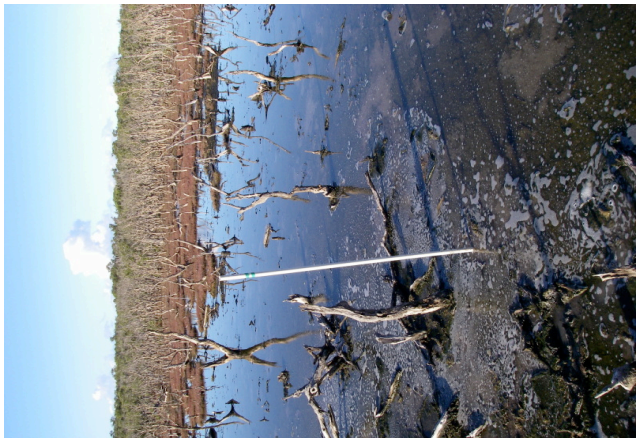
Site 18 East

Site 18 North

2006 **Site 19 West** **2008**

Site 19 South

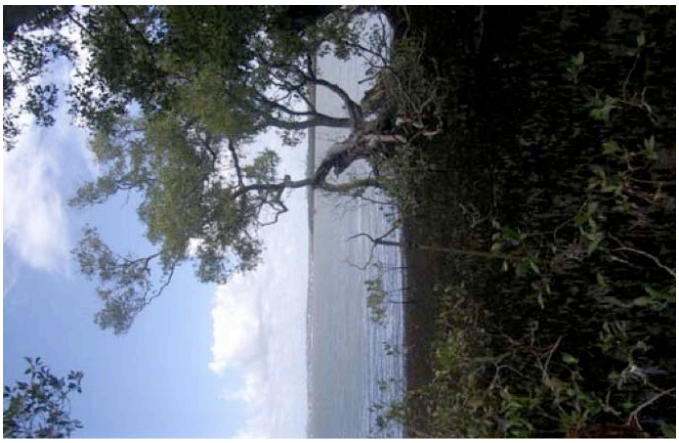
Site 19 East



Site 19 North

2006 **Site 20 West** **2008**

Site 20 South



Site 20 East

Site 20 North

2006 **Site 22 West** **2008**

Site 22 South

Site 22 East

Site 22 North

2006 **Site 23 West** **2008**

Site 23 South

Site 23 East

Site 23 North

Appendix B Survey Data from Fisherman Islands in 2008

Table B1 2008 field survey data for Fisherman Islands (UTM AGD 84 Zone 56J)[1]

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	1	516482.275	6969857.383	good	60	2	60		40		0	15		15	1	1	1	0	0	1	0	0	0	0	2	
11/06/08	2	516494.453	6969842.28	good	60	5	100				0	20		20	0	0	2	1	2	1	4	0	0	2	2	
11/06/08	3	516531.142	6969819.502	good	60	5	100				0	20		20	0	0	2	1	2	1	4	0	0	2	2	
11/06/08	4	516558.535	6969809.763	good	60	5	100				0	20		20	0	0	2	1	2	1	4	0	0	2	2	
11/06/08	5	516618.627	6969793.536	good	60	5	100				0	20		20	0	0	2	1	2	1	4	0	0	2	2	
11/06/08	6	516799.118	6969756.004	good	50	3	20		80		5	90		30	1	1	0	0	0	0	1	0	0	0	1	
11/06/08	7	516852.384	6969753.869	good	60	5	60		40		0	5		10	0	1	0	0	0	1	2	0	0	1	2	
11/06/08	8	516857.42	6969781.697	good	60	5	60		40		0	5		10	0	1	0	0	0	1	2	0	0	1	2	
11/06/08	9	516849.738	6969811.835	fair	40	5	60		40		0	5		10	0	1	0	0	0	1	2	0	0	1	2	
11/06/08	10	516842.008	6969813.192	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	11	516803.902	6969824.321	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	12	516792.608	6969825.358	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	13	516803.344	6969834.098	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	14	516794.975	6969835.075	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	15	516787.388	6969831.706	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	16	516789.13	6969826.764	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	17	516789.67	6969815.808	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	18	516782.583	6969809.04	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	19	516770.978	6969812.473	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	20	516770.883	6969809.985	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	21	516764.675	6969809	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	22	516763.432	6969803.208	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	23	516759.407	6969786.984	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	24	516773.527	6969785.619	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	25	516782.711	6969781.02	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	26	516792.051	6969787.59	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	27	516791.444	6969785.743	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	28	516790.581	6969779.171	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	29	516799.08	6969776.884	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	30	516805.623	6969780.088	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	31	516809.294	6969773.528	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	32	516827.558	6969773.336	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	33	516828.725	6969772.304	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	34	516827.37	6969763.309	fair	40	2.5	20		80	2	50	50		0	1	20	0	0	1	0	0	0	0	0	1	
11/06/08	35	516751.244	6969762.132	fair	60	2.5	20		80		20	100		100	1	1	1	0	0	1	0	0	0	0	1	
11/06/08	36	516757.537	6969788.472	fair	60	2.5	20		80		20	100		100	1	1	1	0	0	1	0	0	0	0	1	
11/06/08	37	516758.335	6969809.008	fair	60	2.5	20		80		20	100		100	1	1	1	0	0	1	0	0	0	0	1	
11/06/08	38	516749.827	6969816.819	saltmarsh	5																					
11/06/08	39	516745.704	6969813.501	saltmarsh	5																					
11/06/08	40	516740.626	6969814.9	saltmarsh	5																					
11/06/08	41	516724.408	6969827.159	saltmarsh	5																					
11/06/08	42	516729.327	6969837.013	saltmarsh	5																					
11/06/08	43	516733.257	6969843.933	saltmarsh	5																					
11/06/08	44	516742.017	6969838.778	saltmarsh	5																					
11/06/08	45	516744.335	6969830.363	saltmarsh	5																					
11/06/08	46	516743.306	6969835.387	saltmarsh	5																					
11/06/08	47	516734.013	6969845.297	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	48	516740.243	6969856.049	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	49	516739.992	6969860.357	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	50	516739.681	6969863.774	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	51	516741.797	6969871.654	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	52	516743.258	6969885.504	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	53	516746.468	6969881.22	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	54	516747.169	6969878.703	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	55	516747.828	6969869.826	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	56	516745.359	6969864.342	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	57	516746.635	6969857.99	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	58	516733.333	6969881.646	dead	10	2.5	40		60		90	100		100		0		0	2	2	0	0	0	0	0	
11/06/08	59	516725.889	6969879.79	dead	20	2.5	40		60																	
11/06/08	60	516725.364	6969877.674	dead	20	2.5	40		60																	
11/06/08	61	516722.287	6969864.17	dead	20	2.5	40		60																	
11/06/08	62	516722.828	6969859.211	dead	20	2.5	40		60																	
11/06/08	63	516720.802	6969856.623	dead	20	2.5	40		60																	
11/06/08	64	516724.181	6969849.303	dead	20	2.5	40		60																	
11/06/08	65	516719.469	6969851.835	dead	20	2.5	40		60																	
11/06/08	66	516710.699	6969855.681	dead	20	2.5	40		60																	
11/06/08	67	516711.707	6969860.062	dead	20	2.5	40		60																	
11/06/08	68	516704.844	6969864.862	dead	20	2.5	40		60																	
11/06/08	69	516704.208	6969866.33	dead	20	2.5	40		60																	
11/06/08	70	516696.579	6969875.225	dead	20	2.5	40		60																	
11/06/08	71	516690.381	6969875.447	dead	20	2.5	40		60																	
11/06/08	72	516689.575	6969880.035	dead	20	2.5	40		60																	
11/06/08	73	516685.148	6969884.729	dead	20	2.5	40		60																	
11/06/08	74	516680.774	6969886.119	dead	20	2.5	40		60																	
11/06/08	75	516669.809	6969885.586	dead	20	2.5	40		60																	
11/06/08	76	516667.928	6969891.809	dead	20	2.5	40		60																	
11/06/08	77	516679.467	6969887.801	dead	20	2.5	40		60																	
11/06/08	78	516691.436	6969883.31	dead	20	2.5	40		60																	
11/06/08	79	516704.793	6969888.426	dead	20	2.5	40		60																	
11/06/08	80	516710.965	6969880.823	dead	20	2.5	40		60																	
11/06/08	81	516722.61	6969876.025	dead	20	2.5	40		60																	
11/06/08	82	516744.506	6969906.94	good																						
11/06/08	83	516933.98	6969988.177	saltmarsh																						
11/06/08	84	516946.668	6969965.06	saltmarsh																						
11/06/08	85	516970.788	6969973.717	saltmarsh																						
11/06/08	86	516967.921	6969986.311	saltmarsh																						
11/06/08	87	516953.555	6969995.086	saltmarsh																						
11/06/08	88	516953.017	6970007.277	saltmarsh																						
11/06/08	89	516972.093	6970012.301	fair	50	3	100				10	60		20	1	2	2	0	1	1	0	0	0	0	0	
11/06/08	90	516988.165	6970020.56	fair	50	3	100				10	60		20	1	2	2	0	1	1	0	0	0	0	0	
11/06/08	91	516991.339	6970015.013	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	92	516989.26	6970009.325	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	93	516982.057	6970002.715	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	94	516977.47	6969993.437	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	95	516978.04	6969986.575	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	96	516985.369	6969982.805	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	97	516995.54	6969984.35	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	98	517004.653	6969981.989	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	99	517015.479	6969978.269	poor	30	1.5	90	10			40	100		100	1	2	2	0	2	1	0	0	0	0	0	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	100	517030.62	6969978.768	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	101	517039.732	6969981.689	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	102	517053.419	6969979.628	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	103	517059.589	6969976.267	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	104	517068.604	6969975.419	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	105	517067.868	6969970.574	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	106	517049.271	6969969.922	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	107	517043.209	6969973.022	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	108	517013.862	6969977.696	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	109	517001.87	6969977.592	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	110	516984.601	6969972.445	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	111	516984.889	6969965.193	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	112	516981.485	6969954.883	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	113	516973.965	6969952.266	poor	30	1.5	90		10		40	100		100	1	2	2	0	2	1	0	0	0	0	0	
11/06/08	114	516965.235	6969937.729	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	115	516975.804	6969933.676	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	116	516987.711	6969932.592	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	117	516999.597	6969933.912	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	118	517005.12	6969925.038	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	119	517012.176	6969921.686	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	120	517032.828	6969909.504	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	121	517055.016	6969906.001	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	122	517070.445	6969893.167	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	123	517068.124	6969881.091	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	124	517080.637	6969856.544	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	125	517098.111	6969859.955	fair	60		100				30	30		0	2	10	na	2	1	0	0	0	0	0	0	
11/06/08	126	517129.037	6969823.554	poor	30	2	100				50	100		100	1	2	1	0	1	2	0	0	0	0	1	
11/06/08	127	517115.72	6969811.828	poor	30	2	100				50	100		100	1	2	1	0	1	2	0	0	0	0	1	
11/06/08	128	517119.119	6969795.158	poor	30	2	100				50	100		100	1	2	1	0	1	2	0	0	0	0	1	
11/06/08	129	517117.397	6969778.541	poor	30	2	100				50	100		100	1	2	1	0	1	2	0	0	0	0	1	
11/06/08	130	517107.941	6969772.121	poor	30	2	100				50	100		100	1	2	1	0	1	2	0	0	0	0	1	
11/06/08	131	517081.746	6969778.61	fair	50	2	100				10	50		50	1	2	1	0	1	1	0	0	0	0	1	
11/06/08	132	517077.359	6969763.984	fair	50	2	100				10	50		50	1	2	1	0	1	1	0	0	0	0	1	
11/06/08	133	517085.077	6969742.424	fair	50	2	100				10	50		50	1	2	1	0	1	1	0	0	0	0	1	
11/06/08	134	517101.572	6969739.254	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	135	517121.117	6969735.958	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	136	517128.019	6969741.426	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	137	517136.843	6969740.383	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	138	517155.507	6969753.467	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	139	517156.499	6969757.031	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	140	517151.266	6969760.464	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	141	517135.525	6969751.768	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	142	517122.977	6969751.08	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	143	517125.721	6969757.427	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	144	517142.598	6969766.882	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	145	517152.771	6969769.95	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	146	517170.39	6969770.659	fair	60	2.5	100				5	50		30	1	1	2	0	0	1	0	2	0	0	0	
11/06/08	147	517184.441	6969767.78	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	
11/06/08	148	517246.752	6969768.37	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	
11/06/08	149	517238.111	6969781.324	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	150	517215.45	6969778.562	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	
11/06/08	151	517224.107	6969817.711	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	
11/06/08	152	517240.027	6969818.413	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	
11/06/08	153	517260.428	6969822.711	fair	20	3	100				10	20		20	1	2	1	0	0	2	0	2	0	0	0	
11/06/08	154	517168.116	6969903.8	regrowth	40	2.5	100				50	100		100	1	2	1	0	3	na	0	0	0	0	0	
11/06/08	155	517175.301	6969898.21	regrowth	40	2.5	100				50	100		100	1	2	1	0	3	na	0	0	0	0	0	
11/06/08	156	517191.729	6969899.867	regrowth	40	2.5	100				50	100		100	1	2	1	0	3	na	0	0	0	0	0	
11/06/08	157	517204.472	6969886.758	regrowth	40	2.5	100				50	100		100	1	2	1	0	3	na	0	0	0	0	0	
11/06/08	158	517216.35	6969882.016	regrowth	40	2.5	100				50	100		100	1	2	1	0	3	na	0	0	0	0	0	
11/06/08	159	517230.332	6969883.64	regrowth	40	2.5	100				50	100		100	1	2	1	0	3	na	0	0	0	0	0	
11/06/08	160	517244.782	6969881.335	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	161	517251.77	6969877.055	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	162	517257.722	6969872.228	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	163	517264.954	6969870.834	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	164	517262.75	6969882.675	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	165	517253.952	6969890.505	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	166	517235.563	6969896.5	fair	60	2	100				5	100		100	1	1	1	0	2	3	0	0	0	0	0	
11/06/08	167	517244.945	6969908.845	poor	40	3	100				60	100		100	2	2			3							
11/06/08	168	517253.188	6969912.63	poor	40	3	100				60	100		100	2	2			3							
11/06/08	169	517263.287	6969922.745	poor	40	3	100				60	100		100	2	2			3							
11/06/08	170	517275.568	6969921.855	poor	40	3	100				60	100		100	2	2			3							
11/06/08	171	517285.43	6969922.074	poor	40	3	100				60	100		100	2	2			3							
11/06/08	172	517308.448	6969960.599	poor	40	3	100				60	100		100	2	2			3							
11/06/08	173	517312.749	6969966.758	fair																						
11/06/08	174	517305.212	6970010.563	fair																						
11/06/08	175	517321.533	6969989.306	fair																						
11/06/08	176	517331.653	6969966.861	poor	50	3	100																			
11/06/08	177	517322.617	6969953.04	poor	50	3	100																			
11/06/08	178	517320.015	6969929.972	poor	50	3	100																			
11/06/08	179	517315.848	6969907.371	poor	50	3	100																			
11/06/08	180	517293.913	6969896.65	poor	50	3	100																			
11/06/08	181	517271.225	6969892.43	fair	60	2.5	100																			
11/06/08	182	517287.713	6969889.631	fair	60	2.5	100																			
11/06/08	183	517292.093	6969875.178	fair	60	2.5	100																			
11/06/08	184	517298.396	6969855.551	fair	60	2.5	100																			
11/06/08	185	517287.709	6969852.141	fair	60	2.5	100																			
11/06/08	186	517292.482	6969839.628	fair	60	2.5	100																			
11/06/08	187	517322.343	6969818.222	poor																						
11/06/08	188	517353.784	6969806.73	poor																						
11/06/08	189	517364.824	6969813.548	poor																						
11/06/08	190	517361.278	6969831.481	poor																						
11/06/08	191	517366.276	6969844.156	poor																						
11/06/08	192	517375.167	6969860.484	poor																						
12/06/08	193	517536.364	6969447.212	saltmarsh	0	1.5		100																		
12/06/08	194	517565.263	6969460.67	saltmarsh	0	1.5		100																		
12/06/08	195	517619.623	6969487.878	fair	40	6	70	20	10	0	5	40	1	1	1	0	0	0	3	0	0	3	1			
12/06/08	196	517639.189	6969500.189	fair	40	6	70	20	10	0	5	40	1	1	1	0	0	0	3	0	0	3	1			
12/06/08	197	517706.972	6969388.521	regrowth	30	4	100				15	100	1	1	1	0	2	0	1	0	0	2	0			
12/06/08	198	517717.411	6969369.984	regrowth	30	4	100				15	100	1	1	1	0	2	0	1	0	0	2	0			
12/06/08	199	517718.611	6969356.984	regrowth	30	4	100				15	100	1	1	1	0	2	0	1	0	0	2	0			

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	200	517724.846	6969348.442	regrowth	30	4	100					15		100	1	1	1	0	2	0	1	0	0	2	0	
12/06/08	201	517733.958	6969351.493	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	202	517744.166	6969356.074	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	203	517755.919	6969369.436	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	204	517759.013	6969382.661	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	205	517765.727	6969389.708	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	206	517780.166	6969386.502	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	207	517792.653	6969391.219	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	208	517801.096	6969395.83	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	209	517815.289	6969406.069	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	210	517826.401	6969411.336	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	211	517855.23	6969421.878	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	212	517894.737	6969435.737	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	213	517889.302	6969447.592	dead							all	100		100		na	0	0	0	0	0	0	1	0	1	
12/06/08	214	517883.42	6969454.462	regrowth																						
12/06/08	215	517871.223	6969449.912	regrowth																						
12/06/08	216	517882.255	6969456.97	regrowth																						
12/06/08	217	517889.273	6969472.929	regrowth																						
12/06/08	218	517904.072	6969472.109	regrowth																						
12/06/08	219	517907.94	6969453.795	regrowth																						
12/06/08	220	517907.547	6969440.287	regrowth																						
12/06/08	221	517915.781	6969449.642	dead																						
12/06/08	222	517935.351	6969441.211	dead																						
12/06/08	223	517936.052	6969427.739	dead																						
12/06/08	224	517958.56	6969434.223	dead																						
12/06/08	225	517967.064	6969424.082	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	226	517981.457	6969417.274	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	227	517998.846	6969430.961	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	228	517990.585	6969408.997	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	229	517997.121	6969401.959	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	230	518014.678	6969427.79	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	231	518020.959	6969422.034	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	232	518024.969	6969415.845	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	233	518029.972	6969409.162	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	234	518038.476	6969427.143	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	235	518031.355	6969436.131	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	236	518020.06	6969442.015	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	237	518006.064	6969459.203	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	238	518000.278	6969463.426	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	239	517990.275	6969474.592	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	240	517978.556	6969478.833	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	241	517978.622	6969484.775	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	242	517982.867	6969485.855	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	243	517992.248	6969480.215	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	244	517998.045	6969477.913	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	245	518005.792	6969471.143	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	246	518011.645	6969467.801	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	247	518024.287	6969453.93	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	248	518030.987	6969451.098	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	249	518042.49	6969429.263	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	250	518047.255	6969412.395	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	251	518033.647	6969400.234	dead	15	100					100	70		100	1	1	1	0	2	2	0	1	1	0	1	
12/06/08	252	518019.525	6969382.262	poor	40	2	100				100	50		40	2	1	1	0	1	1	0	1	1	0	0	
12/06/08	253	518042.883	6969380.612	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	254	518042.383	6969390.278	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	255	518053.643	6969394.328	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	256	518080.575	6969411.056	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	257	518092.682	6969433.859	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	258	518094.837	6969444.857	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	259	518088.017	6969456.204	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	260	518101.636	6969481.335	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	261	518100.844	6969495.291	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	262	518097.493	6969503.949	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	263	518098.847	6969517.455	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	264	518084.391	6969531.988	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	265	518089.256	6969543.206	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	266	518097.721	6969540.464	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	267	518117.399	6969526.833	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	268	518136.766	6969505.116	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	269	518147.42	6969486.076	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	270	518178.41	6969450.499	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	271	518199.698	6969427.934	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	272	518215.394	6969400.448	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	273	518234.407	6969363.607	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	274	518245.577	6969346.869	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	275	518252.363	6969334.985	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	276	518269.146	6969314.237	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	277	518277.81	6969295.182	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	278	518290.991	6969276.417	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	279	518318.964	6969235.487	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	280	518326.191	6969213.546	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	281	518328.272	6969198.187	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	282	518313.778	6969186.287	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	283	518269.555	6969204.829	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	284	518265.277	6969209.598	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	285	518276.581	6969220.974	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	286	518289.897	6969209.385	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	287	518289.61	6969233.618	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	288	518273.135	6969232.733	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	289	518253.126	6969229.903	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	290	518251.574	6969244.788	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	291	518258.965	6969260.96	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	292	518250.682	6969274.351	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	293	518240.085	6969281.042	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	294	518224.629	6969280.684	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	295	518229.955	6969289.785	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	296	518246.065	6969301.468	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	297	518245.872	6969305.117	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	298	518234.208	6969313.286	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	299	518221.712	6969319.349	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	

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12/06/08	300	518218.559	6969338.609	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	301	518219.115	6969350.79	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	302	518204.275	6969357.58	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	303	518186.953	6969361.292	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	304	518170.374	6969362.83	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	305	518164.835	6969360.944	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	306	518156.641	6969378.884	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	307	518140.937	6969383.633	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	308	518125.139	6969376.043	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	309	518115.689	6969368.351	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	310	518102.312	6969344.566	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	311	518101.067	6969348.588	dead	60	2.5	100				30	25		30	1	0	1	0	1	1	0	1	1	0	1	
12/06/08	312	518120.348	6969380.553	poor	40	2	100				100	50		40	2	1	1	0	1	1	0	1	1	0	0	
12/06/08	313	518104.521	6969336.764	poor	40	2	100				100	50		40	2	1	1	0	1	1	0	1	1	0	0	
12/06/08	314	518125.401	6969345.646	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	315	518133.553	6969339.088	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	316	518127.776	6969315.617	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	317	518129.927	6969307.778	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	318	518141.648	6969304.26	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	319	518150.746	6969309.427	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	320	518128.156	6969298.152	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	321	518130.461	6969304.434	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	322	518119.035	6969299.754	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	323	518116.566	6969305.894	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	324	518108.735	6969311.653	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	325	518085.704	6969315.475	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	326	518077.927	6969313.128	poor	25	4	100				100	50		75		2	2	0	2	2	0	2	1	1	1	
12/06/08	327	518096.13	6969293.92	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	328	518093.447	6969273.117	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	329	518106.535	6969252.951	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	330	518118.473	6969245.134	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	331	518139.995	6969240.627	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	332	518154.761	6969251.041	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	333	518157.678	6969267.424	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	334	518175.401	6969271.483	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	335	518183.334	6969268.026	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	336	518194.87	6969268.186	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	337	518201.39	6969261.825	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	338	518191.385	6969254.394	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	339	518190.986	6969236.708	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	340	518193.947	6969227.067	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	341	518174.854	6969221.246	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	342	518175.015	6969218.191	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	343	518188.723	6969208.199	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	344	518215.025	6969208.309	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	345	518220.623	6969211.485	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	346	518235.387	6969220.218	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	347	518232.353	6969214.466	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	348	518214.059	6969205.274	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	349	518215.32	6969195.069	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	

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12/06/08	350	518228.908	6969187.584	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	351	518210.027	6969168.746	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	352	518232.286	6969163.616	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	353	518247.643	6969159.434	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	354	518259.709	6969165.404	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	355	518261.553	6969157.342	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	356	518274.299	6969152.133	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	357	518263.442	6969140.089	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	358	518257.063	6969130.174	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	359	518272.918	6969121.153	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	360	518281.261	6969114.122	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	361	518284.008	6969106.087	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	362	518283.069	6969098.995	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	363	518287.757	6969091.756	poor	30	3	100				100	70		75	2	2	2	0	2	1	0	0	0	0	0	
12/06/08	364	518249.68	6969108.404	poor	20	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	365	518237.346	6969122.859	poor	20	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	366	518224.221	6969139.832	poor	20	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	367	518199.36	6969161.678	poor	20	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	368	518185.425	6969174.827	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	369	518160.147	6969172.144	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	370	518150.591	6969188.155	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	371	518135.306	6969207.285	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	372	518130.4	6969224.348	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	373	518114.094	6969231.289	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	374	518096.329	6969232.243	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	375	518084.476	6969230.135	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	376	518070.537	6969224.501	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	377	518063.176	6969228.3	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	378	518085.661	6969247.123	poor	30	3	100				100	50		60	2	2	2	0	1	1	0	0	1	1	1	
12/06/08	379	518002.915	6969318.196	poor	20	4	100				100	50		80	1		1	0	3	1	1	0	0	1	0	
12/06/08	380	517997.313	6969329.42	poor	20	4	100				100	50		80	1		1	0	3	1	1	0	0	1	0	
12/06/08	381	517980.545	6969332.574	poor	20	4	100				100	50		80	1		1	0	3	1	1	0	0	1	0	
12/06/08	382	517965.82	6969344.043	poor	20	4	100				100	50		80	1		1	0	3	1	1	0	0	1	0	
12/06/08	383	517946.219	6969364.962	fair	60	4.5	100				10	5		40	1	1	1	0	2	1	1	0	1	2	1	
12/06/08	384	517907.27	6969386.707	fair	60	4.5	100				10	5		40	1	1	1	0	2	1	1	0	1	2	1	
12/06/08	385	517858.246	6969438.604	fair	50	4	100				10	5		40	0	0	1	0	4	1	1	1	1	2	1	
12/06/08	386	517847.555	6969449.269	fair	50	4	100				10	5		40	0	0	1	0	4	1	1	1	1	2	1	
12/06/08	387	517841.909	6969453.213	fair	50	4	100				10	5		40	0	0	1	0	4	1	1	1	1	2	1	
12/06/08	388	517816.952	6969472.069	fair	50	4	100				10	5		40	0	0	1	0	4	1	1	1	1	2	1	
12/06/08	389	517807.482	6969479.241	fair	50	4	100				10	5		40	0	0	1	0	4	1	1	1	1	2	1	
12/06/08	390	517787.757	6969488.777	good	65	4.5	100				10	5		40	0	0	1	0	1	0	1	1	1	3	1	
12/06/08	391	517765.168	6969512.494	good	65	4.5	100				10	5		40	0	0	1	0	1	0	1	1	1	3	1	
12/06/08	392	517738.777	6969520.016	good	65	4.5	100				10	5		40	0	0	1	0	1	0	1	1	1	3	1	
12/06/08	393	516804.991	6969772.327	poor	65	4.5	100				10	5		40	0	0	1	0	1	0	1	1	1	3	1	
12/06/08	394	516824.564	6969735.553	good	60	8	90	10			2	10		40	1	1	1	0	1	1	3	0	0	2	2	
12/06/08	395	516839.161	6969822.137	poor	80	3.5	20	80															0			
12/06/08	396	516906.868	6969883.032	good	80	3.5	20	80															0			
12/06/08	397	516982.416	6969849.458	good	80	3.5	80	20															0			
12/06/08	398	517017.017	6969838.946				100																			
12/06/08	399	517069.034	6969825.894	fair																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	400	517111.012	6969828.918	saltmarsh																						
12/06/08	401	516381.31	6968883.59																							
13/06/08	402	517028.365	6969632.456	good	70	6	60		40		3	10		60	0	0	2	0	1	1	0	0	0	2	1	
13/06/08	403	517038.723	6969667.48	good	60	5.5	10		90		10	5		35	1	1	1	0	0	1	0	0	0	2	0	
13/06/08	404	517039.292	6969683.291	good	60	5.5	10		90		10	5		35	1	1	1	0	0	1	0	0	0	2	0	
13/06/08	405	517053.919	6969689.695	good	60	5.5	10		90		10	5		35	1	1	1	0	0	1	0	0	0	2	0	
13/06/08	406	517135.718	6969658.646	poor	30	2.5	80		20		100	80		100	1	1	1	0	0	2	0	0	0	1	0	
13/06/08	407	517106.695	6969680.941	poor	30	2.5	80		20		100	80		100	1	1	1	0	0	2	0	0	0	1	0	
13/06/08	408	517066.619	6969704.588	dead	0	3.5	20		80																	
13/06/08	409	517072.319	6969697.608	dead	0	3.5	20		80																	
13/06/08	410	517096.141	6969695.653	dead	0	3.5	20		80																	
13/06/08	411	517099.912	6969696	dead	0	3.5	20		80																	
13/06/08	412	517102.022	6969699.637	dead	0	3.5	20		80																	
13/06/08	413	517095.043	6969698.634	dead	0	3.5	20		80																	
13/06/08	414	517086.219	6969705.526	dead	0	3.5	20		80																	
13/06/08	415	517070.461	6969708.835	dead	0	3.5	20		80																	
13/06/08	416	517059.735	6969712.74	dead	0	3.5	20		80																	
13/06/08	417	517058.077	6969712.083	dead	0	3.5	20		80																	
13/06/08	418	517054.739	6969713.574	dead	0	3.5	20		80																	
13/06/08	419	517048.658	6969720.555	dead	0	3.5	20		80																	
13/06/08	420	517039.707	6969725.404	dead	0	3.5	20		80																	
13/06/08	421	517035.438	6969725.085	dead	0	3.5	20		80																	
13/06/08	422	517028.198	6969726.766	dead	0	3.5	20		80																	
13/06/08	423	517031.779	6969721.599	dead	0	3.5	20		80																	
13/06/08	424	517036.093	6969719.124	dead	0	3.5	20		80																	
13/06/08	425	517036.625	6969714.23	dead	0	3.5	20		80																	
13/06/08	426	517038.762	6969713.698	dead	0	3.5	20		80																	
13/06/08	427	517047.293	6969716.425	dead	0	3.5	20		80																	
13/06/08	428	517070.987	6969705.158	dead	0	3.5	20		80																	
13/06/08	429	517066.834	6969728.597	poor	30	3.5	50		50		20	30		80	1	2	2	0	3	2	1	0	0	1	1	
13/06/08	430	517083.679	6969744.125	fair	60	2	100				1	5		20	1	2	1	0	0	1	0	0	0	1	0	
13/06/08	431	517137.252	6969795.68	saltmarsh																						
13/06/08	432	516412.589	6968813.981	dead	0	0															0	0	1	0	0	
13/06/08	433	516413.849	6968826.921	dead	0	0															0	0	1	0	0	
13/06/08	434	516426.216	6968817.416	dead	0	0															0	0	1	0	0	
13/06/08	435	516425.781	6968814.204	dead	0	0															0	0	1	0	0	
13/06/08	436	516451.925	6968814.271	dead	0	0															0	0	1	0	0	
13/06/08	437	516451.741	6968819.044	fair																						
13/06/08	438	516444.71	6968834.354	fair																						
13/06/08	439	516468.039	6968830.711	fair																						
13/06/08	440	516494.448	6968818.29	fair																						
13/06/08	441	516493.262	6968805.433	fair																						
13/06/08	442	516498.304	6968802.093	fair																						
13/06/08	443	516502.014	6968787.753	fair																						
13/06/08	444	516493.915	6968834.919	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	
13/06/08	445	516550.487	6968829.346	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	
13/06/08	446	516565.397	6968824.637	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	
13/06/08	447	516607.416	6968811.629	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	
13/06/08	448	516629.575	6968824.727	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	
13/06/08	449	516643.577	6968835.635	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	

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13/06/08	450	516687.728	6968848.016	fair	50	7	80		20		10	15		100	1	1	1	0	1	1	3	0	0	2	2	
13/06/08	451	516760.116	6968815.951	good	55	8	100				2	10		80	2	2	1	0	0	1	2	0	0	2	3	
13/06/08	452	516708.507	6968748.441	good	60	6	40		60		4	10		25	1	1	1	0	0	0	3	0	0	1	2	
13/06/08	453	516647.562	6968773.926	good	60	6	40		60		4	10		25	1	1	1	0	0	0	3	0	0	1	2	
13/06/08	454	516693.566	6968681.66	fair	30	7	30		70		5	25		100	1	2	1	0	3	2	0	0	0	2	2	
13/06/08	455	516679.985	6968669.349	fair	30	7	30		70		5	25		100	1	2	1	0	3	2	0	0	0	2	2	
13/06/08	456	516659.724	6968650.26	poor	25	3	100				17	60		100	2	2	1	0	2	3	0	0	1	1	1	
13/06/08	457	516630.743	6968635.287	poor	25	3	100				17	60		100	2	2	1	0	2	3	0	0	1	1	1	
13/06/08	458	516615.09	6968629.413	poor	25	3	100				17	60		100	2	2	1	0	2	3	0	0	1	1	1	
13/06/08	459	516594.396	6968615.022	poor	25	3	100				17	60		100	2	2	1	0	2	3	0	0	1	1	1	
13/06/08	460	516572.813	6968610.734	poor	25	3	100				17	60		100	2	2	1	0	2	3	0	0	1	1	1	
13/06/08	461	516548.225	6968596.832	poor	25	3	100				17	60		100	2	2	1	0	2	3	0	0	1	1	1	
13/06/08	462	516877.776	6968132.543	dead																						
13/06/08	463	516908.581	6968119.271	poor																						
13/06/08	464	516977.099	6968084.313	fair																						
13/06/08	465	517006.011	6968085.665	fair																						
13/06/08	466	517028.993	6968071.855	dead	10	10	100				60	50		40	2	2	3	1	0	3	2	0	0	0	0	
13/06/08	467	517037.262	6968059.886	dead	10	10	100				60	50		40	2	2	3	1	0	3	2	0	0	0	0	
13/06/08	468	517032.299	6968059.902	dead	10	10	100				60	50		40	2	2	3	1	0	3	2	0	0	0	0	
13/06/08	469	517023.912	6968064.277	dead	10	10	100				60	50		40	2	2	3	1	0	3	2	0	0	0	0	
13/06/08	470	517023.051	6968071.047	dead	10	10	100				60	50		40	2	2	3	1	0	3	2	0	0	0	0	
13/06/08	471	517043.668	6968084.248	good																						
13/06/08	472	517064.231	6968081.843	good																						
13/06/08	473	517102.753	6968064.696	good																						
11/06/08	1	517548.935	6971013.835	fair	7	6	100				5	10		10	1	1	2	10	1	1	2	0	0	2	1	
11/06/08	2	517545.085	6971016.069	fair	7	6	100				5	10		10	1	1	2	10	1	1	2	0	0	2	1	
11/06/08	3	517518.853	6970963.733	fair	7	6	100				5	10		10	1	1	2	10	1	1	2	0	0	2	1	
11/06/08	4	517555.235	6970939.328	fair	7	6	100				5	10		10	1	1	2	10	1	1	2	0	0	2	1	Dead edge P980-82
11/06/08	5	517567.995	6970931.418	fair	7	6	100				5	10		10	1	1	2	10	1	1	2	0	0	2	1	
11/06/08	6	517571.303	6970914.915	fair	7	6	100				5	10		10	1	1	2	10	1	1	2	0	0	2	1	
11/06/08	7	517572.174	6970915.49	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	Dead edge
11/06/08	8	517610.744	6970925.378	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	9	517619.922	6970933.525	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	10	517629.492	6970943.27	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	11	517633.083	6970950.59	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	12	517630.498	6970962.617	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	13	517630.482	6970963.304	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	14	517619.028	6970974.461	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	15	517598.809	6970982.967	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	16	517586.559	6970994.209	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	17	517579.194	6970990.673	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	18	517560.615	6970991.888	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	19	517555.857	6970980.262	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	20	517547.725	6970972.772	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	21	517542.079	6970971.675	fair	80	5	100				0	10		10	1	1	2	0	1	1	2	0	0	2	2	
11/06/08	22	517493.881	6970904.813	good	90	5	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	good/fair edge
11/06/08	23	517549.791	6970853.567	good	90	5	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	
11/06/08	24	517577.017	6970807.794	good	90	5	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	
11/06/08	25	517570.56	6970778.325	good	90	8	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	
11/06/08	26	517562.231	6970755.061	good	90	8	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	

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11/06/08	27	517544.995	6970722.396	good	90	8	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	
11/06/08	28	517558.355	6970681.525	good	90	8	100				0	10		5	0	1	1	0	1	0	2	0	0	2	3	
11/06/08	29	517609.678	6970547.748	dead																						
11/06/08	30	517615.464	6970548.287	dead																						
11/06/08	31	517617.841	6970541.321	dead																						
11/06/08	32	517623.44	6970533.523	dead																						
11/06/08	33	517627.361	6970534.158	dead																						
11/06/08	34	517634.672	6970517.863	dead																						
11/06/08	35	517645.094	6970503.541	dead																						
11/06/08	36	517659.268	6970488.024	dead																						
11/06/08	37	517658.06	6970483.69	dead																						
11/06/08	38	517664.46	6970467.703	dead																						
11/06/08	39	517729.289	6970476.42	good																						pore water
11/06/08	40	517689.203	6970482.466	good																						pore water
11/06/08	41	517678.932	6970474.775	dead																						pore water
11/06/08	42	517661.257	6970476.639	dead																						pore water
11/06/08	43	517635.615	6970470.316	good																						pore water
11/06/08	44	517601.978	6970465.862	fair																						pore water
11/06/08	45	517573.23	6970467.082	poor																						possibly regrowth
11/06/08	46	517396.844	6970588.29																							
11/06/08	47	516569.549	6969847.331	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	Ceriops 50%
11/06/08	48	516579.759	6969816.828	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	49	516587.937	6969821.45	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	50	516629.944	6969827.539	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	51	516646.41	6969827.238	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	52	516677.96	6969827.696	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	53	516689.071	6969802.483	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	54	516708.021	6969788.067	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	55	516727.81	6969781.68	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	56	516738.425	6969775.166	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	57	516753.332	6969773.967	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	58	516775.664	6969761.254	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	59	516802.807	6969750.762	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	60	516817.135	6969756.722	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	61	516860.628	6969789.009	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	62	516850.919	6969827.051	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	63	516870.96	6969804.889	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	64	516884.558	6969804.545	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	photo 985
11/06/08	65	516962.78	6969744.952	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	66	516989.97	6969732.697	fair	80	6	50		50		5	10		10	1	1	1	0	1	0	0	1	0	1	2	
11/06/08	67	516990.121	6969734.47	dead																						
11/06/08	68	516997.012	6969731.61	dead																						
11/06/08	69	516999.473	6969731.049	dead																						
11/06/08	70	516999.1	6969731.226	dead																						
11/06/08	71	516997.475	6969730.56	dead																						
11/06/08	72	516991.328	6969732.537	dead																						
11/06/08	73	516985.232	6969728.423	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	74	517031.634	6969701.239	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	75	517045.067	6969700.914	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	76	517089.365	6969679.433	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	77	517091.578	6969679.913	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	78	517111.673	6969673.646	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	79	517132.488	6969677.748	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	80	517175.169	6969697.455	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	81	517225.768	6969613.945	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	82	517263.73	6969625.729	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	83	517285.586	6969616.33	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	84	517357.087	6969604.976	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	85	517313.004	6969672.239	fair	50	4	60		40		20	30		30	1	1	2	0	0	2	1	0	0	2	2	
11/06/08	86	517313.69	6969688.625	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	87	517320.565	6969703.544	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	88	517334.684	6969713.997	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	89	517341.262	6969741.665	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	90	517343.292	6969747.483	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	91	517374.109	6969746.074	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	92	517400.277	6969750.169	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	93	517428.931	6969765.438	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	94	517461.521	6969786.606	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	95	517482.609	6969802.471	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	96	517496.637	6969812.042	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	97	517522.775	6969806.703	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	98	517530.693	6969786.6	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	99	517621.264	6969844.85	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	100	517672.414	6969897.874	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	101	517696.335	6969918.153	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	102	517705.386	6969913.08	fair	70	6	90		10		10	20		20	1	1	1	1	1	2	1	1	0	2	2	
11/06/08	103	517721.639	6969897.821	fair																						dead fair area
11/06/08	104	517721.796	6969897.384	fair																						
11/06/08	105	517734.149	6969889.187	fair																						
11/06/08	106	517747.861	6969881.721	fair																						
11/06/08	107	517744.043	6969888.458	fair																						
11/06/08	108	517732.742	6969896.598	fair																						
11/06/08	109	517713.886	6969905.956	fair																						
11/06/08	110	517735.655	6969984.99	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	111	517710.8	6970064.175	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	112	517698.432	6970078.64	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	113	517694.626	6970111.465	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	114	517698.41	6970132.693	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	115	517704.226	6970171.577	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	116	517701.071	6970195.776	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	117	517826.872	6970229.37	fair	70	5	100				10	10		10	1	1	1	0	3	1	1	0	0	1	1	
11/06/08	118	517777.853	6970229.943	good																						pore water
11/06/08	119	517775.011	6970230.773	good																						pore water
11/06/08	120	517719.736	6970226.063	fair																						pore water
11/06/08	121	517669.827	6970246.95	poor																						pore water
11/06/08	122	517714.213	6970246.691	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	123	517710.54	6970279.805	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	124	517706.149	6970309.233	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	125	517697.276	6970345.241	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	126	517684.275	6970370.105	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	

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11/06/08	127	517669.565	6970393.003	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	128	517658.286	6970404.522	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	129	517647.205	6970444.164	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	130	517637.654	6970470.629	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	131	517626.717	6970489.687	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	132	517612.279	6970512.102	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	133	517566.892	6970537.727	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	134	517530.883	6970555.753	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	135	517533.591	6970588.625	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	136	517529.444	6970644.234	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
11/06/08	137	517526.846	6970671.005	fair	60	12	100				10	20		20	1	1	1	0	2	2	2	0	0	2	2	
12/06/08	138	517567.062	6969495.669	regrowth	30	10	100				10	10		10	1	1	1	0	1	0	3	0	0	3	2	few trees wih some old dead and lots of seedlings
12/06/08	139	517691.267	6969422.144	regrowth	30	10	100				10	10		10	1	1	1	0	1	0	3	0	0	3	2	small patch of low bushes
12/06/08	140	517691.497	6969414.911	regrowth	30	10	100				10	10		10	1	1	1	0	1	0	3	0	0	3	2	
12/06/08	141	517695.965	6969415.805	regrowth	30	10	100				10	10		10	1	1	1	0	1	0	3	0	0	3	2	
12/06/08	142	517699.342	6969424.5	regrowth	30	10	100				10	10		10	1	1	1	0	1	0	3	0	0	3	2	
12/06/08	143	517695.626	6969428.005	regrowth	30	10	100				10	10		10	1	1	1	0	1	0	3	0	0	3	2	
12/06/08	144	517733.478	6969546.112	good	70	6	100				10	20		20	0	1	1	0	1	0	2	0	0	3	3	
12/06/08	145	517760.076	6969543.92	good	70	6	100				10	20		20	0	1	1	0	1	0	2	0	0	3	3	
12/06/08	146	517798.262	6969578.653	good	70	6	60		40		10	20		20	0	1	1	0	1	0	2	0	0	3	3	
12/06/08	147	517795.326	6969639.34	good	70	6	70		30		10	20		20	0	1	1	0	1	0	2	0	0	3	3	
12/06/08	148	517831.69	6969713.534	good	70	6	90			10	10	20		20	0	1	1	0	1	0	2	0	0	3	3	
12/06/08	149	517877.084	6969695.252	regrowth	70	6	100				10	20		20	0	1	1	0	1	0	2	0	0	3	3	couple of old dead trees surrounded by patch of thick large seedlings p995
12/06/08	150	517916.994	6969615.877	fair	50	6	100				10	20		20	1	1	2	0	2	1	1	0	0	2	2	
12/06/08	151	517942.054	6969564.749	fair																						
12/06/08	152	517966.726	6969566.207	poor	40	4	100				10	40		40	1	1	2	1	3	1	1	0	0	2	2	
12/06/08	153	517983.362	6969551.885	poor	20						20	40		50	1	1	1	1	3	2	1	2	0	2	2	
12/06/08	154	517989.642	6969545.562	dead																						some epicormic growth
12/06/08	155	517997.424	6969539.999	dead																						
12/06/08	156	518001.081	6969553.186	dead																						
12/06/08	157	518009.754	6969561.919	dead																						
12/06/08	158	518022.05	6969566.506	dead																						
12/06/08	159	518036.596	6969568.277	dead																						
12/06/08	160	518038.457	6969577.104	dead																						
12/06/08	161	518038.196	6969585.488	dead																						
12/06/08	162	518045.605	6969591.252	dead																						
12/06/08	163	518059.169	6969584.612	dead																						
12/06/08	164	518066.2	6969575.791	dead																						
12/06/08	165	518050.391	6969572.156	dead																						
12/06/08	166	518044.793	6969563.214	dead																						
12/06/08	167	518051.79	6969559.481	dead																						
12/06/08	168	518048.519	6969556.023	dead																						
12/06/08	169	518037.017	6969556.039	dead																						
12/06/08	170	518029.905	6969554.824	dead																						
12/06/08	171	518020.966	6969556.481	dead																						
12/06/08	172	518012.882	6969542.538	dead																						

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12/06/08	173	518010.872	6969527.751	dead																						
12/06/08	174	517999.953	6969524.193	dead																						
12/06/08	175	517983.306	6969519.705	dead																						
12/06/08	176	518054.033	6969591.852	poor	40	4	100				30	50		60	1	2	1	1	1	2	1	1	0	1	3	poor/good edge
12/06/08	177	518065.18	6969586.386	poor	40	4	100				30	50		60	1	2	1	1	1	2	1	1	0	1	3	
12/06/08	178	518068.621	6969582.082	poor	40	4	100				30	50		60	1	2	1	1	1	2	1	1	0	1	3	
12/06/08	179	518075.195	6969567.152	poor	40	4	100				30	50		60	1	2	1	1	1	2	1	1	0	1	3	
12/06/08	180	518087.645	6969546.708	poor	40	4	100				30	50		60	1	2	1	1	1	2	1	1	0	1	3	
12/06/08	181	518116.449	6969529.332	dead																						
12/06/08	182	518122.527	6969525.915	dead																						
12/06/08	183	518351.297	6969173.252																							
12/06/08	184	518343.111	6969174.434																							
12/06/08	185	518347.085	6969155.107																							
12/06/08	186	518348.925	6969144.446																							
12/06/08	187	518356.076	6969138.892																							
12/06/08	188	518362.667	6969140.442																							
12/06/08	189	518368.985	6969153.988																							
12/06/08	190	518364.732	6969163.771																							
12/06/08	191	518352.703	6969171.829																							
12/06/08	192	518364.833	6969109.41	dead																						
12/06/08	193	518354.159	6969108.795																							
12/06/08	194	518347.52	6969113.605																							
12/06/08	195	518340.658	6969107.729																							
12/06/08	196	518336.761	6969112.006																							
12/06/08	197	518325.929	6969110.49																							
12/06/08	198	518338.852	6969102.82																							
12/06/08	199	518339.972	6969086.85																							
12/06/08	200	518347.254	6969074.788																							
12/06/08	201	518346.03	6969053.807																							
12/06/08	202	518340.749	6969041.55																							
12/06/08	203	518337.501	6969036.281																							
12/06/08	204	518337.527	6969025.92																							
12/06/08	205	518346.13	6969015.444																							
12/06/08	206	518369.967	6969024.219																							
12/06/08	207	518373.639	6969041.649																							
12/06/08	208	518374.035	6969062.706																							
12/06/08	209	518376.239	6969073.611																							
12/06/08	210	518364.556	6969091.056																							
12/06/08	211	518361.683	6969103.482																							
12/06/08	212	518393.121	6969080.326	recently dead																						ring of old recently dead trees with thick cover of seedlings p996
12/06/08	213	518394.707	6969076.787	recently dead																						
12/06/08	214	518400.992	6969074.271	recently dead																						
12/06/08	215	518407.15	6969080.185	recently dead																						
12/06/08	216	518407.208	6969085.495	recently dead																						
12/06/08	217	518403.389	6969086.383	recently dead																						
12/06/08	218	518337.982	6968975.227	fair	70	5	100				20	30		30	1	2	2	0	2	2	0	0	0	1	13	

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12/06/08	219	518349.385	6968936.874	good	80	5	40			60	10	10		10	1	1	1	0	1	1	2	0	0	2	3	
12/06/08	220	518335.595	6968920.072	fair	70	5	100				20	30		30	1	2	2	0	2	2	0	0	0	2	13	
12/06/08	221	518338.84	6968895.25	fair	70	5	100				20	30		30	1	2	2	0	2	2	0	0	0	2	13	
12/06/08	222	518347.223	6968876.687	fair	70	5	100				20	30		30	1	2	2	0	2	2	0	0	0	2	13	
12/06/08	223	518353.953	6968861.153	fair	70	5	20			80	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	224	518375.494	6968841.912	fair	70	5	20			80	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	225	518382.779	6968826.442	fair	70	5	20			80	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	226	518389.931	6968816.061	fair	70	5	20			80	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	227	518395.594	6968784.959	fair	70	5	20			80	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	228	518402.234	6968770.438	fair	70	5	20			80	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	229	518421.169	6968754.059	fair	70	5	80			20	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	230	518436.926	6968751.826	fair	70	5	80			20	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	231	518472.172	6968759.767	fair	70	5	80			20	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	232	518521.406	6968779.189	fair	70	5	80			20	20	30		30	1	2	2	0	2	2	2	2	0	2	13	
12/06/08	233	518410.965	6968939.344	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	234	518391.836	6968958.545	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	235	518390.817	6968991.887	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	236	518410.275	6969019.962	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	237	518426.603	6969055.385	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	238	518426.963	6969058.021	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	239	518443.504	6969108.141	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	240	518436.302	6969146.246	good	80	5	100				10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	241	518427.694	6969180.211	good	80	5	40			60	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	242	518395.363	6969232.16	good	80	5	40			60	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	243	518363.787	6969274.33	good	80	5	50			50	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	244	518340.142	6969299.731	good	80	5	40			60	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	245	518324.204	6969320.459	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	246	518307.118	6969370.908	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	247	518283.463	6969412.593	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	248	518268.103	6969437.043	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	249	518245.349	6969483.016	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	250	518216.867	6969532.924	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	251	518170.344	6969588.31	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	252	518133.112	6969622.819	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	253	518095.668	6969659.539	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	254	517994.357	6969720.101	good	80	5	90			10	10	10		10	1	1	1	0	1	1	3	0	0	2	3	
12/06/08	255	517160.779	6970221.409																							saltmarshbare
12/06/08	256	517206.503	6970181.849																							saltmarshbare
12/06/08	257	517229.901	6970160.212																							saltmarshbare
12/06/08	258	517251.397	6970141.826																							saltmarshbare
12/06/08	259	517340.455	6970044.038																							saltmarshbare
12/06/08	260	517307.998	6970017.68																							saltmarshbare
12/06/08	261	517304.99	6969988.568																							saltmarshbare
12/06/08	262	517303.09	6969975.062																							saltmarshbare
12/06/08	263	517296.091	6969965.936																							saltmarshbare
12/06/08	264	517268.47	6969942.532																							saltmarshbare
12/06/08	265	517244.327	6969922.911																							saltmarshbare
12/06/08	266	517214.172	6969912.936																							saltmarshbare
12/06/08	267	517198.923	6969912.8																							saltmarshbare
12/06/08	268	517168.115	6969921.245																							saltmarshbare

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	269	517160.66	6969929.602																							saltmarshbare
12/06/08	270	517148.352	6969922.433																							saltmarshbare
12/06/08	271	517130.977	6969907.064																							saltmarshbare
12/06/08	272	517121.815	6969909.603																							saltmarshbare
12/06/08	273	517100.426	6969927.18																							saltmarshbare
12/06/08	274	517115.187	6969952.208																							saltmarshbare
12/06/08	275	517137.846	6969977.244																							saltmarshbare
12/06/08	276	517150.921	6970005.246																							saltmarshbare
12/06/08	277	517145.37	6970024.185																							saltmarshbare
12/06/08	278	517134.227	6970025.909																							saltmarshbare
12/06/08	279	517119.348	6970029.541																							saltmarshbare
12/06/08	280	517103.874	6970022.581																							saltmarshbare
12/06/08	281	517098.445	6970009.999																							saltmarshbare
12/06/08	282	517106.025	6969995.913																							saltmarshbare
12/06/08	283	517111.172	6969984.886																							saltmarshbare
12/06/08	284	517105.452	6969971.608																							saltmarshbare
12/06/08	285	517091.08	6969993.855																							saltmarshbare
12/06/08	286	517079.948	6970004.036																							saltmarshbare
12/06/08	287	517065.952	6970016.933																							saltmarshbare
12/06/08	288	517055.199	6970019.427																							saltmarshbare
12/06/08	289	517034.932	6970034.023																							saltmarshbare
12/06/08	290	517390.833	6970662.416																							p15 west 996-8
12/06/08	291	517273.247	6970444.103	fair																						
12/06/08	292	517284.769	6970451.886	poor																						
12/06/08	293	517293.516	6970460.118																							
12/06/08	294	517312.281	6970473.739																							
12/06/08	295	517318.317	6970475.151																							
12/06/08	296	517343.788	6970472.256																							
12/06/08	297	517353.235	6970465.585																							
12/06/08	298	517359.753	6970462.41																							
12/06/08	299	517376.452	6970467.772																							
12/06/08	300	517379.055	6970468.52																							
12/06/08	301	517393.647	6970460.802																							
12/06/08	302	517404.933	6970442.413																							
12/06/08	303	517414.473	6970442.891																							
12/06/08	304	517422.023	6970443.382																							
12/06/08	305	517432.432	6970431.529																							
12/06/08	306	517432.283	6970420.017																							
12/06/08	307	517442.654	6970422.555																							
12/06/08	308	517443.916	6970435.329																							
12/06/08	309	517441.472	6970447.643																							
12/06/08	310	517438.011	6970455.837																							
12/06/08	311	517431.854	6970461.825																							
12/06/08	312	517435.305	6970464.559																							
12/06/08	313	517443.219	6970458.485																							
12/06/08	314	517451.325	6970447.481																							
12/06/08	315	517456.495	6970434.856																							
12/06/08	316	517467.259	6970427.952																							
12/06/08	317	517476.696	6970426.007																							
12/06/08	318	517482.861	6970425.014																							

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12/06/08	319	517488.401	6970416.539																							
12/06/08	320	517489.832	6970408.887																							
12/06/08	321	517497.607	6970404.038																							
12/06/08	322	517500.924	6970393.83																							
12/06/08	323	517501.151	6970384.722																							
12/06/08	324	517508.836	6970386.493																							
12/06/08	325	517519.415	6970388.744																							
12/06/08	326	517523.672	6970392.878																							
12/06/08	327	517526.389	6970397.888																							
12/06/08	328	517533.079	6970404.935																							
12/06/08	329	517534.287	6970409.473																							
12/06/08	330	517528.256	6970410.93																							
12/06/08	331	517521.662	6970412.722																							
12/06/08	332	517513.918	6970416.038																							
12/06/08	333	517516.307	6970412.265																							
12/06/08	334	517514.395	6970402.315																							
12/06/08	335	517511.989	6970400.378																							
12/06/08	336	517516.952	6970399.601																							
12/06/08	337	517527.473	6970391.1																							
12/06/08	338	517533.334	6970386.096																							
12/06/08	339	517538.001	6970375.765																							
12/06/08	340	517548.84	6970368.982																							
12/06/08	341	517553.216	6970363.228																							
12/06/08	342	517558.029	6970367.78																							
12/06/08	343	517565.017	6970362.914																							
12/06/08	344	517559.352	6970360.183																							
12/06/08	345	517560.961	6970354.917																							
12/06/08	346	517561.728	6970346.903																							
12/06/08	347	517566.729	6970337.547																							
12/06/08	348	517566.654	6970331.67																							
12/06/08	349	517561.24	6970324.334																							
12/06/08	350	517554.586	6970318.624																							
12/06/08	351	517554.461	6970312.71																							
12/06/08	352	517560.418	6970306.026																							
12/06/08	353	517561.958	6970292.915																							
12/06/08	354	517560.931	6970282.035																							
12/06/08	355	517565.132	6970276.013																							
12/06/08	356	517565.679	6970264.202																							
12/06/08	357	517564.747	6970256.163																							
12/06/08	358	517561.661	6970253.986																							
12/06/08	359	517564.698	6970244.836																							
12/06/08	360	517551.028	6970242.256																							
12/06/08	361	517550.402	6970250.242																							
12/06/08	362	517545.062	6970253.842																							
12/06/08	363	517535.512	6970257.923																							
12/06/08	364	517520.092	6970259.941																							
12/06/08	365	517515.812	6970257.078																							
12/06/08	366	517527.064	6970250.025																							
12/06/08	367	517527.149	6970239.784																							
12/06/08	368	517532.576	6970221.746																							

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12/06/08	369	517539.77	6970210.511																							
12/06/08	370	517549.598	6970204.415																							
12/06/08	371	517553.284	6970197.038																							
12/06/08	372	517556.958	6970176.041																							
12/06/08	373	517557.695	6970164.035																							
12/06/08	374	517563.58	6970152.793																							
12/06/08	375	517557.05	6970135.617																							
12/06/08	376	517555.677	6970114.664																							
12/06/08	377	517559.355	6970102.153																							
12/06/08	378	517563.435	6970092.231																							
12/06/08	379	517550.538	6970079.057																							
12/06/08	380	517550.713	6970068.5																							
12/06/08	381	517558.472	6970064.07																							
12/06/08	382	517567.594	6970056.908	fair																						
12/06/08	383	517560.749	6970051.468	fair																						
12/06/08	384	517550.139	6970044.074	fair																						
12/06/08	385	517533.101	6970038.361	poor																						
12/06/08	386	517525.347	6970034.862	poor																						
12/06/08	387	517520.08	6970031.62	poor																						
12/06/08	388	517508.832	6970030.03	poor																						
12/06/08	389	517500.557	6970026.997	poor																						
12/06/08	390	517497.41	6970022.415	poor																						
12/06/08	391	517485.667	6970022.339	poor																						
12/06/08	392	517484.696	6970021.764	poor																						
12/06/08	393	517470.922	6970009.38	poor																						
12/06/08	394	517480.047	6969998.718	poor																						
12/06/08	395	517492.35	6969984.3	poor																						
12/06/08	396	517488.754	6969996.347	poor																						
12/06/08	397	517489.715	6969996.55	poor																						
12/06/08	398	517510.552	6969986.688	poor																						
12/06/08	399	517522.099	6969971.473	poor																						
12/06/08	400	517589.793	6969899.051	fair																						
12/06/08	401	517615.26	6969916.859	fair																						
12/06/08	402	517639.305	6969925.691	fair																						
12/06/08	403	517663.859	6969930.65	fair																						
12/06/08	404	517673.022	6969951.443	fair																						
12/06/08	405	517684.764	6969962.428	fair																						
12/06/08	406	517704.337	6969973.012	fair																						
12/06/08	407	517688.544	6969991.91	fair																						
12/06/08	408	517696.836	6970012.184	fair																						
12/06/08	409	517691.478	6970032.237	fair																						
12/06/08	410	517685.718	6970049.496	fair																						
12/06/08	411	517678.046	6970061.92	fair																						
12/06/08	412	517670.199	6970085.885	fair																						
12/06/08	413	517665.073	6970100.051	fair																						
12/06/08	414	517661.396	6970118.644	fair																						
12/06/08	415	517653.516	6970142.952	fair																						
12/06/08	416	517652.054	6970169.285	fair																						
12/06/08	417	517651.589	6970180.232	poor																						
12/06/08	418	517652.111	6970191.678	poor																						

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12/06/08	419	517652.887	6970206.56	poor																						
12/06/08	420	517652.637	6970222.706	regrowth																						
12/06/08	421	517649.04	6970245.486	regrowth																						
12/06/08	422	517637.988	6970265.082	regrowth																						
12/06/08	423	517634.644	6970314.211	regrowth																						
12/06/08	424	517631.83	6970334.334	regrowth																						
12/06/08	425	517623.702	6970341.337	regrowth																						
12/06/08	426	517606.608	6970355.028	regrowth																						
12/06/08	427	517613.085	6970363.337	regrowth																						
12/06/08	428	517622.029	6970370.39	regrowth																						
12/06/08	429	517623.346	6970370.193	fair																						
12/06/08	430	517615.463	6970386.257	fair																						
12/06/08	431	517604.836	6970407.375	fair																						
12/06/08	432	517586.694	6970424.253	fair																						
12/06/08	433	517577.332	6970444.2	fair																						
12/06/08	434	517555.643	6970472.242	fair																						
12/06/08	435	517537.496	6970486.064	fair																						
12/06/08	436	517521.52	6970493.422	regrowth																						
12/06/08	437	517517.157	6970496.445	regrowth																						
12/06/08	438	517517.283	6970509.545	regrowth																						
12/06/08	439	517507.932	6970518.657	regrowth																						
12/06/08	440	517466.538	6970520.416	regrowth																						
12/06/08	441	517452.326	6970527.223	regrowth																						
12/06/08	442	517435.992	6970539.789	regrowth																						
12/06/08	443	517411.007	6970582.022	fair																						
12/06/08	444	517411.607	6970583.776	fair																						
12/06/08	445	517409.798	6970600.026	fair																						
12/06/08	446	517400.868	6970590.94	fair																						
12/06/08	447	517392.238	6970589.504	fair																						
12/06/08	448	517387.407	6970578.128	fair																						
12/06/08	449	517388.751	6970567.486	fair																						
12/06/08	450	517403.434	6970565.702	fair																						
12/06/08	451	517410.585	6970570.798	fair																						
13/06/08	562	516685.65	6967665.46	fair																						
13/06/08	563	516617.675	6967683.935	poor	30	6	100				20	30		40	1	1	1	0	3	3	0	0	0	2	3	
13/06/08	564	516607.282	6967694.06	poor																						
13/06/08	565	516594.21	6967702.387	poor																						
13/06/08	566	516583.483	6967716.7	poor																						
13/06/08	567	516574.754	6967720.054	poor																						
13/06/08	568	516568.168	6967726.581	poor																						
13/06/08	569	516557.733	6967736.38	poor																						
13/06/08	570	516545.086	6967740.093	poor																						
13/06/08	571	516535.813	6967739.353	poor																						
13/06/08	572	516516.402	6967741.357	poor																						
13/06/08	573	516501.574	6967743.633	poor																						
13/06/08	574	516493.828	6967744.544	poor																						
13/06/08	575	516486.039	6967744.23	poor																						
13/06/08	576	516478.127	6967757.062	poor																						
13/06/08	577	516474.577	6967766.389	fair																						
13/06/08	578	516535.694	6967486.289																							sediment WI3

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13/06/08	579	516547.965	6967504.451	fair	60	20	100				5	10		10	1	1	1	0	1	1	2	0	0	3	3	
13/06/08	580	516564.693	6967516.127	fair	60	20	100				5	10		10	1	1	1	0	1	1	2	0	0	3	3	
13/06/08	581	516577.814	6967532.199	fair	60	20	100				5	10		10	1	1	1	0	1	1	2	0	0	3	3	
13/06/08	582	516612.345	6967517.845	fair	60	20	100				5	10		10	1	1	1	0	1	1	2	0	0	3	3	
13/06/08	583	516626.087	6967490.437	fair	60	20	60		40		5	10		10	1	1	1	0	1	1	2	0	0	3	3	
13/06/08	584	516639.822	6967464.348	fair																						
13/06/08	585	516650.104	6967458.466	fair																						
13/06/08	586	516662.197	6967443.177	fair																						
13/06/08	587	516679.306	6967442.745	fair																						
13/06/08	588	516696.455	6967417.236	fair																						
13/06/08	589	516705.92	6967401.199	fair																						
13/06/08	590	516725.524	6967395.462	fair																						
13/06/08	591	516749.852	6967396.506	fair																						
13/06/08	592	516766.012	6967404.96	fair																						
13/06/08	593	516781.772	6967399.878	fair																						
13/06/08	594	516794.731	6967388.654	fair																						
13/06/08	595	516802.187	6967381.672	fair																						
13/06/08	596	516811.602	6967383.859	fair																						
13/06/08	597	516836.22	6967397.25	fair																						
13/06/08	598	516854.064	6967406.974	fair																						
13/06/08	599	516889.59	6967411.465	fair																						
13/06/08	600	516915.112	6967413.621	fair																						
13/06/08	601	516935.862	6967421.735	fair																						
13/06/08	602	516957.661	6967421.89	fair																						
13/06/08	603	516969.553	6967435.225	fair																						
13/06/08	604	517000.126	6967470.769	fair																						
13/06/08	605	517084.966	6967396.952	good																						pore water site 5
13/06/08	606	517030.611	6967430.553	good																						pore water site 4
13/06/08	607	516986.826	6967445.841	fair																						pore water site 3
13/06/08	608	516957.068	6967501.82	poor																						pore water site 2
13/06/08	609	516912.68	6967512.15	dead																						pore water site 1
13/06/08	610	517032.555	6967518.158	fair	70	14	100				5	10		10	1	1	1	1	1	1	2	0	0	2	2	
13/06/08	611	517039.347	6967534.099	fair																						
13/06/08	612	517038.041	6967554.192	fair																						
13/06/08	613	517043.513	6967568.668	fair																						
13/06/08	614	517040.753	6967591.447	fair																						
13/06/08	615	517045.015	6967623.704	fair																						
13/06/08	616	517038.079	6967640.704	fair																						
13/06/08	617	517029.689	6967661.169	fair																						
13/06/08	618	517023.794	6967687.963	fair																						
13/06/08	619	517016.016	6967701.91	fair																						
13/06/08	620	517015.55	6967729.949	fair																						
13/06/08	621	517016.38	6967749.232	fair																						
13/06/08	622	517007.267	6967779.316	fair																						
13/06/08	623	517013.003	6967799.474	fair																						
13/06/08	624	517019.672	6967810.43	fair																						
13/06/08	625	517023.133	6967832.624	fair																						
13/06/08	626	517017.763	6967867.234	fair																						
13/06/08	627	517007.356	6967885.075	fair																						
13/06/08	628	517012.602	6967897.852	fair																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
13/06/08	629	517016.851	6967908.913	fair																						
13/06/08	630	517017.855	6967933.329	fair																						
13/06/08	631	517020.072	6967948.906	fair																						
13/06/08	632	517015.199	6967960.221	fair																						
13/06/08	633	517021.295	6967970.611	fair																						
13/06/08	634	517019.599	6967984.27	fair																						
13/06/08	635	517101.515	6967997.665	good																						pore water site 5
13/06/08	636	517037.958	6967988.571	good																						pore water site 4
13/06/08	637	517018.975	6967993.983	fair																						pore water site 3
13/06/08	638	516983.143	6967991.136	poor																						pore water site 2
13/06/08	639	516949.286	6967990.375	dead																						pore water site 1
13/06/08	640	517040.055	6968006.534	fair	10	10	100				10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	641	517032.775	6968026.468	fair																						
13/06/08	642	517031.531	6968032.18	fair																						
13/06/08	643	517039.236	6968055.231	fair																						
13/06/08	644	517037.545	6968066.663	fair																						
13/06/08	645	517032.788	6968095.553	fair																						
13/06/08	646	517034.457	6968110.025	fair																						
13/06/08	647	517039.268	6968119.832	fair																						
13/06/08	648	517032.199	6968124.976	fair																						
13/06/08	649	517033.34	6968164.377	fair																						
13/06/08	650	517036.767	6968185.745	fair																						
13/06/08	651	517035.105	6968200.519	fair																						
13/06/08	652	517031.254	6968207.72	fair																						
13/06/08	653	517023.606	6968213.867	fair																						
13/06/08	654	517009.223	6968238.454	fair																						
13/06/08	655	517016.25	6968257.059	fair																						
13/06/08	656	517012.484	6968271.854	fair																						
13/06/08	657	517005.539	6968300.414	fair																						
13/06/08	658	517012.954	6968323.493	fair																						
13/06/08	659	517015.097	6968339.46	fair																						
13/06/08	660	517012.58	6968352.536	fair																						
13/06/08	661	517001.956	6968375.39	fair																						
13/06/08	662	517002.184	6968402.37	fair																						
13/06/08	663	516994.942	6968420.642	fair																						
13/06/08	664	516988.222	6968432.331	fair																						
13/06/08	665	516987.229	6968457.726	fair																						
13/06/08	666	516964.054	6968487.978	fair																						
13/06/08	667	516959.343	6968508.94	fair																						
13/06/08	668	516912.244	6968544.685	fair																						
13/06/08	669	516896.965	6968557.657	fair																						
13/06/08	670	516876.933	6968572.494	fair																						
13/06/08	671	516857.595	6968586.345	fair																						
13/06/08	672	516841.127	6968607.982	fair																						
13/06/08	673	516824.142	6968609.175	fair																						
13/06/08	674	516794.888	6968612.78	fair																						
13/06/08	675	516755.803	6968644.011	fair																						
13/06/08	676	516744.158	6968659.912	fair																						
13/06/08	677	516703.982	6968675.5	fair																						
13/06/08	678	516683.618	6968678.072	fair																						

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13/06/08	679	516654.213	6968686.365	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	680	516633.127	6968694.991	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	681	516613.163	6968735.489	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	682	516586.111	6968744.188	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	683	516581.055	6968730.946	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	684	516543.617	6968736.92	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
13/06/08	685	516507.686	6968779.092	fair			50		50		10	10		10	1	1	1	0	1	1	1	0	0	1	2	
11/06/08	1	517753.409	6971227.516	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	231-234
11/06/08	2	517728.792	6971226.187	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	3	517703.508	6971199.262	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	4	517715.293	6971176.238	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	5	517711.796	6971159.253	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	6	517686.651	6971148.417	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	7	517676.418	6971144.737	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	8	517674.337	6971115.039	good	75	15	100					0	20	15	1	1	1	1	1	0	2	0	a	2	2	
11/06/08	9	517655.147	6971118.614	fair	60	15	100					5	25	20	1	2	2	1	1	1	1	0	a	3	1	237-238 seagrass
11/06/08	10	517652.152	6971104.84	fair	60	15	100					5	25	20	1	2	2	1	1	1	1	0	a	3	1	
11/06/08	11	517654.157	6971093.445	fair	60	15	100					5	25	20	1	2	2	1	1	1	1	0	a	3	1	
11/06/08	12	517644.606	6971073.368	fair	60	15	100					5	25	20	1	2	2	1	1	1	1	0	a	3	1	
11/06/08	13	517625.94	6971072.735	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	239-245 bareish
11/06/08	14	517623.727	6971072.358	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	15	517628.034	6971076.53	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	16	517632.063	6971082.782	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	17	517633.3	6971090.161	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	18	517637.68	6971098.232	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	19	517635.236	6971104.92	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	20	517628.463	6971109.591	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	21	517615.283	6971101.932	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	22	517612.328	6971093.153	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	23	517602.951	6971068.136	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	24	517604.178	6971068.041	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	25	517607.889	6971066.569	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	26	517614.202	6971065.278	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	27	517616.152	6971066.678	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	28	517622.048	6971063.494	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	29	517622.924	6971061.756	poor	10	2	95	5				5	50	40	1	2	2	1	1	1	2	1	poor	1	1	
11/06/08	30	517631.745	6971046.118	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	246-249 bare patches
11/06/08	31	517625.777	6971045.523	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	32	517618.708	6971046.1	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	33	517614.679	6971045.511	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	34	517606.001	6971044.772	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	35	517600.832	6971040.982	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	36	517621.561	6971030.442	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	37	517582.181	6971009.748	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	38	517593.385	6970997.301	poor	40	12	90	5				5	25	20	2	2	2	1	1	1	2	0	0	3	1	
11/06/08	39	517594.677	6970979.956	dead	5	1	95	5				95	40	30	1	2	2	1	2	2	1	1	poor	1	1	250-255 hole of death
11/06/08	40	517623.674	6970995.549	good																						boundary of good and fair
11/06/08	41	517627.938	6970998.43	good																						boundary of good and fair

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11/06/08	42	517633.042	6970997.225	good																						boundary of good and fair
11/06/08	43	517635.312	6971002.142	good																						boundary of good and fair
11/06/08	44	517636.194	6971004.843	good																						boundary of good and fair
11/06/08	45	517633.069	6971010.139	good																						boundary of good and fair
11/06/08	46	517633.199	6971014.401	good																						boundary of good and fair
11/06/08	47	517636.971	6971014.99	good																						boundary of good and fair
11/06/08	48	517640.147	6971015.737	good																						boundary of good and fair
11/06/08	49	517643.233	6971017.849	good																						boundary of good and fair
11/06/08	50	517647.286	6971023.73	dead																						boundary of good and fair
11/06/08	51	517650.649	6971034.012	good																						boundary of good and fair
11/06/08	52	517646.662	6971039.653	good																						boundary of good and fair
11/06/08	53	517647.111	6971040.368	good																						boundary of good and fair
11/06/08	54	517647.012	6971046.932	good																						boundary of good and fair
11/06/08	55	517646.957	6971048.835	good																						boundary of good and fair
11/06/08	56	517648.249	6971053.522	good																						boundary of good and fair
11/06/08	57	517648.709	6971062.546	good																						boundary of good and fair
11/06/08	58	517654.937	6971065.025	good																						boundary of good and fair
11/06/08	59	517657.659	6971067.862	good																						boundary of good and fair
11/06/08	60	517659.473	6971072.325	good																						boundary of good and fair
11/06/08	61	517663.31	6971078.048	good																						boundary of good and fair
11/06/08	62	517664.534	6971081.779	good																						boundary of good and fair
11/06/08	63	517669.436	6971084.418	good																						boundary of good and fair
11/06/08	64	517672.03	6971090.569	good																						boundary of good and fair
11/06/08	65	517675.745	6971097.583	good																						boundary of good and fair
11/06/08	66	517677.108	6971100.125	good																						boundary of good and fair
11/06/08	67	517678.049	6971102.983	good																						boundary of good and fair
11/06/08	68	517676.238	6971117.163	good																						boundary of good and fair
11/06/08	69	517676.75	6971122.139	good																						boundary of good and fair
11/06/08	70	517678.155	6971125.163	good																						boundary of good and fair
11/06/08	71	517678.965	6971129.173	good																						boundary of good and fair
11/06/08	72	517680.652	6971137.712	good																						boundary of good and fair
11/06/08	73	517682.738	6971141.646	good																						boundary of good and fair
11/06/08	74	517682.162	6971144.562	good																						boundary of good and fair
11/06/08	75	517686.055	6971154.843	good																						boundary of good and fair
11/06/08	76	517683.928	6971162.311	good																						boundary of good and fair

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11/06/08	77	517623.048	6970974.836	good																						boundary of good and fair
11/06/08	78	517622.1	6970973.046	good																						boundary of good and fair
11/06/08	79	517627.083	6970968.554	good																						boundary of good and fair
11/06/08	80	517627.781	6970963.893	good																						boundary of good and fair
11/06/08	81	517630.48	6970961.698	good																						boundary of good and fair
11/06/08	82	517629.637	6970951.783	good																						boundary of good and fair
11/06/08	83	517624.272	6970950.463	good																						boundary of good and fair
11/06/08	84	517614.011	6970943.691	good																						boundary of good and fair
11/06/08	85	517628.908	6970940.541	good																						boundary of good and fair
11/06/08	86	517618.389	6970934.02	good																						boundary of good and fair
11/06/08	87	517614.569	6970922.578	good																						boundary of good and fair
11/06/08	88	517620.316	6970919.394	good																						boundary of good and fair
11/06/08	89	517620.497	6970912.588	good																						boundary of good and fair
11/06/08	90	517618.208	6970905.786	good																						boundary of good and fair
11/06/08	91	517616.156	6970902.614	good																						boundary of good and fair
11/06/08	92	517609.185	6970901.668	good																						boundary of good and fair
11/06/08	93	517603.707	6970896.04	good																						boundary of good and fair
11/06/08	94	517598.93	6970894.06	good																						boundary of good and fair
11/06/08	95	517595.341	6970893.712	good																						boundary of good and fair
11/06/08	96	517590.913	6970892.113	good																						boundary of good and fair
11/06/08	97	517583.212	6970891.195	good																						boundary of good and fair
11/06/08	98	517577.068	6970894.751	good																						boundary of good and fair
11/06/08	99	517575.148	6970879.787	good																						boundary of good and fair
11/06/08	100	517580.062	6970873.327	good																						boundary of good and fair
11/06/08	101	517585.643	6970870.163	poor		12	95	5			5	30	20	1	1	1	1	1	1	1	0	a	1	1	small dead patch on map
11/06/08	102	517595.65	6970861.152	poor		12	95	5			5	30	20	1	1	1	1	1	1	1	0	a	1	1	
11/06/08	103	517573.006	6970900.253	good																						fair low lying
11/06/08	104	517563.069	6970899.998	good																						fair low lying
11/06/08	105	517558.177	6970898.464	good																						fair low lying
11/06/08	106	517552.643	6970899.901	good																						fair low lying
11/06/08	107	517550.799	6970897.49	good																						fair low lying
11/06/08	108	517516.702	6970891.068	good																						fair low lying
11/06/08	109	517510.765	6970894.948	good																						fair low lying
11/06/08	110	517502.873	6970899.128	good																						fair low lying
11/06/08	111	517495.858	6970902.267	good																						fair low lying
11/06/08	112	517486.855	6970906.439	good																						fair low lying
11/06/08	113	517460.499	6970859.869	fair	20	10	100				10	40	30	2	2	1	1	1	2	2	0	poor	1	0	274-278 algae
11/06/08	114	517446.186	6970824.349	dead	5	10	95	5			90	20	70	2	2	2	1	2	3	2	1	poor	0	0	279-87 recently dead
11/06/08	115	517444.504	6970824.834	dead	5	10	95	5			90	20	70	2	2	2	1	2	3	2	1	poor	0	0	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	116	517441.974	6970823.603	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	117	517437.877	6970821.752	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	118	517434.241	6970817.319	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	119	517434.391	6970811.739	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	120	517435.984	6970807.42	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	121	517441.33	6970802.138	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	122	517443.224	6970799.016	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	123	517442.236	6970797.727	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	124	517442.636	6970793.781	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	125	517440.778	6970792.242	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	126	517436.647	6970789.723	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	127	517436.89	6970785.758	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	128	517436.703	6970782.908	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	129	517439.172	6970776.118	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	130	517438.934	6970771.996	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	131	517442.503	6970770.403	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	132	517445.997	6970773.36	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	133	517446.367	6970776.924	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	134	517448.033	6970783.115	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	135	517450.656	6970785.71	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	136	517453.402	6970788.037	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	137	517454.873	6970790.672	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	138	517452.5	6970794.584	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	139	517453.657	6970798.546	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	140	517453.464	6970802.158	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	141	517452.432	6970805.094	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	142	517454.305	6970810.624	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	143	517456.97	6970813.954	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	144	517459.277	6970816.401	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	145	517460.841	6970820.345	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	146	517462.49	6970825.969	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	147	517462.153	6970833.666	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	148	517464.885	6970837.218	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	149	517465.746	6970842.788	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	150	517462.748	6970844.491	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	151	517460.083	6970846.974	dead	5	10	95	5				90	20	70	2	2	2	1	2	3	2	1	poor	0	0	
11/06/08	152	517426.031	6970773.23	good																						fairl landward good seaward
11/06/08	153	517425.305	6970763.241	good																						fairl landward good seaward
11/06/08	154	517421.883	6970764.342	good																						fairl landward good seaward
11/06/08	155	517418.627	6970759.296	good																						fairl landward good seaward
11/06/08	156	517418.039	6970753.252	good																						fairl landward good seaward
11/06/08	157	517418.031	6970748.007	good																						fairl landward good seaward
11/06/08	158	517417.075	6970746.161	good																						fairl landward good seaward
11/06/08	159	517410.322	6970741.064	good																						fairl landward good seaward
11/06/08	160	517400.99	6970735.154	good																						fairl landward good seaward
11/06/08	161	517398.016	6970730.451	good																						fairl landward good seaward

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
11/06/08	162	517396.269	6970725.523	good																						fairl landward good seaward
11/06/08	163	517396.262	6970726.433	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	288-295 dead with poor ring landward 5m
11/06/08	164	517394.752	6970725.581	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	165	517392.846	6970725.287	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	166	517391.351	6970723.432	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	167	517388.605	6970721.31	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	168	517385.715	6970716.904	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	169	517382.451	6970712.071	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	170	517381.376	6970708.266	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	171	517379.49	6970704.806	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	172	517379.085	6970694.176	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	173	517376.621	6970692.48	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	174	517375.359	6970684.516	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	175	517376.375	6970682.203	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	176	517382.749	6970676.874	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	177	517382.432	6970669.8	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	178	517379.773	6970664.957	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	179	517380.048	6970660.398	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	180	517386.706	6970656.619	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	181	517387.77	6970653.108	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	182	517395.729	6970654.759	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	183	517399.873	6970654.595	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	184	517401.766	6970657.294	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	185	517403.554	6970661.386	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	186	517402.283	6970665.593	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	187	517398.843	6970670.51	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	188	517399.313	6970675.086	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	189	517398.772	6970679.367	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	190	517398.385	6970686.489	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	191	517398.84	6970691.687	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	192	517393.63	6970700.069	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	193	517391.938	6970704.723	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	194	517393.603	6970709.744	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	195	517395.089	6970717.355	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	196	517396.104	6970720.658	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
11/06/08	197	517394.711	6970725.674	dead	5	2	100					95	40	35	2	2	2	2	2	3		1	a	0	1	
12/06/08	488	518278.712	6969244.413	dead																						transect 2 sample 1 10.30am(southern at east fisherman)
12/06/08	489	518307.34	6969270.135	poor																						s2
12/06/08	490	518301.116	6969263.914																							ignore
12/06/08	491	518322.797	6969282.441	fair																						s3
12/06/08	492	518346.453	6969308.681	good																						s4
12/06/08	493	518374.947	6969328.089	good																						s5
12/06/08	494	518115.774	6969515.332	dead																						transect 1 sample 1 11.15 am (northern at east fisherman)
12/06/08	495	518120.344	6969523.755	poor																						s2
12/06/08	496	518132.176	6969544.563	fair																						s3
12/06/08	497	518158.551	6969565.85	good																						s4

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	498	518181.24	6969604.55	good																						s5
12/06/08	499	517152.252	6969588.888								20	15		10	1	1	1	0	1	1	3	0	a	1	2	eroding along shoreline for approx 30m long by 10m into forest 2346-2349
12/06/08	500	516715.226	6969724.004	poor	30	18	100				20	15		10	1	1	1	0	1	1	3	0	a	1	2	eronding but longer thinner area 300m lon by <5m into forest 2350-2353
12/06/08	361	516106.89	6969263.666	fair	50%	5	100					0%	10%	10%	1	1	2	0	1	1	2	0	A	0	0	Some Seagrass Wrack
12/06/08	362	516056.681	6969339.716	fair	50%	6	100					0%	10%	10%	1	1	2	1	1	1	2	0	A	1	1	Photo 606-7, Epi Algae
12/06/08	363	515745.945	6969462.803	fair	60%	14	100					2%	20%	20%	1	1	2	0	0	0	2	0	A	1	2	Photo 607, 9 dead seedling
12/06/08	364	515731.969	6969401.6	fair	60%	15	100					3%	15%	15%	1	1	2	0	1	0	3	0	A	3	1	Photo 610 Seedlings
12/06/08	365	515715.306	6969370.008	fair	30%	15	100					10%	10%	10%	1	1	2	0	0	0	0	0	A	1	2	Photo 611-13 raised area
12/06/08	366	515709.021	6969315.851	fair	50%	15	100					5%	5%	5%	1	1	2	0	0	0	3	0	A	1	1	Photo 614-15; to west
12/06/08	366	515709.021	6969315.851	fair	60%	15	80	10		10		2%	20%	20%	1	1	2	0	0	0	2	0	A	1	2	Strip of fair health along either side of dainage channel which appears to have been excavated and dumped on either side to form road and ridge, Photo 617, 618 *Zostera* & *Caulerpa*
12/06/08	367	515719.36	6969197.518																							in channel. Channel Outlet, Photo 619-20, 629
12/06/08	368	515657.532	6969177.404	good	60%	15	85			10		2%	5%	5%	1	1	2	0	1	0	3	0	A	2	1	To South
12/06/08	368	515657.532	6969177.404	fair	40%	12	0	10				0%	20%	20%	1	1	2	0	0	0	0	0	A	0	0	To North. Photo 627, Human activity and seagrass and litter washed up
12/06/08	369	515592.238	6969161.871	good	70%	10	20	20	20	20		0%	10%	10%	1	1	1	0	1	1	2	0	A	0	3	Photo 624-25
12/06/08	370	515536.548	6969139.567	fair	60%	10	10		90			5%	10%	10%	1	1	1	0	1	0	0	0	A	0	1	Photo 626-28, Erosion and Litter Seaward. Photo 630-32, Litter and Erosion Landward. Photo 633-35
12/06/08	371	515524.828	6969189.188	fair	50%							5%	10%	10%	1	1	1	0	1	0	3	0	A	0	1	
12/06/08	371	515524.828	6969189.188	good	60%	12	20	10	50			2%	10%	5%	0	1	1	0	0	0	4	0	A	0	2	
12/06/08	372	515522.79	6969235.742	good	60%	12	20	10	50			2%	10%	5%	0	1	1	0	0	0	4	0	A	0	2	
12/06/08	373	515533.719	6969208.46	good	60%	12	20	10	50			2%	10%	5%	0	1	1	0	0	0	4	0	A	0	2	
12/06/08	374	515543.765	6969190.529	good	60%	12	20	10	50			2%	10%	5%	0	1	1	0	0	0	4	0	A	0	2	
12/06/08	375	515536.783	6969167.958	good	60%	12	20	10	50			2%	10%	5%	0	1	1	0	0	0	4	0	A	0	2	
12/06/08	376	515535.894	6969158.954	good	60%	12	20	10	50			2%	10%	5%	0	1	1	0	0	0	4	0	A	0	2	Photo site 1 Phot # N638 E639 S640 W641 & Sediment site FI 1
12/06/08	377	515554.143	6969180.201	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	
12/06/08	378	515571.2	6969188.73	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	
12/06/08	379	515577.004	6969211.089	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	
12/06/08	380	515586.416	6969229.32	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	
12/06/08	381	515594.181	6969249.244	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	
12/06/08	382	515565.96	6969245.724	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	
12/06/08	383	515554.469	6969228.219	good	70%	15	60	10	10	10		5%	10%	10%	1	1	1	0	1	0	4	0	A	1	2	Sandy derm/spit extending in at WPT 383. Photo 641

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	384	515557.036	6969304.719	fair	60%	10	80	10		10		1%	10%	10%	1	1	1	0	1	0	1	1	A	2	2	Litter
12/06/08	385	515551.835	6969333.479																							Photo 642. Saltmarsh only - pigfaie, sueda etc
12/06/08	386	515552.007	6969338.177	poor	10%	12	95			5		70%	10%	10%	2	1	1	0	2	2	0	0	A	0	0	Photo 646-47, sand accreting
12/06/08	387	515573.026	6969373.876	poor	10%	12	95			5		70%	10%	10%	2	1	1	0	2	2	0	0	A	0	0	
12/06/08	388	515588.642	6969370.105	poor	10%	12	95			5		70%	10%	10%	2	1	1	0	2	2	0	0	A	0	0	Seaward
12/06/08	389	515596.25	6969357.506	fair	60%	18	60	40				3%	10%	10%	1	1	1	0	1	0	4	0	A	1	3	Landward
12/06/08	390	515606.28	6969379.07	fair	60%	18	60	40				3%	10%	10%	1	1	1	0	1	0	4	0	A	1	3	
12/06/08	391	515591.948	6969382.533	fair	60%	18	60	40				3%	10%	10%	1	1	1	0	1	0	4	0	A	1	3	Margin of good landward and fair seaward
12/06/08	392	515591.09	6969405.104	fair	60%	18	60	40				3%	10%	10%	1	1	1	0	1	0	4	0	A	1	3	
12/06/08	393	515603.048	6969418.189	fair	60%	18	60	40				3%	10%	10%	1	1	1	0	1	0	4	0	A	1	3	
12/06/08	394	515604.106	6969429.153	good	60%	15	95	5		5		3%	10%	10%	1	1	1	0	1	0	5	0	A	3	2	Photo 648-51, seedlings and epi
12/06/08	395	515596.818	6969458.445	good	60%	15	95	5		5		3%	10%	10%	1	1	1	0	1	0	5	0	A	3	2	Margin of good landward and fair seaward
12/06/08	396	515636.505	6969433.419	RG	20%	18	90	10				10%	40%	30%	2	2	1	1	2	0	4	0	A	3	1	Photo 652-55. Area previously recorded as dead is regrowing, lots of seedlings and some saplings
12/06/08	397	515635.684	6969478.357																							Photo site 2, N657, E659, S660, W662 & sediment site FI 2
12/06/08	398	515624.366	6969486.569	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	Ring of AM with lots of seedlings, no understory
12/06/08	399	515623.107	6969486.877	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	400	515619.285	6969485.554	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	401	515604.439	6969475.528	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	402	515606.77	6969470.892	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	403	515609.79	6969467.675	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	404	515611.29	6969460.673	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	405	515610.773	6969458.687	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	406	515608.967	6969452.292	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	407	515609.534	6969442.525	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	408	515611.982	6969438.696	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	409	515616.999	6969434.512	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	410	515620.31	6969431.759	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	411	515619.696	6969431.203	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	412	515619.543	6969428.307	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	413	515622.05	6969418.536	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	414	515622.067	6969418.462	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	415	515627.174	6969413.804	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	416	515639.756	6969416.499	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	417	515646.835	6969417.688	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	418	515649.853	6969419.197	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	419	515655.875	6969417.035	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	420	515665.858	6969415.027	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	421	515680.945	6969412.408	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	422	515682.818	6969412.591	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	423	515707.873	6969441.173	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	424	515713.952	6969445.501	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	425	515717.908	6969447.306	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
12/06/08	426	515721.069	6969450.543	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	427	515730.086	6969458.107	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	428	515737.728	6969465.135	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	429	515744.085	6969478.71	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	430	515745.262	6969485.569	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	431	515756.806	6969550.591	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	432	515751.66	6969556.614	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	433	515745.623	6969560.187	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
12/06/08	434	515739.958	6969562.905	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	435	515730.996	6969566.269	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	436	515725.336	6969566.285	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	437	515724.864	6969566.406	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	438	515721.435	6969561.044	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	439	515716.82	6969549.027	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	Photo 664-65, Recently broken tree plus seedlings
14/05/08	440	515728.728	6969542.606	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	441	515739.199	6969545.953	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	442	515741.197	6969540.204	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	443	515737.859	6969528.584	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	444	515731.552	6969514.795	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	445	515726.453	6969513.326	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	446	515718.432	6969514.014	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	447	515713.563	6969516.341	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	448	515703.365	6969518.991	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	449	515695.945	6969516.457	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	450	515690.146	6969517.82	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	451	515676.93	6969513.027	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	Photo 666
14/05/08	452	515662.848	6969497.457	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	453	515656.737	6969494.874	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	454	515655.663	6969491.208	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	455	515654.455	6969486.363	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	456	515651.935	6969478.651	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	457	515645.788	6969454.344																							Ring of dense est seedlings, possibly previous dead section but no regrowth
14/05/08	458	515647.75	6969452.921																							
14/05/08	459	515652.101	6969453.342																							
14/05/08	460	515653.627	6969454.556																							
14/05/08	461	515662.331	6969456.616																							
14/05/08	462	515667.541	6969454.334																							
14/05/08	463	515670.395	6969450.524																							
14/05/08	464	515669.01	6969443.135																							
14/05/08	465	515667.154	6969437.094																							
14/05/08	466	515663.919	6969434.424																							
14/05/08	467	515658.679	6969432.397																							
14/05/08	468	515652.177	6969428.284																							
14/05/08	469	515647.111	6969426.563																							
14/05/08	470	515641.455	6969422.708																							
14/05/08	471	515637	6969419.102																							
14/05/08	472	515634.228	6969416.042																							
14/05/08	473	515631.215	6969418.33																							
14/05/08	474	515629.701	6969420.337																							

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
14/05/08	475	515627.74	6969422.921																							
14/05/08	476	515629.212	6969426.855																							
14/05/08	477	515632.158	6969429.72																							
14/05/08	478	515633.784	6969431.538																							
14/05/08	479	515633.646	6969433.664																							
14/05/08	480	515633.436	6969437.518																							
14/05/08	481	515633.638	6969440.535																							
14/05/08	482	515632.769	6969441.557																							
14/05/08	483	515633.74	6969442.224																							
14/05/08	484	515636.983	6969444.383																							
14/05/08	485	515640.502	6969448.826																							
14/05/08	486	515610.522	6969508.303																							
14/05/08	487	515582.197	6969527.511	fair	30%	8	100					10%	15%	10%	1	1	1	0	1	1	2	0	A	3	3	Landward, Photo 672
14/05/08	487	515582.197	6969527.511	fair	20%	15	50	50				20%	25%	20%	2	1	1	0	2	0	0	0	A	0	0	Seaward, Photo 673, saltmarsh
14/05/08	488	515555.871	6969554.924	good	50%	18	100					0%	10%	10%	1	1	1	2	2	1	1	0	A	0	1	
14/05/08	489	515552.63	6969567.527	good	50%	18	100					0%	10%	10%	1	1	1	2	2	1	1	0	A	0	1	
14/05/08	490	515570.968	6969592.405	good	50%	18	100					0%	10%	10%	1	1	1	2	2	1	1	0	A	0	1	Seaward. Photo 674-79
14/05/08	491	515576.722	6969607.494	good	50%	18	100					0%	10%	10%	1	1	1	2	2	1	1	0	A	0	1	
14/05/08	492	515573.997	6969628.192	good	50%	18	100					0%	10%	10%	1	1	1	2	2	1	1	0	A	0	1	
14/05/08	493	515591.881	6969622.701																							Start of what was mapped as regrowth but now desnse saplings
14/05/08	494	515609.5	6969617.08	good	80%	12	100					0%	16%	10%	1	1	1	0	0	0	3	0	A	0	3	Photo 680-82, litter
14/05/08	495	515614.216	6969610.927	RG																						
14/05/08	496	515617.968	6969608.982	RG																						
14/05/08	497	515630.482	6969603.553	RG																						
14/05/08	498	515635.403	6969602.507	RG																						
14/05/08	499	515644.361	6969602.069	RG																						
14/05/08	500	515695.747	6969588.346	RG																						
14/05/08	501	515708.088	6969582.806	RG																						
14/05/08	502	515715.216	6969571.497	good	60%	18	100					10%	10%	10%	1	1	1	0	1	0	3	0	A	4	2	
14/05/08	503	518158.474	6971659.823	good	40%	12	90	5	5			0%	5%	5%	1	1	1	0	0	0	0	0	A	1	1	Seagrass wrack
14/05/08	504	518114.389	6971660.121	dead	5%	6	100					30%	10%	5%	2	1	1	0	1	1	0	0	P	0	0	Anoxic odour 880-1
14/05/08	505	518066.009	6971653.962																							
14/05/08	506	518069.004	6971655.908																							
14/05/08	507	518068.328	6971658.824																							
14/05/08	508	518065.793	6971659.515																							
14/05/08	509	518064.181	6971662.126																							
14/05/08	510	518062.809	6971664.978																							
14/05/08	511	518060.756	6971666.69																							Ring of dead with only sparse small shrubs, no seedlings. Photo 882-84 Hydrocarbon slick
14/05/08	512	518057.442	6971667.149																							
14/05/08	513	518052.85	6971667.175																							
14/05/08	514	518051.253	6971657.624																							
14/05/08	515	518049.619	6971657.022																							
14/05/08	516	518046.367	6971655.189																							
14/05/08	517	518043.479	6971652.556																							
14/05/08	518	518041.874	6971648.938																							
14/05/08	519	518031.041	6971631.694																							
14/05/08	520	518051.376	6971645.489	RG/fair	80%	2	100					0%	10%	5%	1	1	1	0	1	1	0	0	A	1	1	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi Algae	Floating Algae	BMA	Seedling	Macro-fauna	Comments / Photos
14/05/08	520	518051.376	6971645.489	D/RG	5%	1	100					0%	0%	0%	1	1	1	0	0	2	0	0	P	0	0	
14/05/08	521	518024.737	6971605.81	RG/fair	80%	2	100					0%	10%	5%	1	1	1	0	1	1	0	0	A	1	1	
14/05/08	521	518024.737	6971605.81	dead	5%	2	100					60%	50%	40%	1	1	2	2	2	2	0	0	A	0	1	Dead strip approx 5m wide (newly dead shrubs, some small shrubs and trees but no seedlings)
14/05/08	522	518026.539	6971568.725																							
14/05/08	523	518022.844	6971558.899																							
14/05/08	524	518019.216	6971548.793																							
14/05/08	525	518011.31	6971538.611																							
14/05/08	526	518010.78	6971527.721																							
14/05/08	527	517987.884	6971496.68	dead	5%	2	100					40%	60%	10%	1	1	1		0	1	0	0	A	0	2	Small dead patch amongst fair
14/05/08	528	517971.413	6971461.396	fair	40%	10	80		10	10		0%	40%	30%	1	1	1	0	0	1	1	0	A	0	2	
14/05/08	529	517941.906	6971415.101	fair	40%	10	80		10	10		0%	40%	30%	1	1	1	0	0	1	1	0	A	0	2	
14/05/08	530	517910.546	6971382.977																							dead not regrowing, small patch
14/05/08	531	517807.732	6971286.616	good	50%	12	95			5		5%	10%	5%	1	1	1	0	1	0	3	0	A	3	1	Photo 891-92, Seagrass Wrack
14/05/08	532	517808.073	6971298.629	fair	40%	10	80		10	10		0%	40%	30%	1	1	1	0	0	1	1	0	A	0	2	

[1] Abbreviations:
Ac = *Aegiceras corniculatum*
Am = *Avicennia marina*
Ct = *Ceriops tagal*
Rs = *Rhizophora stylosa*

Adv. Roots = adventitious roots
Epic. Shoots = epicormic shoots
Epi. Algae = epiphytic algae
BMA = benthic mat algae

Appendix C Survey Data From Whyte Island in 2008

Table C1 2008 field survey data for Whyte Island (UTM AGD 84 Zone 56J)[1]

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
13/6/08	452	516420.292	6968719.27	fair																						
13/6/08	453	516423.07	6968733.155	fair																						
13/6/08	454	516417.666	6968762.659	fair																						
13/6/08	455	516436.342	6968780.358	dead																						
13/6/08	456	516457.482	6968750.248	dead																						
13/6/08	457	516467.338	6968722.605	dead																						
13/6/08	458	516518.889	6968754.38	dead																						
13/6/08	459	516525.914	6968703.446	dead																						
13/6/08	460	516552.336	6968701.452	regrowth	80	1	100				10	10		10	1	1	1	0	0	1	0	0	0	1	3	
13/6/08	461	516556.181	6968701.4	regrowth																						
13/6/08	462	516569.297	6968706.953	regrowth																						
13/6/08	463	516580.912	6968680.087	regrowth																						
13/6/08	464	516600.479	6968676.189	poor	50	6	90		10		10	40		40	1	1	1	1	3	3	0	0	0	2	2	
13/6/08	465	516615.923	6968669.028	poor																						
13/6/08	466	516625.158	6968665.933	poor																						
13/6/08	467	516633.602	6968653.629	poor																						
13/6/08	468	516640.634	6968645.263	poor																						
13/6/08	469	516678.422	6968617.117	poor																						
13/6/08	470	516693.971	6968589.429	poor																						
13/6/08	471	516723.139	6968559.772	poor																						
13/6/08	472	516740.692	6968543.212	poor																						
13/6/08	473	516759.328	6968537.338	poor																						
13/6/08	474	516792.693	6968528.704	poor																						
13/6/08	475	516823.318	6968527.919	poor																						
13/6/08	476	516845.209	6968515.188	poor																						Boundary with dead
13/6/08	477	516877.519	6968510.928	poor																						
13/6/08	478	516892.543	6968499.451	poor																						
13/6/08	479	516910.349	6968474.72	poor																						
13/6/08	480	516931.218	6968447.748	poor																						
13/6/08	481	516940.857	6968425.805	poor																						
13/6/08	482	516946.545	6968398.594	poor																						
13/6/08	483	516947.792	6968377.647	poor																						
13/6/08	484	516952.592	6968355.153	poor																						
13/6/08	485	516961.745	6968334.864	poor																						
13/6/08	486	516961.707	6968301.635	poor																						
13/6/08	487	516966.832	6968274.536	poor																						
13/6/08	488	516979.198	6968235.107	poor																						
13/6/08	489	516977.953	6968209.762	poor																						
13/6/08	490	516965.375	6968180.413	poor																						
13/6/08	491	516935.897	6968176.926	poor																						
13/6/08	492	516947.616	6968160.56	poor																						
13/6/08	493	516959.556	6968148.362	poor																						
13/6/08	494	516964.804	6968132.813	regrowth																						
13/6/08	495	516966.709	6968120.379	poor																						
13/6/08	496	516969.939	6968095.724	poor																						
13/6/08	497	516959.299	6968065.295	poor																						
13/6/08	498	516960.281	6968038.351	poor																						
13/6/08	499	516971.979	6968019.107	poor																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
13/6/08	500	516973.276	6967992.477	poor																						
13/6/08	501	516979.56	6967970.715	poor																						
13/6/08	502	516970.726	6967928.307	poor																						
13/6/08	503	516961.02	6967908.211	poor																						
13/6/08	504	516956.728	6967878.126	poor																						
13/6/08	505	516960.665	6967854.761	poor																						
13/6/08	506	516960.918	6967833.982	poor																						
13/6/08	507	516957.773	6967824.879	poor																						
13/6/08	508	516938.444	6967820.523	poor																						
13/6/08	509	516923.109	6967809.747	poor																						
13/6/08	510	516918.761	6967787.173	poor																						
13/6/08	511	516920.883	6967775.398	poor																						
13/6/08	512	516927.562	6967758.546	poor																						
13/6/08	513	516936.185	6967750.773	poor																						
13/6/08	514	516939.087	6967734.233	poor																						
13/6/08	515	516941.935	6967708.679	poor																						
13/6/08	516	516933.514	6967688.348	poor																						
13/6/08	517	516926.816	6967662.278	poor																						
13/6/08	518	516934.067	6967639.261	poor																						
13/6/08	519	516944.864	6967622.126	poor																						
13/6/08	520	516946.589	6967611.196	poor																						
13/6/08	521	516944.021	6967593.178	poor																						
13/6/08	522	516941.046	6967580.843	poor																						
13/6/08	523	516959.896	6967575.293	poor																						
13/6/08	524	516958.896	6967565.277	poor																						
13/6/08	525	516957.97	6967554.48	poor																						Boundary with dead
13/6/08	526	516959.545	6967543.383	poor																						
13/6/08	527	516961.824	6967531.598	poor																						
13/6/08	528	516964.07	6967520.612	poor																						
13/6/08	529	516964.971	6967513.136	poor																						
13/6/08	530	516961.148	6967504.377	poor																						
13/6/08	531	516977.464	6967487.457	poor																						
13/6/08	532	516955.233	6967474.972	poor																						
13/6/08	533	516949.104	6967470.478	poor																						
13/6/08	534	516928.92	6967464.258	poor																						
13/6/08	535	516917.431	6967454.432	poor																						
13/6/08	536	516909.64	6967458.565	dead																						
13/6/08	537	516888.307	6967472.289	regrowth																						
13/6/08	538	516871.985	6967485.013	regrowth																						
13/6/08	539	516862.913	6967497.076	regrowth																						
13/6/08	540	516846.009	6967508.352	regrowth																						
13/6/08	541	516830.049	6967506.694	regrowth																						
13/6/08	542	516819.389	6967509.067	poor																						
13/6/08	543	516797.781	6967515.456	poor																						
13/6/08	544	516790.87	6967515.122	poor																						
13/6/08	545	516772.271	6967510.283	fair																						
13/6/08	546	516758.942	6967500.227	fair																						
13/6/08	547	516751.692	6967500.098	fair																						
13/6/08	548	516714.085	6967488.488	fair																						
13/6/08	549	516698.099	6967516.595	fair																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
13/6/08	550	516693.651	6967529.804	poor																						
13/6/08	551	516688.103	6967544.444	poor																						
13/6/08	552	516682.97	6967559.157	poor																						
13/6/08	553	516682.457	6967578.404	poor																						
13/6/08	554	516677.568	6967590.035	poor																						
13/6/08	555	516675.002	6967597.884	fair																						
13/6/08	556	516669.673	6967615.281	fair																						
13/6/08	557	516668.725	6967630.685	fair																						
13/6/08	558	516659.682	6967646.973	fair																						
13/6/08	559	516661.309	6967661.129	fair																						
11/6/08	560	516661.557	6967660.256	fair																						
11/6/08	561	516669.421	6967661.1	fair																						
11/6/08	198	516511.371	6968451.646	saltmarsh																						
11/6/08	199	516509.43	6968444.054	saltmarsh																						
11/6/08	200	516510.451	6968433.032	saltmarsh																						
11/6/08	201	516508.225	6968423.24	saltmarsh																						
11/6/08	202	516505.83	6968416.466	saltmarsh																						
11/6/08	203	516505.755	6968404.387	saltmarsh																						
11/6/08	204	516502.388	6968395.952	saltmarsh																						
11/6/08	205	516499.69	6968391.954	saltmarsh																						
11/6/08	206	516497.472	6968387.918	saltmarsh																						
11/6/08	207	516491.952	6968374.798	saltmarsh																						
11/6/08	208	516484.677	6968362.301	saltmarsh																						
11/6/08	209	516481.177	6968359.781	saltmarsh																						
11/6/08	210	516477.213	6968357.558	saltmarsh																						Boundary with dead
11/6/08	211	516475.029	6968354.311	saltmarsh																						
11/6/08	212	516474.486	6968351.035	saltmarsh																						
11/6/08	213	516474.414	6968346.875	saltmarsh																						
11/6/08	214	516469.597	6968338.303	saltmarsh																						
11/6/08	215	516462.727	6968331.934	saltmarsh																						
11/6/08	216	516458.847	6968323.695	saltmarsh																						
11/6/08	217	516457.802	6968316.742	saltmarsh																						
11/6/08	218	516454.255	6968310.201	saltmarsh																						
11/6/08	219	516451.231	6968305.062	saltmarsh																						
11/6/08	220	516448.407	6968299.486	saltmarsh																						
11/6/08	221	516446.493	6968293.946	saltmarsh																						
11/6/08	222	516446.732	6968286.62	saltmarsh																						
11/6/08	223	516447.333	6968277.084	saltmarsh																						
11/6/08	224	516451.41	6968265.482	saltmarsh																						
11/6/08	225	516447.738	6968252.044	saltmarsh																						
11/6/08	226	516437.361	6968244.055	saltmarsh																						
11/6/08	227	516437.993	6968233.339	saltmarsh																						
11/6/08	228	516443.055	6968226.685	saltmarsh																						
11/6/08	229	516439.592	6968214.23	saltmarsh																						
11/6/08	230	516438.534	6968197.538	saltmarsh																						
11/6/08	231	516431.535	6968187.66	saltmarsh																						
11/6/08	232	516427.164	6968178.177	saltmarsh																						
11/6/08	233	516426.045	6968172.014	saltmarsh																						
11/6/08	234	516425.931	6968166.982	saltmarsh																						
11/6/08	235	516427.877	6968159.979	saltmarsh																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
11/6/08	236	516431.963	6968154.319	saltmarsh																						
11/6/08	237	516431.184	6968148.49	saltmarsh																						
11/6/08	238	516430.764	6968143.82	saltmarsh																						
11/6/08	239	516430.82	6968136.708	saltmarsh																						
11/6/08	240	516432.569	6968130.578	saltmarsh																						
11/6/08	241	516430.684	6968121.566	saltmarsh																						
11/6/08	242	516431.317	6968111.937	saltmarsh																						
11/6/08	243	516425.484	6968117.933	saltmarsh																						
11/6/08	244	516423.564	6968125.688	saltmarsh																						
11/6/08	245	516418.885	6968121.581	saltmarsh																						
11/6/08	246	516417.544	6968116.848	saltmarsh																						
11/6/08	247	516417.938	6968113.849	saltmarsh																						
11/6/08	248	516417.047	6968110.675	saltmarsh																						
11/6/08	249	516415.402	6968106.972	saltmarsh																						
11/6/08	250	516418.146	6968101.816	saltmarsh																						
11/6/08	251	516419.19	6968096.105	saltmarsh																						
11/6/08	252	516420.34	6968088.1	saltmarsh																						
11/6/08	253	516422.032	6968083.326	saltmarsh																						Boundary with dead
11/6/08	254	516421.966	6968077.124	saltmarsh																						
11/6/08	255	516420.176	6968071.11	saltmarsh																						
11/6/08	256	516424.858	6968058.95	saltmarsh																						
11/6/08	257	516433.38	6968049.524	saltmarsh																						
11/6/08	258	516431.976	6968034.449	saltmarsh																						
11/6/08	259	516430.927	6968025.036	saltmarsh																						
11/6/08	260	516428.807	6968019.737	saltmarsh																						
11/6/08	261	516429.764	6968016.57	saltmarsh																						
11/6/08	262	516433.41	6968016.751	saltmarsh																						
11/6/08	263	516436.09	6968019.467	saltmarsh																						
11/6/08	264	516439.23	6968018.952	saltmarsh																						
11/6/08	265	516442.626	6968018.14	saltmarsh																						
11/6/08	266	516444.437	6968015.844	saltmarsh																						
11/6/08	267	516447.344	6968014.207	saltmarsh																						
11/6/08	268	516451.072	6968013.737	saltmarsh																						
11/6/08	269	516452.795	6968013.401	saltmarsh																						
11/6/08	270	516455.852	6968013.573	saltmarsh																						
11/6/08	271	516457.94	6968013.459	saltmarsh																						sm dead boundary 2296-2300
11/6/08	272	516465.91	6968006.605	saltmarsh																						
11/6/08	273	516468.901	6967999.963	saltmarsh																						
11/6/08	274	516471.156	6968001.028	saltmarsh																						
11/6/08	275	516473.067	6967998.751	saltmarsh																						
11/6/08	276	516476.957	6967995.635	saltmarsh																						
11/6/08	277	516478.042	6967994.891	saltmarsh																						
11/6/08	278	516482.201	6967995.034	saltmarsh																						
11/6/08	279	516485.118	6967989.283	saltmarsh																						Boundary with dead
11/6/08	280	516487.882	6967986.15	saltmarsh																						
11/6/08	281	516490.449	6967985.181	saltmarsh																						
11/6/08	282	516492.45	6967982.189	saltmarsh																						
11/6/08	283	516493.864	6967980.182	saltmarsh																						
11/6/08	284	516498.362	6967978.764	saltmarsh																						
11/6/08	285	516503.226	6967978.916	saltmarsh																						

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11/6/08	286	516507.71	6967979.884	saltmarsh																						
11/6/08	287	516515.845	6967978.62	saltmarsh																						
11/6/08	288	516519.161	6967980.185	saltmarsh																						
11/6/08	289	516524.142	6967981.143	saltmarsh																						
11/6/08	290	516528.336	6967982.289	saltmarsh																						
11/6/08	291	516540.018	6967981.131	saltmarsh																						
11/6/08	292	516540.047	6967978.327	saltmarsh																						
11/6/08	293	516532.589	6967977.734	saltmarsh																						
11/6/08	294	516529.226	6967978.147	saltmarsh																						
11/6/08	295	516524.726	6967971.496	saltmarsh																						
11/6/08	296	516520.157	6967969.228	saltmarsh																						
11/6/08	297	516507.472	6967963.526	saltmarsh																						
11/6/08	298	516499.83	6967968.039	saltmarsh																						
11/6/08	299	516478.495	6967968.708	saltmarsh																						
11/6/08	300	516472.715	6967983.311	saltmarsh																						
11/6/08	301	516467.268	6967987.06	saltmarsh																						
11/6/08	302	516460.206	6967991.396	saltmarsh																						
11/6/08	303	516454.236	6967988.665	saltmarsh																						
11/6/08	304	516449.122	6967987.688	saltmarsh																						
11/6/08	305	516442.964	6967979.925	saltmarsh																						
11/6/08	306	516442.171	6967975.674	saltmarsh																						
11/6/08	307	516445.577	6967963.906	saltmarsh																						
11/6/08	308	516452.552	6967943.685	saltmarsh																						
11/6/08	309	516461.765	6967899.999	saltmarsh																						
11/6/08	310	516474.645	6967909.117	saltmarsh																						Boundary with dead
11/6/08	311	516495.171	6967904.772	saltmarsh																						
11/6/08	312	516498.298	6967900.785	saltmarsh																						
11/6/08	313	516487.439	6967897.838	saltmarsh																						
11/6/08	314	516481.928	6967896.666	saltmarsh																						
11/6/08	315	516478.471	6967901.489	saltmarsh																						
11/6/08	316	516476.185	6967902.672	saltmarsh																						
11/6/08	317	516474.318	6967899.954	saltmarsh																						
11/6/08	318	516471.91	6967896.29	saltmarsh																						
11/6/08	319	516472.933	6967893.113	saltmarsh																						
11/6/08	320	516473.442	6967889.362	saltmarsh																						
11/6/08	321	516469.917	6967886.739	saltmarsh																						
11/6/08	322	516467.464	6967887.114	saltmarsh																						
11/6/08	323	516463.154	6967886.061	saltmarsh																						
11/6/08	324	516460.575	6967884.393	saltmarsh																						
11/6/08	325	516459.122	6967882.065	saltmarsh																						
11/6/08	326	516456.548	6967878.03	saltmarsh																						
11/6/08	327	516453.776	6967874.914	saltmarsh																						
11/6/08	328	516451.653	6967873.143	saltmarsh																						
11/6/08	329	516451.558	6967869.987	saltmarsh																						
11/6/08	330	516450.427	6967867.621	saltmarsh																						
11/6/08	331	516449.289	6967864.948	saltmarsh																						
11/6/08	332	516446.619	6967857.432	saltmarsh																						
11/6/08	333	516448.447	6967842.899	saltmarsh																						
11/6/08	334	516448.112	6967840.235	saltmarsh																						
11/6/08	335	516452.24	6967835.374	saltmarsh																						

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11/6/08	336	516459.788	6967816.85	saltmarsh																						
11/6/08	337	516460.679	6967807.286	saltmarsh																						
11/6/08	338	516460.378	6967799.72	saltmarsh																						Boundary with dead
11/6/08	339	516461.051	6967794.938	saltmarsh																						
11/6/08	340	516464.437	6967786.651	saltmarsh																						lots of crabs 2301
11/6/08	341	516463.22	6967774.89	saltmarsh																						
11/6/08	342	516472.255	6967771.433	saltmarsh																						
11/6/08	343	516477.546	6967768.344	saltmarsh																						Boundary with dead
11/6/08	344	516478.838	6967768.082	saltmarsh																						
11/6/08	345	516485.441	6967767.794	saltmarsh																						
11/6/08	346	516492.309	6967767.191	saltmarsh																						algae recently dead strip landward of saltmarsh 2302-2306
11/6/08	347	516502.202	6967760.957	saltmarsh																						
11/6/08	348	516508.638	6967759.695	saltmarsh																						
11/6/08	349	516522.864	6967764.773	saltmarsh																						
11/6/08	350	516528.901	6967762.806	saltmarsh																						
11/6/08	351	516533.649	6967763.161	saltmarsh																						
11/6/08	352	516546.193	6967762.114	saltmarsh																						
11/6/08	353	516552.507	6967762.969	saltmarsh																						
11/6/08	354	516556.809	6967757.634	saltmarsh																						
11/6/08	355	516563.574	6967754.18	saltmarsh																						
11/6/08	356	516569.355	6967752.668	saltmarsh																						
11/6/08	357	516574.283	6967751.009	saltmarsh																						
11/6/08	358	516581.688	6967749.504	saltmarsh																						
11/6/08	359	516579.386	6967744.178	saltmarsh																						
11/6/08	360	516584.69	6967739.445	saltmarsh																						
11/6/08	361	516586.347	6967751.373	saltmarsh																						
11/6/08	362	516596.993	6967744.08	saltmarsh																						
11/6/08	363	516602.873	6967742.252	saltmarsh																						
11/6/08	364	516607.731	6967737.733	saltmarsh																						
11/6/08	365	516607.484	6967732.766	saltmarsh																						Boundary with dead
11/6/08	366	516602.078	6967723.963	saltmarsh																						
11/6/08	367	516606.37	6967718.043	saltmarsh																						
11/6/08	368	516607.304	6967710.391	saltmarsh																						
11/6/08	369	516626.752	6967705.333	saltmarsh																						
11/6/08	370	516627.535	6967696.335	saltmarsh																						
11/6/08	371	516645.963	6967696.913	saltmarsh																						
11/6/08	372	516658.752	6967687.575	saltmarsh																						
11/6/08	373	516673.843	6967671.26	saltmarsh																						
11/6/08	374	516698.326	6967658.563	saltmarsh																						
11/6/08	375	516670.638	6967654.478	saltmarsh																						
11/6/08	376	516683.903	6967623.979	saltmarsh																						
11/6/08	377	516696.965	6967602.682	saltmarsh																						
11/6/08	378	516707.141	6967573.311	saltmarsh																						
11/6/08	379	516728.515	6967541	saltmarsh																						
11/6/08	380	516746.769	6967541.727	saltmarsh																						
11/6/08	381	516754.879	6967564.704	saltmarsh																						
11/6/08	382	516762.48	6967572.678	saltmarsh																						
11/6/08	383	516775.788	6967567.897	saltmarsh																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
11/6/08	384	516799.138	6967575.004	saltmarsh																						
11/6/08	385	516805.643	6967593.183	saltmarsh																						
11/6/08	386	516829.591	6967625.358	saltmarsh																						Boundary with dead
11/6/08	387	516838.544	6967640.489	saltmarsh																						
11/6/08	388	516859.852	6967663.048	saltmarsh																						mat algae edge of dead and poor 2307-2309
11/6/08	389	516855.547	6967677.565	saltmarsh																						
11/6/08	390	516827.478	6967685.487	saltmarsh																						
11/6/08	391	516816.667	6967728.544	saltmarsh																						
11/6/08	392	516820.335	6967751.026	saltmarsh																						
11/6/08	393	516813.193	6967775.75	saltmarsh																						
11/6/08	394	516769.981	6967791.881	saltmarsh																						
11/6/08	395	516725.155	6967821.94	saltmarsh																						patch of mangrove off this point- pick up on air photos
11/6/08	396	516737.941	6967853.555	saltmarsh																						
11/6/08	397	516737.78	6967880.777	saltmarsh																						
11/6/08	398	516757.75	6967857.445	saltmarsh																						
11/6/08	399	516754.354	6967870.615	saltmarsh																						
11/6/08	400	516774.201	6967902.87	saltmarsh																						
11/6/08	401	516793.853	6967925.274	saltmarsh																						
11/6/08	402	516793.58	6967949.562	saltmarsh																						
11/6/08	403	516812.843	6967979.051	saltmarsh																						
11/6/08	404	516824.162	6968021.214	saltmarsh																						
11/6/08	405	516826.616	6968052.109	saltmarsh																						
11/6/08	406	516846.32	6968064.31	saltmarsh																						
11/6/08	407	516858.682	6968076.269	saltmarsh																						
11/6/08	408	516858.972	6968094.373	saltmarsh																						
11/6/08	409	516869.966	6968111.386	saltmarsh																						
11/6/08	410	516879.767	6968122.486	saltmarsh																						
11/6/08	411	516888.66	6968129.687	saltmarsh																						
11/6/08	412	516872.308	6968162.985	saltmarsh																						
11/6/08	413	516874.316	6968171.255	saltmarsh																						
11/6/08	414	516878.307	6968193.095	saltmarsh																						Boundary with dead
11/6/08	415	516876.645	6968213.923	saltmarsh																						
11/6/08	416	516880.988	6968226.553	saltmarsh																						
11/6/08	417	516874.505	6968247.999	saltmarsh																						
11/6/08	418	516877.214	6968265.747	saltmarsh																						
11/6/08	419	516871.128	6968286.58	saltmarsh																						
11/6/08	420	516871.224	6968290.554	saltmarsh																						
11/6/08	421	516869.016	6968305.198	saltmarsh																						
11/6/08	422	516856.137	6968315.977	saltmarsh																						
11/6/08	423	516849.122	6968330.368	saltmarsh																						
11/6/08	424	516846.829	6968337.594	saltmarsh																						
11/6/08	425	516846.82	6968349.005	saltmarsh																						
11/6/08	426	516833.747	6968363.135	saltmarsh																						
11/6/08	427	516838.669	6968374.901	saltmarsh																						
11/6/08	428	516828.806	6968385.796	saltmarsh																						
11/6/08	429	516816.813	6968395.022	saltmarsh																						
11/6/08	430	516811.991	6968401.472	saltmarsh																						
11/6/08	431	516808.59	6968405.014	saltmarsh																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
11/6/08	432	516803.46	6968410.592	saltmarsh																						
11/6/08	433	516797.58	6968418.529	saltmarsh																						
11/6/08	434	516787.076	6968420.939	saltmarsh																						
11/6/08	435	516765.187	6968441.329	saltmarsh																						
11/6/08	436	516746.119	6968451.921	saltmarsh																						
11/6/08	437	516754.901	6968469.299	saltmarsh																						
11/6/08	438	516748.086	6968484.971	saltmarsh																						
11/6/08	439	516728.668	6968469.975	saltmarsh																						
11/6/08	440	516707.395	6968456.226	saltmarsh																						
11/6/08	441	516696.247	6968453.716	saltmarsh																						
11/6/08	442	516662.468	6968402.299	saltmarsh																						
11/6/08	443	516673.296	6968436.72	saltmarsh																						
11/6/08	444	516660.898	6968460.301	saltmarsh																						
11/6/08	445	516656.776	6968481.447	saltmarsh																						
11/6/08	446	516656.323	6968489.543	saltmarsh																						
11/6/08	447	516656.247	6968506.849	saltmarsh																						
11/6/08	448	516651.015	6968516.912	saltmarsh																						
11/6/08	449	516642.456	6968528.891	saltmarsh																						
11/6/08	450	516627.002	6968547.248	saltmarsh																						
11/6/08	451	516612.144	6968552.96	saltmarsh																						
11/6/08	452	516592.668	6968556.18	saltmarsh																						
11/6/08	453	516586.495	6968556.764	saltmarsh																						
11/6/08	454	516586.585	6968568.119	saltmarsh																						
11/6/08	455	516576.853	6968583.683	saltmarsh																						Boundarty with dead
11/6/08	456	516564.461	6968611.015	saltmarsh																						
11/6/08	457	516549.938	6968625.295	saltmarsh																						
11/6/08	458	516568.741	6968651.108	saltmarsh																						
11/6/08	459	516563.433	6968653.845	saltmarsh																						
11/6/08	460	516548.101	6968652.046	saltmarsh																						
11/6/08	461	516535.009	6968658.423	saltmarsh																						
11/6/08	462	516546.228	6968669.819	saltmarsh																						
11/6/08	463	516532.424	6968683.225	saltmarsh																						
11/6/08	464	516523.201	6968670.268	saltmarsh																						
11/6/08	465	516511.984	6968648.325	saltmarsh																						
11/6/08	466	516488.38	6968644.467	saltmarsh																						
11/6/08	467	516488.994	6968676.014	saltmarsh																						
11/6/08	468	516469.61	6968662.188	saltmarsh																						
11/6/08	469	516461.337	6968640.641	saltmarsh																						
11/6/08	470	516439.612	6968636.39	saltmarsh																						
11/6/08	471	516441.51	6968642.887	saltmarsh																						
11/6/08	472	516449.58	6968647.815	saltmarsh																						
11/6/08	473	516453.071	6968649.955	saltmarsh																						
11/6/08	474	516455.53	6968654.668	saltmarsh																						
11/6/08	475	516453.373	6968664.958	saltmarsh																						
11/6/08	476	516445.737	6968667.726	saltmarsh																						
11/6/08	477	516443.731	6968679.956	saltmarsh																						
11/6/08	478	516430.986	6968685.414	saltmarsh																						
11/6/08	479	516416.825	6968679.714	saltmarsh																						
11/6/08	480	516577.136	6968584.583	dead																						transect 1 sample 1
11/6/08	481	516595.948	6968592.292	poor																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
11/6/08	482	516661.745	6968613.612	fair																						
11/6/08	483	516729.525	6968629.934	good																						
11/6/08	484	516772.742	6968645.185																							ignore
11/6/08	485	516792.792	6968661.034	good																						
12/06/08	501	516548.013	6968629.708	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	recently dead strip <5m deep 2351
12/06/08	502	516568.347	6968622.921	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	503	516571.11	6968613.42	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	504	516574.169	6968602.553	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	505	516588.038	6968582.61	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	506	516603.313	6968579.163	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	507	516625.597	6968562.152	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	508	516697.413	6968458.143	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	509	516718.739	6968474.826	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	510	516713.469	6968486.634	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	511	516733.507	6968494.526	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	512	516757.633	6968510.09	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	2355
12/06/08	513	516770.071	6968491.839	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	514	516787.424	6968469.217	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	515	516803.977	6968443.319	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	2356
12/06/08	516	516836.876	6968415.374	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	517	516827.315	6968403.865	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	518	516863.385	6968385.859	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	519	516861.743	6968331.223	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	520	516879.426	6968295.129	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	521	516878.589	6968211.209	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	522	516893.106	6968205.321	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	523	516884.512	6968174.481	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	524	516902.114	6968163.807	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	525	516909.217	6968153.111	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	526	516896.899	6968143.937	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	527	516889.065	6968135.397	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	528	516880.408	6968118.177	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	2366-2367
12/06/08	529	516899.779	6968104.938	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	530	516869.398	6968107.682	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	531	516863.387	6968093.476	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	532	516863.247	6968075.567	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	533	516847.617	6968055.413	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	534	516827.209	6968050.075	dead	10	1	100				90	90		90	2	1	2	2	2	3	1	0	a	0	1	
12/06/08	535	516839.035	6967991.177	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	536	516839.555	6967965.533	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	537	516844.033	6967950.096	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	538	516826.289	6967941.579	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	539	516845.754	6967918.063	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	540	516828.697	6967908.904	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	541	516801.315	6967898.367	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	542	516831.865	6967881.186	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	543	516810.062	6967866.807	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	544	516805.85	6967828.514	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	545	516813.537	6967814.763	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	546	516790.693	6967790.144	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh

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12/06/08	547	516872.539	6967777.748	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	548	516875.607	6967797.984	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	549	516869.939	6967827.563	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	550	516867.699	6967843.061	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	551	516869.689	6967868.637	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	552	516873.438	6967889.457	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	553	516896.916	6967898.569	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	554	516881.108	6967923.269	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	555	516876.085	6967957.637	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	556	516881.12	6967968.27	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	557	516880.165	6967978.178	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	558	516892.983	6967996.079	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	559	516887.494	6968041.311	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	560	516864.913	6968051.824	poor	30	4	100				15	30		25	2	2	2	1	3	3	1	0	a	0	1	dead/saltmarsh
12/06/08	561	516808.028	6967984.294	poor	20	15	100				30	50		40	2	2	2	1	1	2	1	0	a	0	0	2361
12/06/08	562	516744.479	6967859.599	poor	30	4	100				30	40		30	1	1	1	1	1	1	0	0	a	0	0	2362-2364
12/06/08	563	516871.648	6967738.792	dead	10	5	100				80	60		50	2	2	2	1	1	2	0	0	poor	0	1	2365-2368
12/06/08	564	516890.207	6967713.968	dead	10	5	100				80	60		50	2	2	2	1	1	2	0	0	poor	0	1	
12/06/08	565	516910.509	6967697.349	dead	10	5	100				80	60		50	2	2	2	1	1	2	0	0	poor	0	1	
12/06/08	566	516926.548	6967684.18	dead	10	5	100				80	60		50	2	2	2	1	1	2	0	0	poor	0	1	strip approx 40m wide of recently dead as above (poor to east, dead/saltmarsh to west with small centre of recently dead surrounded by long term dead dead patches of poor - see aerial photo)
12/06/08	567	516891.846	6967659.114	dead	10	5	100				80	60		50	2	2	2	1	1	2	0	0	poor	0	1	
12/06/08	568	516883.725	6967622.145	dead	10	5	100				80	60		50	2	2	2	1	1	2	0	0	poor	0	1	
12/06/08	569	516911.669	6967607.716	regrowth	40	1	100				30	50		50		1	1	0	0	2	1	0	poor	1	2	2369-2370
12/06/08	570	516885.976	6967530.682	dead																						patch of long time dead 80mX 25m 2371
12/06/08	571	516850.463	6967601.877	dead																						patch of long time dead 20mX 20m (adjoins previous in SE) sediment collection #2
12/06/08	572	516701.867	6967776.107	fair	50	4	100				10	10		10	1	1	1	1	2	1	1	0	a	0	2	2372
12/06/08	573	516690.845	6967799.222	fair	50	4	100				10	10		10	1	1	1	1	2	1	1	0	a	0	2	
12/06/08	574	516692.557	6967814.548	fair	50	4	100				10	10		10	1	1	1	1	2	1	1	0	a	0	2	
12/06/08	575	516666.921	6967808.864	fair	50	4	100				10	10		10	1	1	1	1	2	1	1	0	a	0	2	
12/06/08	576	516644.964	6967796.926	fair	50	4	100				10	10		10	1	1	1	1	2	1	1	0	a	0	2	
12/06/08	577	516424.516	6968556.741																							carpark dirt new
13/6/08	578	516436.728	6968598.467	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	2378-2380 saltmarsh
13/6/08	579	516490.247	6968578.583	fair	10	4	100				0	10		10	1	1	1	0	0	0	0	0	a	0	1	
13/6/08	580	516501.328	6968537.28	fair	10	4	100				0	10		10	1	1	1	0	0	0	0	0	a	0	1	
13/6/08	581	516494.6	6968519.101	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	continuation from 578 (southern section not mapped 2006) 2381-2382 litter 2383-2384 BMA
13/6/08	582	516506.012	6968428.712	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
13/6/08	583	516485.033	6968374.603	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	584	516467.387	6968358.583	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	585	516450.529	6968324.616	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	2385-2389 insect weeds(red berry)
13/6/08	586	516438.249	6968250.877	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	587	516429.413	6968186.948	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	2390-2391 track litter
13/6/08	588	516403.336	6968186.259	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	589	516419.563	6968169.841	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	590	516407.218	6968146.238	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	2392-2394 litter - margin with terrestrial (casuarina red berry)
13/6/08	591	516410.46	6968116.523	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	592	516413.448	6968095.89	poor	10	4	100				5	5		5	1	2	1	0	0	0	0	0	poor	0	0	
13/6/08	593	516424.758	6968034.412	poor		10	100				5	10		10	1	1	2	1	2	2	0	0	poor	1	1	2395
13/6/08	594	516432.031	6968013.763	dead	5	2	100				90	75		75	4	3	3	2	3	3	0	0	poor	0	1	2396-2399 boundary dead/poor
13/6/08	595	516451.177	6967993.469	dead	5	2	100				90	75		75	4	3	3	2	3	3	0	0	poor	0	1	
13/6/08	596	516460.055	6967996.698	dead	5	2	100				90	75		75	4	3	3	2	3	3	0	0	poor	0	1	
13/6/08	597	516474.355	6967989.167	dead	5	2	100				90	75		75	4	3	3	2	3	3	0	0	poor	0	1	
13/6/08	598	516486.122	6967983.599	dead	5	2	100				90	75		75	4	3	3	2	3	3	0	0	poor	0	1	
13/6/08	599	516508.967	6967978.239	poor	20	8	100				10	50		50	2	1	2	1	3	2	0	0	poor	0	1	
13/6/08	600	516540.335	6967970.537	poor	20	4	100				20	25		20	2	2	2	2	2	2	0	0	a	0	1	2405-2408
13/6/08	601	516556.398	6967950.164	poor																						
13/6/08	602	516511.465	6967957.105	poor																						
13/6/08	603	516537.745	6967936.393	poor																						
13/6/08	604	516548.085	6967936.184	poor																						
13/6/08	605	516560.579	6967904.498	poor																						
13/6/08	606	516579.25	6967894.325	poor																						
13/6/08	607	516596.361	6967907.783	poor																						
13/6/08	608	516616.27	6967887.98	poor																						
13/6/08	609	516600.537	6967870.742	poor																						
13/6/08	610	516624.094	6967883.076	poor																						
13/6/08	611	516656.542	6967908.499	poor																						
13/6/08	612	516664.517	6967960.267	poor																						
13/6/08	613	516652.273	6967974.276	poor																						
13/6/08	614	516664.799	6968002.594	poor																						
13/6/08	615	516681.225	6968017.316	poor																						Boundary with dead
13/6/08	616	516698.88	6968039.973	poor																						
13/6/08	617	516710.386	6968055.63	poor																						
13/6/08	618	516715.107	6968078.602	poor																						
13/6/08	619	516732.545	6968082.236	poor																						
13/6/08	620	516727.819	6968110.142	poor																						
13/6/08	621	516716.526	6968110.38	poor																						
13/6/08	622	516714.116	6968129.825	poor																						
13/6/08	623	516705.57	6968133.151	poor																						
13/6/08	624	516706.372	6968144.254	poor																						
13/6/08	625	516704.473	6968161.303	poor																						
13/6/08	626	516714.128	6968175.077	poor																						
13/6/08	627	516716.888	6968187.449	poor																						
13/6/08	628	516713.987	6968198.901	poor																						
13/6/08	629	516716.337	6968214.839	poor																						

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13/6/08	630	516710.874	6968218.718	poor																						
13/6/08	631	516702.93	6968214.282	poor																						
13/6/08	632	516707.374	6968198.204	poor																						
13/6/08	633	516707.263	6968178.03	poor																						
13/6/08	634	516697.556	6968138.102	poor																						
13/6/08	635	516705.629	6968109.866	poor																						
13/6/08	636	516725.712	6968096.246	poor																						
13/6/08	637	516712.861	6968084.714	poor																						
13/6/08	638	516692.951	6968042.989	poor																						
13/6/08	639	516674.848	6968019.32	poor																						
13/6/08	640	516659.724	6968005.786	poor																						
13/6/08	641	516653.766	6967993.167	poor																						
13/6/08	642	516646.682	6967969.446	poor																						
13/6/08	643	516658.036	6967959.041	poor																						
13/6/08	644	516658.687	6967944.12	poor																						Boundary with dead
13/6/08	645	516651.908	6967931.345	poor																						
13/6/08	646	516651.618	6967918.979	poor																						
13/6/08	647	516650.02	6967913.345	poor																						
13/6/08	648	516651.084	6967909.686	poor																						
13/6/08	649	516646.322	6967905.932	poor																						
13/6/08	650	516632.145	6967905.831	poor																						
13/6/08	651	516622.835	6967907.886	poor																						
13/6/08	652	516606.79	6967923.812	poor																						
13/6/08	653	516607.466	6967909.132	poor																						
13/6/08	654	516587.166	6967915.362	poor																						
13/6/08	655	516565.299	6967920.442	poor																						
13/6/08	656	516563.779	6967954.731	poor																						
13/6/08	657	516546.09	6967973.705	poor																						
13/6/08	658	516594.31	6967934.534	dead																						
13/6/08	659	516618.753	6967959.29	dead																						
13/6/08	660	516629.936	6967956.916	dead																						
13/6/08	661	516628.545	6967981.93	dead																						
13/6/08	662	516634.451	6967974.467	dead																						
13/6/08	663	516642.243	6967964.624	dead																						
13/6/08	664	516644.705	6967947.305	dead																						
13/6/08	665	516663.914	6968040.671	saltmarsh																						pooling water surrounded with saltmarsh, substrate covered in mat algae 2415-2417 2420-2425 saltmarsh plants
13/6/08	666	516668.242	6968133.583	saltmarsh																						
13/6/08	667	516701.721	6968233.363	saltmarsh																						
13/6/08	668	516694.243	6968248.321	saltmarsh																						
13/6/08	669	516692.748	6968258.211	saltmarsh																						
13/6/08	670	516691.198	6968270.292	saltmarsh																						
13/6/08	671	516678.567	6968279.946	saltmarsh																						
13/6/08	672	516672.789	6968289.74	dead																						
13/6/08	673	516661.872	6968298.844	dead																						
13/6/08	674	516641.132	6968311.165	dead																						
13/6/08	675	516630.149	6968326.62	dead																						
13/6/08	676	516617.284	6968341.26	dead																						

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13/6/08	677	516619.845	6968347.997	dead																						
13/6/08	678	516631.719	6968371.907	dead																						
13/6/08	679	516621.019	6968376.749	dead																						
13/6/08	680	516607.852	6968370.351	dead																						
13/6/08	681	516595.87	6968376.245	dead																						
13/6/08	682	516597.757	6968404.801	dead																						
13/6/08	683	516588.326	6968409.939	dead																						
13/6/08	684	516574.862	6968410.988	dead																						
13/6/08	685	516565.508	6968417.239	dead																						
13/6/08	686	516549.082	6968421.569	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	2426-2428
13/6/08	687	516523.074	6968441.26	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	688	516543.99	6968436.654	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	689	516555.459	6968437.354	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	690	516562.368	6968430.019	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	691	516574.189	6968415.77	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	692	516597.632	6968410.752	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	693	516602.663	6968405.37	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	694	516599.021	6968377.587	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	695	516622.881	6968386.607	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	696	516633.721	6968387.882	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	697	516635.179	6968369.349	fair	30	4	100				30	15		10	1	1	1	1	1	1	0	0	a	0	1	
13/6/08	700	516658.959	6968399.11	dead																						recentlydead within long-time dead outside
13/6/08	701	516647.454	6968420.795	dead																						
13/6/08	702	516635.696	6968433.095	dead																						
13/6/08	703	516626.418	6968440.47	dead																						
13/6/08	704	516608.82	6968454.012	dead																						
13/6/08	705	516597.723	6968477.386	dead																						
13/6/08	706	516587.546	6968482.311	dead																						
13/6/08	707	516567.09	6968521.008	dead																						
13/6/08	708	516588.912	6968573.454	dead																						
13/6/08	709	516636.862	6968528.945	dead																						
13/6/08	710	516617.821	6968492.474	dead																						
13/6/08	711	516627.838	6968461.395	dead																						
13/6/08	712	516640.273	6968447.349	dead																						
13/6/08	713	516654.896	6968427.451	dead																						
13/6/08	714	516675.613	6968410.516	poor	30	4	100				20	30		20	3	2	2	1	2	2	1	0	a	0	1	2429-2432 thin stripextending out from larger poor area long time dead in between the abouve strips of poor
13/6/08	715	516686.53	6968437.89	poor	30	4	100				20	30		20	3	2	2	1	2	2	1	0	a	0	1	
13/6/08	716	516699.034	6968456.442	poor	30	4	100				20	30		20	3	2	2	1	2	2	1	0	a	0	1	
13/6/08	717	516710.853	6968470.752	poor	30	4	100				20	30		20	3	2	2	1	2	2	1	0	a	0	1	
13/6/08	718	516676.213	6968455.628	poor	30	4	100				20	30		20	3	2	2	1	2	2	1	0	a	0	1	
13/6/08	719	516674.434	6968444.944	poor	30	4	100				20	30		20	3	2	2	1	2	2	1	0	a	0	1	
13/6/08	720	516667.542	6968465.027	poor																						thin (<5m) strip of poor extending back to main poor ring of forest
13/6/08	721	516664.653	6968479.05	poor																						2435

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13/6/08	722	516667.733	6968495.423	poor																						
13/6/08	723	516665.262	6968506.577	poor																						
13/6/08	724	516669.191	6968519.718	poor																						
13/6/08	727	516513.549	6968444.42	saltmarsh																						
13/6/08	728	516567.813	6968406.355	saltmarsh																						
13/6/08	729	516564.553	6968397.799	saltmarsh																						
13/6/08	730	516552.006	6968408.326	saltmarsh																						
13/6/08	731	516535.549	6968407.884	saltmarsh																						
13/6/08	732	516520.166	6968417.328	saltmarsh																						
13/6/08	733	516556.059	6968360.172	saltmarsh																						moto tracks 2437-2440
13/6/08	734	516569.557	6968378.769	saltmarsh																						
13/6/08	735	516574.884	6968396.625	saltmarsh																						
13/6/08	736	516586.219	6968377.892	saltmarsh																						
13/6/08	737	516583.147	6968367.247	saltmarsh																						
13/6/08	738	516589.811	6968356.106	saltmarsh																						
13/6/08	739	516598.968	6968357.105	saltmarsh																						
13/6/08	740	516612.706	6968368.581	saltmarsh																						
13/6/08	741	516626.696	6968364.737	saltmarsh																						
13/6/08	742	516615.752	6968342.274	saltmarsh																						
13/6/08	743	516628.933	6968310.058	saltmarsh																						
13/6/08	744	516625.461	6968291.215	saltmarsh																						
13/6/08	745	516635.866	6968289.911	saltmarsh																						
13/6/08	746	516650.272	6968281.182	saltmarsh																						
13/6/08	747	516655.763	6968273.218	saltmarsh																						
13/6/08	748	516652.686	6968252.611	saltmarsh																						
13/6/08	749	516656.035	6968235.616	saltmarsh																						
13/6/08	750	516664.742	6968221.984	saltmarsh																						
13/6/08	751	516672.7	6968218.668	saltmarsh																						
13/6/08	752	516670.524	6968208.681	saltmarsh																						floating fine green algae 2441-2446
13/6/08	753	516684.775	6968202.32	saltmarsh																						
13/6/08	754	516672.791	6968187.872	saltmarsh																						
13/6/08	755	516667.981	6968166.636	saltmarsh																						
13/6/08	756	516672.854	6968155.432	saltmarsh																						
13/6/08	757	516663.973	6968150.626	saltmarsh																						
13/6/08	758	516656.134	6968132.207	saltmarsh																						
13/6/08	759	516652.274	6968139.129	saltmarsh																						
13/6/08	760	516643.457	6968144.136	saltmarsh																						
13/6/08	761	516643.337	6968153.959	saltmarsh																						
13/6/08	762	516635.911	6968152.53	saltmarsh																						
13/6/08	763	516631.227	6968144.217	saltmarsh																						
13/6/08	764	516632.927	6968133.482	saltmarsh																						
13/6/08	765	516635.744	6968127.407	saltmarsh																						
13/6/08	766	516641.91	6968121.623	saltmarsh																						
13/6/08	767	516631.167	6968119.038	saltmarsh																						
13/6/08	768	516627.845	6968112.73	saltmarsh																						
13/6/08	769	516617.658	6968110.441	saltmarsh																						
13/6/08	770	516611.198	6968100.58	saltmarsh																						
13/6/08	771	516614.478	6968093.241	saltmarsh																						
13/6/08	772	516590.167	6968069.033	saltmarsh																						

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13/6/08	773	516579.072	6968050.841	saltmarsh																						lots of mat algae 2447-2450
13/6/08	774	516564.347	6968031.642	saltmarsh																						
13/6/08	775	516545.952	6968025.159	saltmarsh																						
13/6/08	776	516534.99	6968019.074	saltmarsh																						
13/6/08	777	516506.919	6968008.184	saltmarsh																						
13/6/08	778	516492.234	6968012.707	saltmarsh																						
13/6/08	779	516480.675	6968024.207	saltmarsh																						
13/6/08	780	516459.662	6968030.4	saltmarsh																						
13/6/08	781	516437.063	6968040.829	saltmarsh																						
13/6/08	782	516441.303	6967946.411	poor	60	12	100				5	20		15	1	1	2	1	2	2	1	0	a	1	1	2451
13/6/08	783	516452.477	6967919.397	poor	60	12	100				5	20		15	1	1	2	1	2	2	1	0	a	1	1	2452-2455 saltmarsh plants
13/6/08	784	516454.041	6967886.723	poor	60	12	100				5	20		15	1	1	2	1	2	2	1	0	a	1	1	2456 red berry coral tree and phiagmites?
13/6/08	785	516448.117	6967868.571	poor	60	12	100				5	20		15	1	1	2	1	2	2	1	0	a	1	1	
13/6/08	786	516457.277	6967797.979	poor	60	12	100				5	20		15	1	1	2	1	2	2	1	0	a	1	1	
13/6/08	787	516469.57	6967758.754	poor	60	12	100				5	20		15	1	1	2	1	2	2	1	0	a	1	1	
13/6/08	788	516479.453	6967763.095	poor																						recently dead poor boundary
13/6/08	789	516498.563	6967753.516	poor																						
13/6/08	790	516512.114	6967744.037	poor																						
13/6/08	791	516521.208	6967741.564	poor																						
13/6/08	792	516542.168	6967745.11	regrowth	20	1	100				10	50		50	1	1	1	1	3	2	0	0	a	1	1	section of regrowth 30m by 30m 2457-2461
13/6/08	793	516558.263	6967754.744	poor																						
13/6/08	794	516584.461	6967747.309	regrowth																						regrowth poor boundary 2462-2463 pneumat deform.
13/6/08	795	516588.086	6967719.776	regrowth																						
13/6/08	796	516606.693	6967717.857	regrowth																						
13/6/08	797	516668.733	6967655.214	regrowth																						
13/6/08	798	516668.275	6967647.323	regrowth																						
13/6/08	799	516670.703	6967635.473	regrowth																						
13/6/08	800	516676.442	6967621.139	regrowth																						
13/6/08	801	516682.812	6967613.601	regrowth																						
13/6/08	802	516688.189	6967601.292	regrowth																						
13/6/08	803	516690.025	6967580.873	regrowth																						
13/6/08	804	516712.823	6967565.764	regrowth																						
13/6/08	805	516723.38	6967572.332	regrowth																						
13/6/08	806	516743.948	6967599.127	poor	5	2	100					15		15	1	1	2	1	1	3	1	2		0	1	2464-2465
13/6/08	807	516790.599	6967619.21	dead																						
13/6/08	808	516836.598	6967677.332	dead																						
13/6/08	809	516840.903	6967687.204	dead																						
13/6/08	810	516839.521	6967694.197	dead																						
13/6/08	811	516862.094	6967708.483	dead																						
13/6/08	812	516827.865	6967726.133	dead																						
13/6/08	813	516824.193	6967748.476	dead																						
13/6/08	814	516821.917	6967762.87	dead																						
13/6/08	815	516820.455	6967772.082	dead																						
13/6/08	816	516825.109	6967788.556	dead																						
13/6/08	817	516433.839	6968305.039	saltmarsh																						

Date	Way-point	Easting	Northing	Health	Cover	Height	Am	Ac	Ct	Rs	# Dead Trees	% Dead Trees	% Live Trees	% Leaves Lost	Colour	Leaf Size	Insect Damage	Adv. Roots	Epic. Shoots	Pneu. Deform.	Epi. Algae	Floating Algae	BMA	Seedlings	Macro-fauna	Comments / Photos
13/6/08	818	516428.12	6968328.23	saltmarsh																						
13/6/08	819	516432.459	6968332.81	saltmarsh																						
13/6/08	820	516428.166	6968344.477	saltmarsh																						
13/6/08	821	516429.966	6968352.134	saltmarsh																						
13/6/08	822	516451.405	6968366.636	saltmarsh																						
13/6/08	823	516457.938	6968380.971	saltmarsh																						
13/6/08	824	516470.654	6968391.278	saltmarsh																						
13/6/08	825	516468.943	6968400.602	saltmarsh																						
13/6/08	826	516480.209	6968410.763	saltmarsh																						
13/6/08	827	516479.931	6968412.917	saltmarsh																						
13/6/08	828	516485.276	6968426.001	saltmarsh																						
13/6/08	829	516479.224	6968441.616	saltmarsh																						
13/6/08	830	516475.199	6968449.884	saltmarsh																						
13/6/08	831	516467.025	6968459.124	saltmarsh																						Landward saltmarsh
13/6/08	832	516471.859	6968473.601	saltmarsh																						
13/6/08	833	516472.164	6968490.981	saltmarsh																						
13/6/08	834	516474.855	6968495.49	saltmarsh																						
13/6/08	835	516466.527	6968501.489	saltmarsh																						
13/6/08	836	516470.815	6968510.508	saltmarsh																						
13/6/08	837	516468.96	6968517.724	saltmarsh																						
13/6/08	838	516461.151	6968521.282	saltmarsh																						
13/6/08	839	516461.222	6968530.881	saltmarsh																						
13/6/08	840	516466.425	6968536.779	saltmarsh																						
13/6/08	841	516462.528	6968546.895	saltmarsh																						
13/6/08	842	516452.059	6968550.707	saltmarsh																						
13/6/08	843	516441.753	6968558.408	saltmarsh																						
13/6/08	844	516426.073	6968562.802	saltmarsh																						

[1] Abbreviations:

Ac = *Aegiceras corniculatum*
Am = *Avicennia marina*
Ct = *Ceriops tagal*
Rs = *Rhizophora stylosa*

Adv. Roots = adventitious roots
Epic. Shoots = epicormic shoots
Epi. Algae = epiphytic algae
MBA = benthic mat algae

Appendix D Structural Formations of Vegetation

Table D1. Structural formations in Australia (Neldner 1993; Specht 1995).

Life form and height of tallest stratum		Foliage Projective Cover of the Dominant Stratum (%)			
		100-70 (4)#	70-30** (3)	30-10 (2)	<10 (1)
Trees* > 30m	(T)#	tall closed-forest	tall open-forest	tall woodland	-
Trees 10-30m	(M)	closed-forest	open-forest	woodland	open-woodland
Trees 5-10m	(I)	low closed-forest	low open-forest	low woodland	low open-woodland
Trees < 5m	(VL)	v. low closed-forest	v. low open-forest	v. low woodland	v. low open-woodland
Shrubs* > 2m	(S)	closed-scrub	open-scrub	tall shrubland	tall open-shrubland
Shrubs 0.25-2m					
sclerophyllous &	(Z)	closed heathland	heathland	open-heathland	sparse heathland
semi-sclerophyllous	(C)	low closed-scrub	low open-scrub	low shrubland	low open-shrubland
non-sclerophyllous					
Shrubs < 0.25m					
sclerophyllous &	(D)	-	-	dwarf open-heathland	dwarf sparse-heathland
semi-sclerophyllous				(fell-field)	(fell-field)
non-sclerophyllous	(W)	-	-	dwarf open-shrubland	dwarf sparse-shrubland
			dense hummock	hummock	open hummock
Hummock grasses	(H)	-	grassland	grassland	grassland
Herbaceous layer					
graminoids & grass	(G)	closed (tussock) grassland	(tussock) grassland	open (tussock) grassland	sparse (tussock) grassland
sedges	(Y)	closed-sedgeland	sedgeland	open-sedgeland	sparse-sedgeland
herbs	(X)	closed-herbland	herbland	open-herbland	sparse-herbland
ferns	(f)	closed-fernland	fernland	-	-
reeds/rushes	®	closed-reedland	reedland	-	-

* a tree is defined as a woody plant usually with a single stem; a shrub is a woody plant with many stems arising at or near the base

\# Symbols and numbers given in parentheses may be used to describe the formation, e.g. tall closed-forest = T4

** this cover class may be subdivided into cover intervals 70-50% and 50-30% to distinguish commercial forests

References

Neldner, V.J., 1993, V*egetation Survey and Mapping in Queensland,* Queensland Botany Bulletin No. 12, Queensland Department of Environment and Heritage, Brisbane.

Specht, R.L., Specht, A., Whelan, M. B. & Hegarty, E.E. 1995, *Conservation Atlas of Plant Communities in Australia*, Southern Cross University Press, Lismore.

Appendix E Laboratory Analysis Certificates

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

40 Reginald St.
Rocklea Qld 4107
Ph: (07) 3710 9100
Fax: (07) 3710 9199

Attention: Kylie McPherson

Client: FRC Environmental

Method	Sample Point J-0805-283	units	PQL	Sample01	Sample02	Sample03	Sample04	Sample05	Sample06	Sample07	Sample08
	SampleXRef			**FI 1**	**FI 2**	**FI 3**	**FI 6**	**FI 7**	**FI 17**	**FI 18**	**FI 4**
	Collected On			19.05.08	19.05.08	19.05.08	19.05.08	19.05.08	19.05.08	19.05.08	19.05.08
	Received On			23.05.08	23.05.08	23.05.08	23.05.08	23.05.08	23.05.08	23.05.08	23.05.08
G030	Moisture Content	%		41	200	170	280	85	72	140	120
	Nutrients										
OS250.6	Total Nitrogen - Soil	mg/L	0.01 mg/kg	*		*	*		*	*	
OS270.10	Total Phosphorus -Soil	mg/L	0.01 mg/kg	490		1100	690		350	420	
	Metals										
OS065.18	Mercury as Hg - Soil	mg/kg	0.01 mg/kg	0.060		0.10	0.080		0.040	0.050	
WCX.4 41	Arsenic as As - Soil	µg/kg	1 mg/kg	2800		2500	2200		3200	3100	
&SCX.4	Cadmium as Cd - Soil	µg/kg	0.1 mg/kg	500		500	500		500	500	
	Chromium as Cr - Soil	µg/kg	1 mg/kg	8900		14000	10000		9400	9500	
	Copper as Cu - Soil	µg/kg	1 mg/kg	5300		11000	8300		4600	4500	
	Lead as Pb - Soil	µg/kg	0.5 mg/kg	4000		8600	4700		3000	3000	
	Nickel as Ni - Soil	µg/kg	1 mg/kg	4700		7000	5600		5300	5400	
	Zinc as Zn - Soil	µg/kg	1 mg/kg	20000		32000	26000		19000	22000	

Authorised for release:_____

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Rocklea Qld 4107
Ph: (07) 3710 9100
Fax: (07) 3710 9199

Attention: Kylie McPherson

Client: FRC Environmental

Method	Sample Point J-0805-283	units	PQL	Sample01	Sample02	Sample03	Sample04	Sample05	Sample06	Sample07	Sample08
	SampleXRef			**FI 1**	**FI 2**	**FI 3**	**FI 6**	**FI 7**	**FI 17**	**FI 18**	**FI 4**
	Collected On			19.05.08	19.05.08	19.05.08	19.05.08	19.05.08	19.05.08	19.05.08	19.05.08
	Received On			23.05.08	23.05.08	23.05.08	23.05.08	23.05.08	23.05.08	23.05.08	23.05.08
	Organics										
GC030	Benzene Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	Ethyl Benzene Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	0 -Xylene - Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	P, M - Xylene Soil	µg/kg	0.1-0.2ug/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Toluene - Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
GC030	TPH Soil C6-C9	mg/kg	1-10 mg/kg	< 1	1.0	< 1	< 1	< 1	< 1	< 1	< 1
	TPH Soil C10-C14	mg/kg	1-10 mg/kg	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
	TPH Soil C15-C28	mg/kg	1-10 mg/kg	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
	TPH Soil C29-C36	mg/kg	1-10 mg/kg	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5

Notes:

Samples are disposed of 14 days after completion of testing.
Results reported on an 'as received' basis

Mercury external results analysed by ALS Accreditation Number 825 Work Order: EB0806905
* Attached external results analysed by Queensland Health Reference: 07EN13552/13556

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Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

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Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0805-283-01 -FI 1	J-0805-283-02 -FI 2	J-0805-283-03 -FI 3	J-0805-283-04 -FI 6	J-0805-283-05 -FI 7	J-0805-283-06 -FI 17	J-0805-283-07 -FI 18
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008
	Date Received	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008
	Date Testing Completed	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008
G030.	Moisture Content @ 105øC	41 %	200 %	170 %	280 %	85 %	72 %	140 %
GC030	Benzene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	Ethyl Benzene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	O - Xylene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	P, M - Xylene - Soil	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg

Authorised for release:

Date: 16/06/2008

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

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40 Reginald St
Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0805-283-01 -FI 1	J-0805-283-02 -FI 2	J-0805-283-03 -FI 3	J-0805-283-04 -FI 6	J-0805-283-05 -FI 7	J-0805-283-06 -FI 17	J-0805-283-07 -FI 18
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008
	Date Received	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008
	Date Testing Completed	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008
GC030	Toluene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	TPH Soil C6-C9	< 1 mg/kg	1.0 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg
GC040	TPH Soil C10-C14	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg
	TPH Soil C15-C28	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg	< 10 mg/kg
	TPH Soil C29-C36	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg	< 5 mg/kg

Authorised for release:

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185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

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Chemical Analytical Results

	Sample Reference	J-0805-283-01 -FI 1	J-0805-283-02 -FI 2	J-0805-283-03 -FI 3	J-0805-283-04 -FI 6	J-0805-283-05 -FI 7	J-0805-283-06 -FI 17	J-0805-283-07 -FI 18
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008
	Date Received	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008
	Date Testing Completed	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008
OS000.	Analysis by External Laboratories	* unitless		* unitless	* unitless		* unitless	* unitless
OS065.18	Mercury as Hg - Soil	0.060 mg/kg		0.10 mg/kg	0.080 mg/kg		0.040 mg/kg	0.050 mg/kg
OS250.6	Total Nitrogen - Soil	*		*	*		*	*
OS270.10	Total Phosphorus as P - Soil	490 mg/kg		1100 mg/kg	690 mg/kg		350 mg/kg	420 mg/kg
WCX.4	Arsenic as As - Soil	2800 µg/kg		2500 µg/kg	2200 µg/kg		3200 µg/kg	3100 µg/kg

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Date: 16/06/2008

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Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0805-283-01 -FI 1	J-0805-283-02 -FI 2	J-0805-283-03 -FI 3	J-0805-283-04 -FI 6	J-0805-283-05 -FI 7	J-0805-283-06 -FI 17	J-0805-283-07 -FI 18
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008
	Date Received	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008
	Date Testing Completed	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008
WCX.4 41&SCX.4	Cadmium as Cd - Soil	500 µg/kg		500 µg/kg	500 µg/kg		500 µg/kg	500 µg/kg
	Chromium as Cr - Soil	8900 µg/kg		14000 µg/kg	10000 µg/kg		9400 µg/kg	9500 µg/kg
	Copper as Cu - Soils	5300 µg/kg		11000 µg/kg	8300 µg/kg		4600 µg/kg	4500 µg/kg
	Lead as Pb - Soil	4000 µg/kg		8600 µg/kg	4700 µg/kg		3000 µg/kg	3000 µg/kg
	Nickel as Ni - Soil	4700 µg/kg		7000 µg/kg	5600 µg/kg		5300 µg/kg	5400 µg/kg

Authorised for release:

Date: 16/06/2008

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Established 1965 ACN 010 252 418 Pty Ltd

P/O Box 3160 Yeronga 4104
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Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0805-283-01 -FI 1	J-0805-283-02 -FI 2	J-0805-283-03 -FI 3	J-0805-283-04 -FI 6	J-0805-283-05 -FI 7	J-0805-283-06 -FI 17	J-0805-283-07 -FI 18
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008	19/05/2008
	Date Received	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008	23/05/2008
	Date Testing Completed	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008	16/06/2008
WCX.4	Zinc as Zn - Soil	20000 µg/kg		32000 µg/kg	26000 µg/kg		19000 µg/kg	22000 µg/kg

Authorised for release:

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Simmonds & Bristow
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P/O Box 3160 Yeronga 4104
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Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0805-283-08 -FI 4
	Sample Point	Sample 04
	Date Collected	19/05/2008
	Date Received	23/05/2008
	Date Testing Completed	16/06/2008
G030.	Moisture Content @ 105øC	120 %
GC030	Benzene - Soil	< 0.1 µg/kg
	Ethyl Benzene - Soil	< 0.1 µg/kg
	O - Xylene - Soil	< 0.1 µg/kg
	P, M - Xylene - Soil	< 0.2 µg/kg

Authorised for release: _____

Date: 16/06/2008

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

P/O Box 3160 Yeronga 4104
40 Reginald St
Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0805-283-08 -FI 4
	Sample Point	Sample 04
	Date Collected	19/05/2008
	Date Received	23/05/2008
	Date Testing Completed	16/06/2008
GC030	Toluene - Soil	< 0.1 µg/kg
	TPH Soil C6-C9	< 1 mg/kg
GC040	TPH Soil C10-C14	< 5 mg/kg
	TPH Soil C15-C28	< 10 mg/kg
	TPH Soil C29-C36	< 5.0 mg/kg

Authorised for release:

Date: 16/06/2008

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Established 1965 ACN 010 252 418 Pty Ltd

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Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304km

Batch Reference No.: J-0805-283

Job Description: Estuarine (Mangrove) Sediment Analysis

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

Notes:

Samples are disposed of 14 days after completion of testing.
Results reported on an 'as received' basis

Mercury external results analysed by ALS Accreditation Number 825 Work Order EB0806905
Attached external results analysed by Queensland Health Reference: 07EN13552/13556

Authorised for release: _____

Date: 16/06/2008

Queensland Government

Queensland Health

SCIENTIFIC SERVICES

Enquiries : D. Wruck

Phone : (07)32749062

Our Ref : 07EN13552/13556

ANALYTICAL REPORT

CLIENT Simmonds & Bristow Pty Ltd

PO BOX 3160

YERONGA Q 4104

CONTACT : KIRI WOODBINE

CLIENT ORDER NO : J805283B

CLIENT PROGRAM : SEDIMENT (J-0805-283)

DATE RECEIVED : 26/05/2008

SAMPLE TYPE : SEDIMENT

The results relate to samples as received.

The responsibility for sampling rests with the client.

The results for the above samples are attached.

The following methods were used :-

Total Kjel. Nitrogen	Method Number	13804
Total Phosphorus	Method Number	13800
Nitrogen Oxides	Method Number	13798

..... 10/06/2008

G. McLean, Analyst

Queensland Health Scientific Services
39 Kessels Road
Coopers Plains Qld 4108

PO Box 594
Archerfield
Qld 4108

Phone (07) 32749111
International Code 61

Fax (07) 32749119

Your Ref.	Our Ref	Total Kjel. Nitrogen mg/kg	Total Phosphorus mg/kg	Nitrogen Oxides mg/kg as N
FI 1 J-0805-283.01	EN13552	700	490	0.1
FI 3 J-0805-283.03	EN13553	4100	1100	0.1
FI 6 J-0805-283.04	EN13554	9200	690	0.2
FI 17 J-0805-283.06	EN13555	1600	350	0.2
FI 18 J-0805-283.07	EN13556	3000	420	0.1

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB0806905**	Page	: 1 of 3
Client	: **SIMMONDS & BRISTOW PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: THE RESULTS ADDRESS	Contact	: Tim Kilmister
Address	: P O BOX 3160 YERONGA QLD, AUSTRALIA 4104	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: results@simmondsbristow.com.au	E-mail	: Services.Brisbane@alsenviro.com
Telephone	: +61 37109100	Telephone	: +61-7-3243 7222
Facsimile	: +61 07 37109199	Facsimile	: +61-7-3243 7218
Project	: J-0805-283	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: J-0805-283		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2008
Sampler	: ----	Issue Date	: 02-JUN-2008
Site	: ----		
		No. of samples received	: 5
Quote number	: ----	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Inorganics

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been preformed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for processing purposes. If the sampling time is displayed as 0:00 the information was not provided by client.

Key : CAS Number = Chemistry Abstract Services number
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: **SOIL**				Client sample ID	J-0805-283-01	J-0805-283-03	J-0805-283-04	J-0805-283-06	J-0805-283-07
				Client sampling date / time	[23-MAY-2008]	[23-MAY-2008]	[23-MAY-2008]	[23-MAY-2008]	[23-MAY-2008]
Compound	*CAS Number*	*LOR*	*Unit*		EB0806905-001	EB0806905-002	EB0806905-003	EB0806905-004	EB0806905-005
EA055: Moisture Content									
^ Moisture Content (dried @ 103°C)	---	1.0	%		**31.6**	**63.1**	**73.7**	**40.7**	**58.4**
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.01	mg/kg		**0.06**	**0.10**	**0.08**	**0.04**	**0.05**

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

40 Reginald St.
Rocklea Qld 4107
Ph: (07) 3710 9100
Fax: (07) 3710 9199

Attention: Kylie McPherson

Client: FRC Environmental

Method	Sample Point- J-0806-278	units	PQL	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	SampleXRef			**FI 9**	**FI 11**	**FI 13**	**FI 15**	**FI 19**	**FI 22**	**FI 23**
	Collected On			18.06.08	18.06.08	18.06.08	18.06.08	18.06.08	18.06.08	18.06.08
	Received On			19.06.08	19.06.08	19.06.08	19.06.08	19.06.08	19.06.08	19.06.08
G030	Moisture Content	%		75	70	88	70	120	410	380
	Nutrients									
OS250.6	Total Nitrogen - Soil	mg/L	0.01 mg/kg	*	*	*	*	*	*	*
OS270.10	Total Phosphorus -Soil	mg/L	0.01 mg/kg	780	670	690	690	750	930	780
	Metals									
OS065.18	Mercury as Hg - Soil	mg/kg	0.01 mg/kg	< 0.010	0.060	0.030	0.080	0.060	0.120	< 0.010
WCX.4 41	Arsenic as As - Soil	µg/kg	1 mg/kg	8500	8300	5100	5800	7200	6600	4000
&SCX.4	Cadmium as Cd - Soil	µg/kg	0.1 mg/kg	< 500	< 500	< 500	< 500	< 500	< 500	< 500
	Chromium as Cr - Soil	µg/kg	1 mg/kg	26000	20000	36000	22000	37000	24000	27000
	Copper as Cu - Soil	µg/kg	1 mg/kg	25000	14000	28000	13000	22000	22000	20000
	Lead as Pb - Soil	µg/kg	0.5 mg/kg	11000	8900	14000	11000	15000	19000	15000
	Nickel as Ni - Soil	µg/kg	1 mg/kg	13000	9900	22000	13000	19000	17000	14000
	Zinc as Zn - Soil	µg/kg	1 mg/kg	44000	36000	73000	52000	66000	74000	45000

Authorised for release:_____

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Method	Sample Point J-0806-278	units	PQL	Sample 01	Sample 02	Sample 03	Sample 04	Sample 05	Sample 06	Sample 07
	SampleXRef			**FI 9**	**FI 11**	**FI 13**	**FI 15**	**FI 19**	**FI 22**	**FI 23**
	Collected On			18.06.08	18.06.08	18.06.08	18.06.08	18.06.08	18.06.08	18.06.08
	Received On			19.06.08	19.06.08	19.06.08	19.06.08	19.06.08	19.06.08	19.06.08
	Organics									
GC020.62	Hexachlorobenzene	mg/kg		< 0.02				< 0.02		< 0.02
GC030	Benzene Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1.9
	Ethyl Benzene Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	0 -Xylene - Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
	P, M - Xylene Soil	µg/kg	0.1-0.2ug/kg	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
	Toluene - Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
GC030	TPH Soil C6-C9	mg/kg	1-10 mg/kg	< 1	< 1	< 1	< 1	< 1	< 1	< 1
	TPH Soil C10-C14	mg/kg	1-10 mg/kg	< 2	< 2	< 2	< 2	< 2	< 2	< 2
	TPH Soil C15-C28	mg/kg	1-10 mg/kg	< 4	< 4	< 4	< 4	< 4	< 4	< 4
	TPH Soil C29-C36	mg/kg	1-10 mg/kg	< 2	< 2	< 2	< 2	< 2	< 2	< 2

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Client: FRC Environmental

Method	Sample Point- J-0806-278	units	PQL	Sample 08	Sample 09	Sample 10
	SampleXRef			**WI 1**	**WI 2**	**WI 3**
	Collected On			18.06.08	18.06.08	18.06.08
	Received On			19.06.08	19.06.08	19.06.08
G030	Moisture Content	%		240	380	240
	Nutrients					
OS250.6	Total Nitrogen - Soil	mg/L	0.01 mg/kg	*	*	*
OS270.10	Total Phosphorus -Soil	mg/L	0.01 mg/kg	780	1000	2700
	Metals					
OS065.18	Mercury as Hg - Soil	mg/kg	0.01 mg/kg	2.7	2.4	< 0.010
WCX.4 41	Arsenic as As - Soil	µg/kg	1 mg/kg	2600	3500	5000
&SCX.4	Cadmium as Cd - Soil	µg/kg	0.1 mg/kg	< 500	< 500	< 500
	Chromium as Cr - Soil	µg/kg	1 mg/kg	28000	24000	41000
	Copper as Cu - Soil	µg/kg	1 mg/kg	31000	34000	56000
	Lead as Pb - Soil	µg/kg	0.5 mg/kg	18000	25000	26000
	Nickel as Ni - Soil	µg/kg	1 mg/kg	18000	15000	20000
	Zinc as Zn - Soil	µg/kg	1 mg/kg	91000	76000	120000

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Client: FRC Environmental

Method	Sample Point J-0806-278	units	PQL	Sample 08	Sample 09	Sample 10
	SampleXRef			**WI 1**	**WI 2**	**WI 3**
	Collected On			18.06.08	18.06.08	18.06.08
	Received On			19.06.08	19.06.08	19.06.08
	Organics					
GC020.62	Hexachlorobenzene	mg/kg		< 0.02	< 0.02	< 0.02
GC030	Benzene Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1
	Ethyl Benzene Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1
	0 -Xylene - Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1
	P, M - Xylene Soil	µg/kg	0.1-0.2ug/kg	< 0.2	< 0.2	< 0.2
	Toluene - Soil	µg/kg	0.1-0.2ug/kg	< 0.1	< 0.1	< 0.1
GC030	TPH Soil C6-C9	mg/kg	1-10 mg/kg	< 1	< 1	< 1
	TPH Soil C10-C14	mg/kg	1-10 mg/kg	< 2	< 2	< 2
	TPH Soil C15-C28	mg/kg	1-10 mg/kg	< 4	< 4	< 4
	TPH Soil C29-C36	mg/kg	1-10 mg/kg	< 2	< 2	< 2

Samples are disposed of 14 days after completion of testing.
Results reported on an 'as received' basis

Mercury external results analysed by ALS Accreditation Number 825 Work Order: EB0808247
OC Type Pesticides external results analysed by Symbio Certificate No: 52148
* Attached external results analysed by Queensland Health

Authorised for release:_____

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Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

P/O Box 3160 Yeronga 4104
40 Reginald St
Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0806-278-01 -FI 9	J-0806-278-02 -FI 11	J-0806-278-03 -FI 13	J-0806-278-04 -FI 15	J-0806-278-05 -FI 19	J-0806-278-06 -FI 22	J-0806-278-07 -FI 23
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008
G030.	Moisture Content @ 105øC	75 %	70 %	88 %	70 %	120 %	410 %	380 %
GC020.62	Hexachlorobenzene	< 0.02 mg/kg				< 0.02 mg/kg		< 0.02 mg/kg
GC030	Benzene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	1.9 µg/kg
	Ethyl Benzene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	O - Xylene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg

Authorised for release:

Date: 15/07/2008

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40 Reginald St
Rocklea, Qld 4106

Attention: Kylie McPherson

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185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0806-278-01 -FI 9	J-0806-278-02 -FI 11	J-0806-278-03 -FI 13	J-0806-278-04 -FI 15	J-0806-278-05 -FI 19	J-0806-278-06 -FI 22	J-0806-278-07 -FI 23
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008
GC030	P, M - Xylene - Soil	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg
	Toluene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	TPH Soil C6-C9	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg
GC040	TPH Soil C10-C14	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg
	TPH Soil C15-C28	< 4 mg/kg	< 4 mg/kg	< 4 mg/kg	< 4 mg/kg	< 4 mg/kg	< 4 mg/kg	< 4 mg/kg

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Date: 15/07/2008

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Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0806-278-01 -FI 9	J-0806-278-02 -FI 11	J-0806-278-03 -FI 13	J-0806-278-04 -FI 15	J-0806-278-05 -FI 19	J-0806-278-06 -FI 22	J-0806-278-07 -FI 23
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008
GC040	TPH Soil C29-C36	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg
OS000.	Analysis by External Laboratories	* unitless	* unitless	* unitless	* unitless	* unitless	* unitless	* unitless
OS020.16	OC's LOR 1ug/kg (Ext - Symbio)	*				*		*
OS065.18	Mercury as Hg - Soil	< 0.010 mg/kg	0.060 mg/kg	0.030 mg/kg	0.080 mg/kg	0.060 mg/kg	0.12 mg/kg	< 0.010 mg/kg
OS250.6	Total Nitrogen - Soil	*	*	*	*	*	*	*

Authorised for release:

Date: 15/07/2008

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40 Reginald St
Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0806-278-01 -FI 9	J-0806-278-02 -FI 11	J-0806-278-03 -FI 13	J-0806-278-04 -FI 15	J-0806-278-05 -FI 19	J-0806-278-06 -FI 22	J-0806-278-07 -FI 23
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008
OS270.10	Total Phosphorus as P - Soil	780 mg/kg	670 mg/kg	690 mg/kg	690 mg/kg	750 mg/kg	930 mg/kg	780 mg/kg
WCX.4 41&SCX.4	Arsenic as As - Soil	8500 µg/kg	8300 µg/kg	5100 µg/kg	5800 µg/kg	7200 µg/kg	6600 µg/kg	4000 µg/kg
	Cadmium as Cd - Soil	< 500 µg/kg	< 500 µg/kg	< 500 µg/kg	< 500 µg/kg	< 500 µg/kg	< 500 µg/kg	< 500 µg/kg
	Chromium as Cr - Soil	26000 µg/kg	20000 µg/kg	36000 µg/kg	22000 µg/kg	37000 µg/kg	24000 µg/kg	27000 µg/kg
	Copper as Cu - Soils	25000 µg/kg	14000 µg/kg	28000 µg/kg	13000 µg/kg	22000 µg/kg	22000 µg/kg	20000 µg/kg

Authorised for release:

Date: 15/07/2008

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Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

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Chemical Analytical Results

	Sample Reference	J-0806-278-01 -FI 9	J-0806-278-02 -FI 11	J-0806-278-03 -FI 13	J-0806-278-04 -FI 15	J-0806-278-05 -FI 19	J-0806-278-06 -FI 22	J-0806-278-07 -FI 23
	Sample Point	Sample 01	Sample 02	Sample 03	Sample 05	Sample 06	Sample 07	Sample 08
	Date Collected	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008	9/07/2008
WCX.4 41&SCX.4	Lead as Pb - Soil	11000 µg/kg	8900 µg/kg	14000 µg/kg	11000 µg/kg	15000 µg/kg	19000 µg/kg	15000 µg/kg
	Nickel as Ni - Soil	13000 µg/kg	9900 µg/kg	22000 µg/kg	13000 µg/kg	19000 µg/kg	17000 µg/kg	14000 µg/kg
	Zinc as Zn - Soil	44000 µg/kg	36000 µg/kg	73000 µg/kg	52000 µg/kg	66000 µg/kg	74000 µg/kg	45000 µg/kg

Authorised for release:

Date: 15/07/2008

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Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0806-278-08 -WI 1	J-0806-278-09 -WI 2	J-0806-278-10 -WI 3
	Sample Point	Sample 04	Sample 09	Sample 10
	Date Collected	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008
G030.	Moisture Content @ 105øC	240 %	380 %	240 %
GC020.62	Hexachlorobenzene	< 0.02 mg/kg	< 0.02 mg/kg	< 0.02 mg/kg
GC030	Benzene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	Ethyl Benzene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	O - Xylene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg

Authorised for release:

Date: 15/07/2008

Simmonds & Bristow
Established 1965 ACN 010 252 418 Pty Ltd

P/O Box 3160 Yeronga 4104
40 Reginald St
Rocklea, Qld 4106

Attention: Kylie McPherson

Client: FRC Environmental
185 Main Road

Wellington Point, QLD 4160

Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

Fax: (07) 3207 5640

Chemical Analytical Results

	Sample Reference	J-0806-278-08 -WI 1	J-0806-278-09 -WI 2	J-0806-278-10 -WI 3
	Sample Point	Sample 04	Sample 09	Sample 10
	Date Collected	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008
GC030	P, M - Xylene - Soil	< 0.2 µg/kg	< 0.2 µg/kg	< 0.2 µg/kg
	Toluene - Soil	< 0.1 µg/kg	< 0.1 µg/kg	< 0.1 µg/kg
	TPH Soil C6-C9	< 1 mg/kg	< 1 mg/kg	< 1 mg/kg
GC040	TPH Soil C10-C14	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg
	TPH Soil C15-C28	< 4 mg/kg	< 4 mg/kg	< 4 mg/kg

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Chemical Analytical Results

	Sample Reference	J-0806-278-08 -WI 1	J-0806-278-09 -WI 2	J-0806-278-10 -WI 3
	Sample Point	Sample 04	Sample 09	Sample 10
	Date Collected	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008
GC040	TPH Soil C29-C36	< 2 mg/kg	< 2 mg/kg	< 2 mg/kg
OS000.	Analysis by External Laboratories	* unitless	* unitless	* unitless
OS020.16	OC's LOR 1ug/kg (Ext - Symbio)	*	*	*
OS065.18	Mercury as Hg - Soil	2.7 mg/kg	2.4 mg/kg	< 0.010 mg/kg
OS250.6	Total Nitrogen - Soil	*	*	*

Authorised for release:

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Chemical Analytical Results

	Sample Reference	J-0806-278-08 -WI 1	J-0806-278-09 -WI 2	J-0806-278-10 -WI 3
	Sample Point	Sample 04	Sample 09	Sample 10
	Date Collected	18/06/2008	18/06/2008	18/06/2008
	Date Received	19/06/2008	19/06/2008	19/06/2008
	Date Testing Completed	9/07/2008	9/07/2008	9/07/2008
OS270.10	Total Phosphorus as P - Soil	780 mg/kg	1000 mg/kg	2700 mg/kg
WCX.4 41&SCX.4	Arsenic as As - Soil	2600 µg/kg	3500 µg/kg	5000 µg/kg
	Cadmium as Cd - Soil	< 500 µg/kg	< 500 µg/kg	< 500 µg/kg
	Chromium as Cr - Soil	28000 µg/kg	24000 µg/kg	41000 µg/kg
	Copper as Cu - Soils	31000 µg/kg	34000 µg/kg	56000 µg/kg

Authorised for release:

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Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

Ph: (07) 3207 5135

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Chemical Analytical Results

		Sample Reference	J-0806-278-08 -WI 1	J-0806-278-09 -WI 2	J-0806-278-10 -WI 3
		Sample Point	Sample 04	Sample 09	Sample 10
		Date Collected	18/06/2008	18/06/2008	18/06/2008
		Date Received	19/06/2008	19/06/2008	19/06/2008
		Date Testing Completed	9/07/2008	9/07/2008	9/07/2008
WCX.4 41&SCX.4	Lead as Pb - Soil		18000 µg/kg	25000 µg/kg	26000 µg/kg
	Nickel as Ni - Soil		18000 µg/kg	15000 µg/kg	20000 µg/kg
	Zinc as Zn - Soil		91000 µg/kg	76000 µg/kg	120000 µg/kg

Notes:

Authorised for release:

Date: 15/07/2008

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Client Order No.: 080304

Batch Reference No.: J-0806-278

Job Description: Estuarine (Mangrove) Sediment Analysis: Fisherman Islands & Whyte Island

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Chemical Analytical Results

Samples are disposed of 14 days after completion of testing.
Results reported on an 'as received' basis

Merecury external results analysed by ALS Accreditation Number 825 Work Order: EB0808247
OC Type Pesticides external results analysed by Symbio Certificate No: 52148
* Attached external results analysed by Queensland Health.

Authorised for release:

Date: 15/07/2008

CERTIFICATE NO.: 52148 **REVISION NO.:** 00
ISSUE DATE: 8/07/08 This certificate supersedes any previous revisions

CLIENT DETAILS: Simmonds & Bristow Pty Ltd
PO Box 3160
YERONGA QLD 4104
CLIENT REF: J806278a
DATE RECEIVED: 24/06/2008
TEST DATE: Sample tested between date received and reported

CONDITIONS OF SAMPLE: Receipt Temperature: Room Temperature
Storage Temperature: Ambient

TEST REQUESTED: OC in Soil
METHOD CODE: CR004.1

RESULTS OF ANALYSIS

Lab Ref	Sample Description	Chemical Detected	Result (mg/kg)
52148-1	J-0806-278-01 Soil	OC Type Pesticides	<LOD

Lab Ref	Sample Description	Chemical Detected	Result (mg/kg)
52148-2	J-0806-278-05 Water-general	OC Type Pesticides	<LOD

Lab Ref	Sample Description	Chemical Detected	Result (mg/kg)
52148-3	J-0806-278-07 Water-general	OC Type Pesticides	<LOD

Lab Ref	Sample Description	Chemical Detected	Result (mg/kg)
52148-4	J-0806-278-08 Water-general	OC Type Pesticides	<LOD

Lab Ref	Sample Description	Chemical Detected	Result (mg/kg)
52148-5	J-0806-278-09 Water-general	OC Type Pesticides	<LOD

HPC Holdings Pty Ltd trading as Symbio Alliance ABN 93 621 286 928
44 Brandl Street, Eight Mile Plains Q 4113 Telephone +61 7 3340 5700 Email admin@symbioalliance.com.au
PO Box 4312, Eight Mile Plains Q 4113 Australia Facsimile + 61 7 3219 0333

CERTIFICATE NO.: 52148

Lab Ref	Sample Description	Chemical Detected	Result (mg/kg)
52148-6	J-0806-278-10 Water-general	OC Type Pesticides	<LOD

<LOD: less than Level of Detection
A result of "<LOD" indicates no chemical on the attached list was detected at a concentration equal to or exceeding the LOD.
If a chemical is detected at a concentration equal to or exceeding the LOD, it will be detailed in the "Result of Analysis".

Results are reported on an "as received" basis and pertain only to the samples submitted.

For Bruce Chen
Director/Symbio Alliance

HPC Holdings Pty Ltd trading as Symbio Alliance ABN 93 621 286 928
44 Brandl Street, Eight Mile Plains Q 4113 | Telephone +61 7 3340 5700 | Email admin@symbioalliance.com.au
PO Box 4312, Eight Mile Plains Q 4113 Australia | Facsimile + 61 7 3219 0333

CERTIFICATE NO.: 52148

METHOD CR004.1 CHEMICAL LIST

CHEMICAL	LOD (mg/kg)
Organochlorine type Pesticides	
ρ,ρ DDE	0.001
ρ,ρ DDD	0.001
ρ,ρ DDT	0.001
o,ρ DDT	0.001
cis Chlordane	0.001
trans Chlordane	0.001
Oxychlordane	0.001
Aldrin	0.001
Dieldrin	0.001
Endrin	0.001
α Endosulfan	0.001
β Endosulfan	0.001
Endosulfan Sulphate	0.001
α BHC	0.001
β BHC	0.001
δ BHC	0.001
Lindane	0.001
Heptachlor	0.001
Heptachlor Epoxide	0.001
HCB	0.001

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■ PO Box 4312, Eight Mile Plains Q 4113 Australia ■ Facsimile + 61 7 3219 0333

Your Ref.	Our Ref	Nitrogen Oxides mg/kg as N	Total Kjel. Nitrogen mg/kg	Total Phosphorus mg/kg
J-0806-278-01	EN16263	0.1	1900	780
J-0806-278-02	EN16264	0.1	1500	670
J-0806-278-03	EN16265	0.5	3100	690
J-0806-278-04	EN16266	0.6	10000	780
J-0806-278-05	EN16267	0.1	1100	690
J-0806-278-06	EN16268	0.1	3100	750
J-0806-278-07	EN16269	0.5	13000	930
J-0806-278-08	EN16270	0.2	10000	780
J-0806-278-09	EN16271	0.7	18000	1000
J-0806-278-10	EN16272	0.7	7400	2700

Appendix F Position of Photographic Monitoring Sites, Sediment Sites and Pore Water Salinity Transects

Table F1 Position of photographic monitoring sites (AGD84 Zone 56J)

Site	Easting	Northing
Coal Loader		
1	515535	6969158
2	515635	6969481
3	515823	6969656
4	515924	6969268
5	516100	6969286
6	516258	6969615
8	516323	6969815
Fisherman Islands		
10	516604	6969873
11	516800	6969726
13	517234	6970249
14	517466	6970396
15	517393	6970664
16	517542	6971027
17	518028	6971302
18	518189	6971533
19	517487	6970184
20	517470	6969501
22	518085	6969346
23	518358	6969906
Whyte Island		
No sites photographed		

Table F2 Position of sediment monitoring sites (AGD84 Zone 56J)

Site	Easting	Northing
Coal Loader		
FI 1	515535	6969158
FI 2	515635	6969481
FI 3	515823	6969656
FI 4	515924	6969268
FI 6	516100	6969286
FI 7		
Fisherman Islands		
FI 9	516604	6969873
FI 11	516805	6969772
FI 13	517234	6970249
FI 15	517393	6970664
FI 17	518028	6971302
FI 18	518189	6971533
FI 19	517487	6970184
FI 22	518085	6969346
FI 23	518358	6969906
Whyte Island		
WI 1	516846	6968690
WI 2	516535	6967739
WI 3	516535	6967486

Table F3 Position of pore water salinity transects (AGD84 Zone 56J)

Site	Start of Transect		End of Transect	
	Easting	Northing	Easting	Northing
Coal Loader				
No transects surveyed				
Fisherman Islands				
FI 1	517601	6970465	517729	6970476
FI 2	517669	6970246	517777	6970229
FI 3	517085	6969755	517027	6969603
FI 4	518115	6969515	518181	6969604
FI 5	518278	6969244	518374	6969328
Whyte Island				
WI 1	516587	6968611	516741	6968859
WI 2	516677	6968551	516846	6968690
WI 3	516886	6968181	517099	6968155
WI 4	516949	6967990	517101	6967997
WI 5	516912	6967512	517084	6967396