

Waituna Lagoon 2009

Macrophyte (*Ruppia*) Monitoring



Prepared
for
Department
of
Conservation
June 2009

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By

Barry Robertson and Leigh Stevens

Cover Photo: Waituna Lagoon - typical bottom sample showing dense brown slimy macroalgal layer (*Bachelotia antillarum*) and *Ruppia*.

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All photos by Wriggle except where noted otherwise.

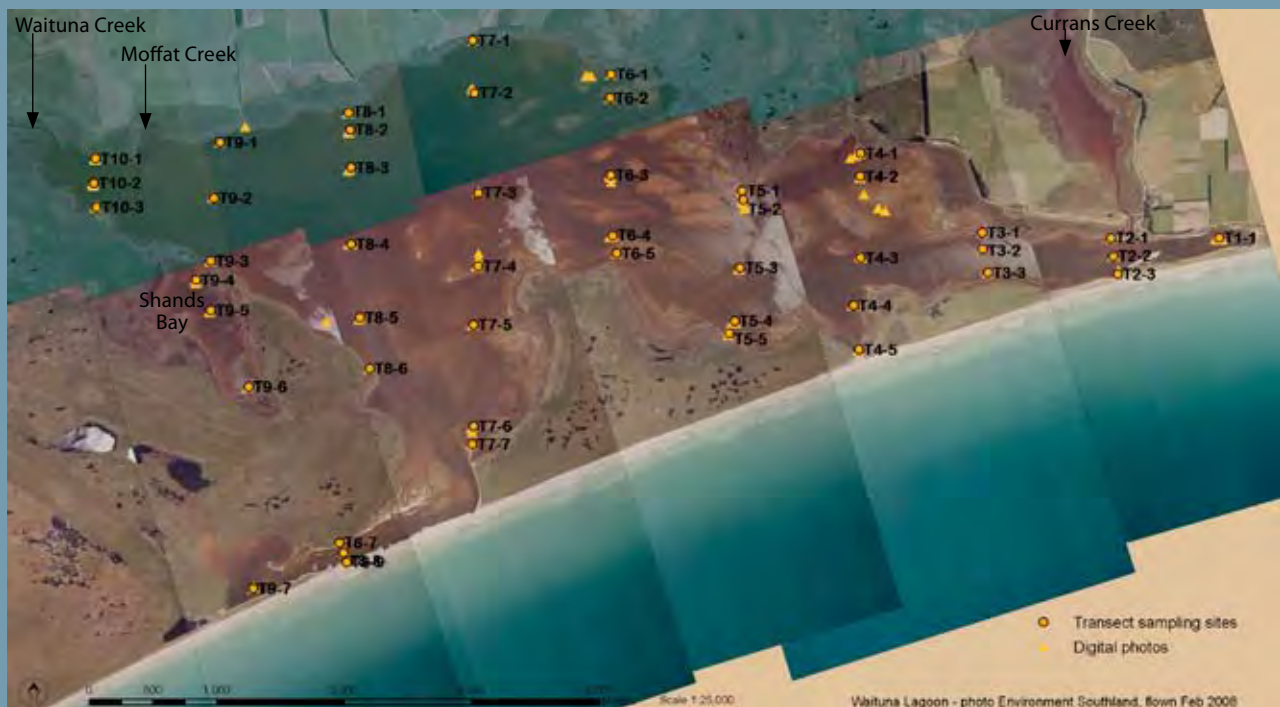


1. INTRODUCTION

Maintaining an understanding of the condition and risks to coastal lagoons is critical to the Department of Conservation (DOC) in their biodiversity conservation role in the Southland region.

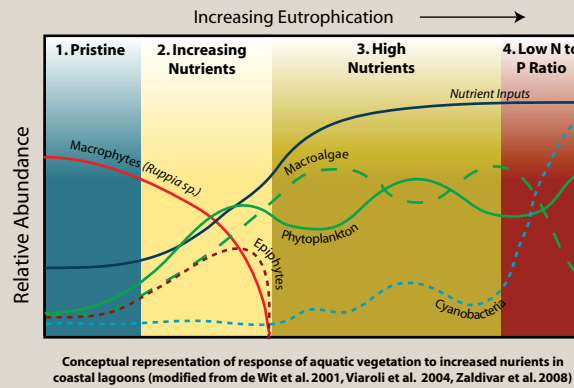
Waituna Lagoon (1350ha), located within the Waituna Lagoon Scientific Reserve, and associated wetland (~2,200ha) is centred in Toetoes Bay in Eastern Southland (Figure 1). It is a large, brackish intermittently open/closed “coastal lake or lagoon” type estuary fed by three streams; Currans Creek, Waituna Creek and Moffat Creek, which pass through highly developed pastoral land and peat bog wetlands. It is separated from the sea by a spit or barrier beach, and the lagoon drains to the sea through a gap at the western end when the lagoon is open. The lagoon also drains through the gravel bar at low rates when closed. Historically, the lagoon was surrounded by a huge peat bog wetland (area approximately 20,000ha stretching from Fortrose Estuary to New River Estuary) whose drainage gave the lagoon water its characteristic clear brown humic stain, low nutrient status, and low pH.

Figure 1. Waituna Lagoon showing transect sampling sites and digital photo locations.

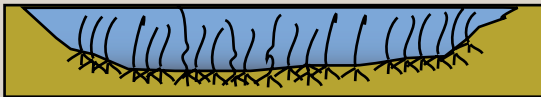


Recent studies of Waituna Lagoon (Schallenberg and Tyrell 2007, Stevens and Robertson 2007, Ryder Consulting 2008) have identified the submerged aquatic macrophyte community (dominated by horse's mane weed, *Ruppia*) as playing a key role in regulating water quality and providing habitat for aquatic fauna in this lagoon's relatively unmodified ecosystem. Various other studies show that brackish coastal lagoons, like Waituna, exhibit a predictable pattern of increasing eutrophication (including changes to aquatic macrophytes) in response to increased nutrients (particularly nitrogen and phosphorus) (de Wit et al. 2001, Viaroli et al. 2004, Zaldivar et al. 2008). Because maintenance of high light levels in the lagoon is essential for macrophyte survival, if the lagoon nutrient levels reach point where the lagoon becomes phytoplankton dominated, or sedimentation becomes too high, decreased clarity (among other factors) may result in macrophytes being lost from the lagoon. A generalised outline of the response is shown in Figure 2 on the following page.

FIGURE 2. COASTAL LAGOON RESPONSE TO INCREASING EUTROPHICATION



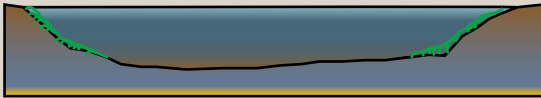
1. Pristine Condition



2. Moderate Nutrient Supply



3. High Nutrient Concentrations



4. Low N to P Ratio



Stage 1. Pristine.

In their pristine state, the net nutrient inputs to such coastal lagoons are low and they are dominated by extensive meadows of macrophyte species (e.g. *Ruppia*), which take advantage of nutrient supply from the sediment. Under these conditions water clarity is high. If such lagoons are closed to the sea (as in the case of Waituna Lagoon in 2007 and 2009), the nutrient supply must be very low to maintain pristine conditions compared with lagoons that are open to the sea.

Stage 2. Increasing Macroalgae, Declining *Ruppia*.

As nutrient levels increase to a moderate level, the estuary tips into a stage where nuisance macroalgae, phytoplankton and epiphyte growth increases, and *Ruppia* growth, sediment oxygenation and water clarity declines. In lagoons like Waituna, even a small nutrient increase is enough to cause this shift.

Stage 3. *Ruppia* Absent, Nuisance Macroalgae Dominant .

When nutrients reach high concentrations, *Ruppia* is lost from the lagoon and replaced with nuisance short-lived macroalgae and phytoplankton. Water clarity is low, sediments are anoxic close to the surface and sulphide rich, and sediment macrofauna is dominated by high numbers of a few tolerant species only.

Stage 4. Nuisance Cyanobacterial Blooms Dominant.

At the fourth stage, the nitrogen to phosphorus ratio declines to low levels and results in nuisance cyanobacteria and toxic bloom events. Sediment macrofauna are often absent, but nuisance short-lived macroalgae. (e.g. *Bachelotia* and *Enteromorpha* sp.) and phytoplankton are still present. Water clarity is low and sediment quality poor (mud content is increasing, anoxic, and sulphides high).



1. Introduction (Continued)

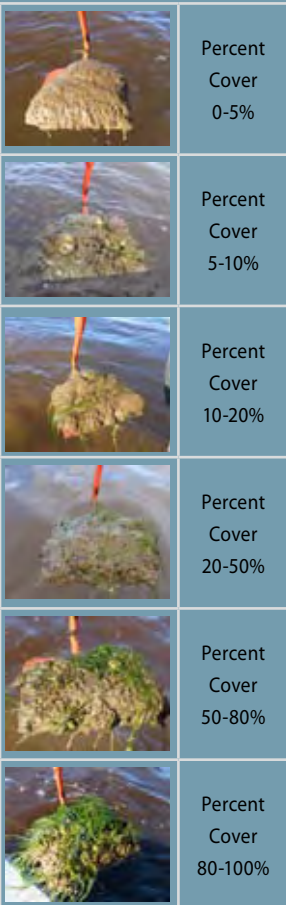
In recognition that maintaining the *Ruppia* community is a key management goal for Waituna Lagoon, broad scale monitoring of the distribution of submerged aquatic macrophytes (including *Ruppia*) and macroalgae in Waituna Lagoon began in March 2007 (Stevens and Robertson 2007). The 2007 survey, undertaken following a period of optimal growing conditions, showed the following:

- An ideal baseline for future comparison (lagoon had been closed for 9 months, and lagoon water level was high 1.13m above mean sea level - msl).
- *Ruppia* beds covered approximately 66% of the lagoon.
- Both *Ruppia polycarpa* and *Ruppia megacarpa* were present. *R. polycarpa* was dominant in water less than 0.5m deep, with plants relatively small (mostly 10-20cm). *R. megacarpa* dominated in the depth range 0.5-2.5m but seemed to prefer depths between 1.0-1.5m. Plants were generally large (>20cm) with flower heads reaching up to the water surface.
- The areas of greatest density were spread throughout the lagoon, but occurred primarily in areas relatively sheltered from wind and wave disturbance (e.g. the head of Waituna Creek, the western embayment and arm, and the narrow eastern arm near Currans Creek).

The current report presents the results of the second macrophyte monitoring survey, undertaken by Wriggle Coastal Management in February 2009 as part of the Arawai Kākāriki Wetland Restoration Programme, which encompasses the Awarua-Waituna wetland complex. The specific objectives of the survey were to:

1. Collect data on the abundance and height of macrophyte species in Waituna Lagoon.
2. Collect information on water quality and sediment type in Waituna Lagoon.
3. Report all data collected during fieldwork and prepare a brief summary of the work undertaken (methods, limitations, monitoring recommendations).

2. METHODS



The methodology used in the 2007 survey (Stevens and Robertson 2007) involved widespread sampling of georeferenced sites (73 sites) to provide a map of overall cover. The 2009 methodology was altered to one of replicated sampling at georeferenced sites along transects (10 transects, 47 sites, 4 replicates) which, through future repeat sampling, will provide a more quantifiable and robust technique to indicate change in macrophyte composition and cover. Details of the 2009 sampling methodology are:

Prior to sample collection, the 10 proposed transects, and the sites along the transects, were identified and positioned on a topographical map for guidance in the field. During field sampling (undertaken by 4 scientists on 25 February 2009 using a jetboat), GPS coordinates were used to locate each site. Broad details on site locations and positions of photographs are shown in Figure 1. Sites were positioned near the edge of lagoon to sample shallow water habitat (generally <0.5m), with mid-lagoon sites in deeper water habitat (generally 0.5-2.0m). Additional sites were included for longer transects to obtain spatial coverage.

Once the jetboat was positioned above each site, 4 replicate sediment samples were collected by digging up a 5-6cm deep layer of the surface sediments with a garden hoe (area 15 x 15cm) and carefully bringing the contents to the surface. At the surface, the sample was photographed and records taken of; the aquatic vegetation (taxa, height, percentage cover and life stage), the sediment type, depth to the blackened sulphide rich layer (redox potential discontinuity layer - RPD). In addition, the water column at each site was sampled for the following; secchi disc clarity, depth and salinity (at surface and bottom). Examples of percentage cover estimates for *Ruppia* sp are shown in the margin figure.

Geo-referenced sampling positions and photographs, and field measurements were recorded and are presented in Appendix 1. The data are also available as an Excel spreadsheet along with an ArcMap GIS layer containing georeferenced digital field photos (GPS- Photolink).

3. RESULTS

The detailed results for the 25 February 2009 sampling of the dominant macrophyte and macroalgal vegetation in Waituna Lagoon are presented in spreadsheet form in Appendix 1. A brief summary of the key findings are presented below, along with other relevant information.

Macrophyte and Macroalgal Cover

The survey results showed that the macrophyte community was dominated by *Ruppia polycarpa*. *Ruppia megacarpa* was also present but only at a few sites. The only other macrophyte which was relatively common (but in isolated patches only) was the water milfoil *Myriophyllum triphyllum*. Figure 3 presents the species composition at each site while Figure 4 summarises the percentage cover and distribution of *Ruppia* across the lagoon in relation to water depth.

Perhaps the most important result of the survey was the widespread occurrence of nuisance macroalgal growths. In particular, the filamentous slime macroalgae, *Bachelotia antillarum*, growing on the sediment surface (and as epiphytic growth on macrophytes). In addition, locally abundant beds of *Enteromorpha* sp., a green filamentous macroalgae, were also present in shallow margin areas. Various charophyte species, including *Nitella* were also locally abundant in some areas.

Figure 3. Aquatic vegetation type along the 10 transects on 25 February 2009.

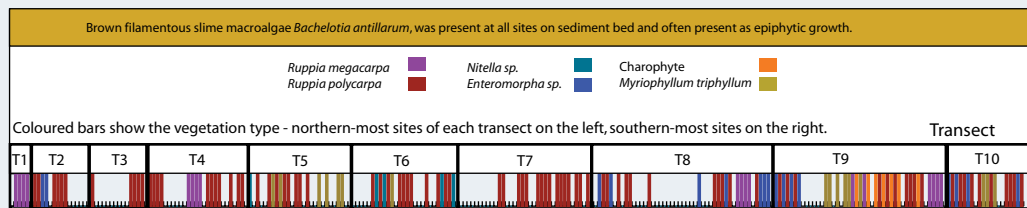


Figure 4. Percent cover of *Ruppia* (mean of 4 replicates) along the 10 transects on 25 February 2009.

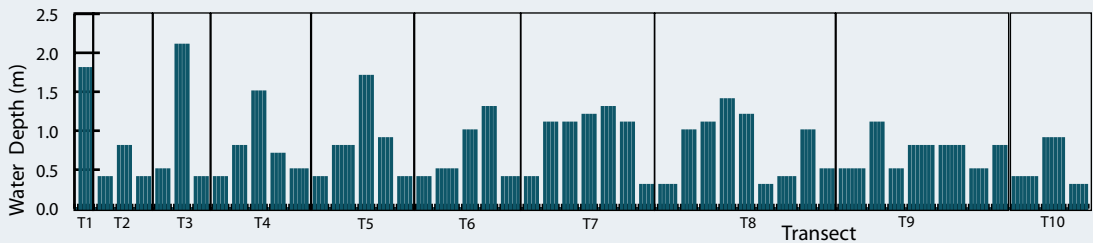


3. Results (Continued)

Water Depth

Approximate lagoon water depth is shown in Figure 4 and at each site in Figure 5. Sampling depths were relatively shallow and varied from 30cm near the margins to 2.1m in the channel at the east end. The lagoon water level was 1.057m above msl on the day of sampling.

Figure 5. Water depth at each site and replicate along the 10 transects on 25 February 2009.



Depth to Black Sulphide (Anoxic) Layer

The depth to the black anoxic sulphide layer varied between sites (Figures 6 and 7). It was in the 0-3cm range at the majority of sites, which is indicative of low sediment oxygenation. However, it was also noted that this anoxic layer was often near the surface only, adjacent to the rotting mass of decaying macroalgae (primarily *Bachelotia*) lying on the sediment surface.

Figure 6. Depth to black anoxic sulphide layer along the 10 transects on 25 February 2009.

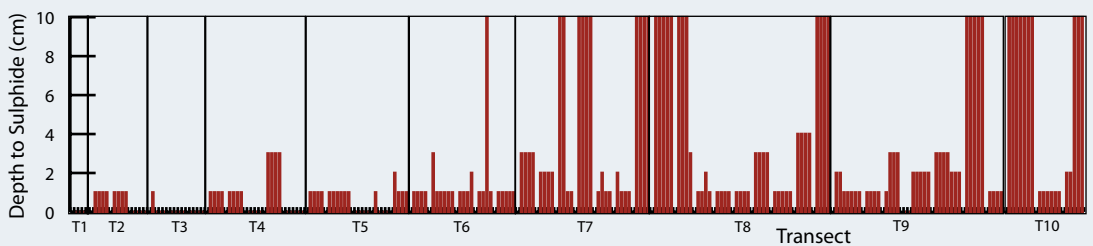


Figure 7. Depth to sulphide (RPD) layer (mean of 4 replicates) along the 10 transects on 25 February 2009.



3. Results (Continued)

Depth to Black Sulphide (Anoxic) Layer

The broad relationship between RPD depth underlying substrate type (mapped previously by Stevens and Robertson 2007) is shown in Figure 7. Overall, the RPD tended to be closer to the surface in finer sediments, although there was significant localised variation depending on the extent of decaying macroalgae present. Anoxic surface sediments were primarily located in the narrow eastern arm of the lagoon.

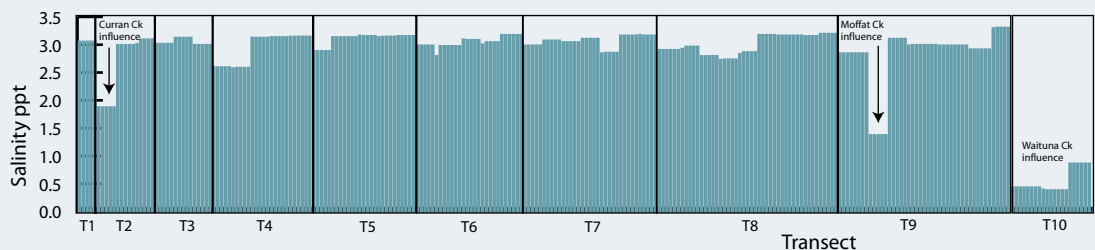
Substrate Type

At each of the sites sampled, substrate type was generally dominated by sand or gravel but the majority of sites also included sand, gravel and mud. Muddy sites dominated in Shands Bay.

Water Salinity

The lagoon was brackish (Figure 8) with a relatively constant salinity of around 3ppt, except near the mouths of the three input streams (Waituna, Moffat and Curran Creeks) where the salinity dropped closer to that of freshwater (0.5 to 2 ppt). The data show little difference between surface and bottom salinities, indicating that the lagoon waters were well-mixed.

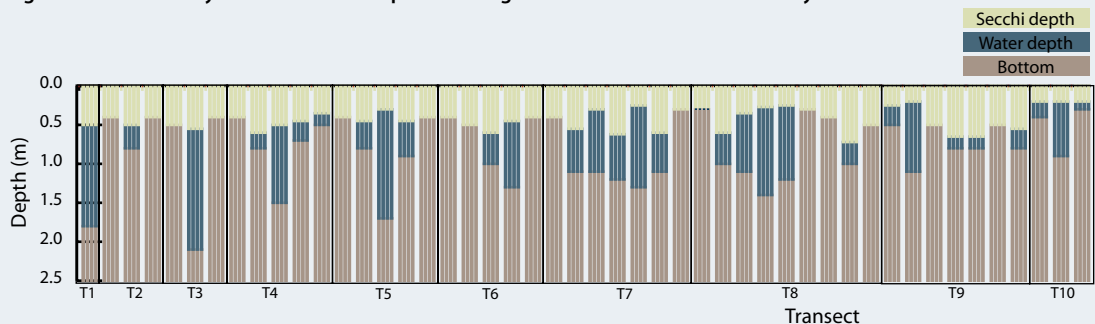
Figure 8. Water salinity at each site and replicate along the 10 transects on 25 February 2009 (surface and bottom measures are included).



Water Clarity

Secchi disc clarity (Figure 9) was low throughout the lagoon (0.2-0.7m) with the lowest values measured near the Waituna Creek input and the highest values near the seaward spit at the western end of the lagoon. Such low values meant that a limited amount of light was reaching the bed over much of the lagoon.

Figure 9. Water clarity at each site and replicate along the 10 transects on 25 February 2009



4. DISCUSSION AND CONCLUSIONS

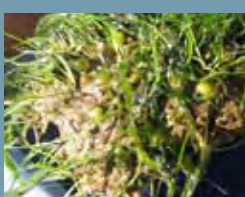


The results of the 2009 monitoring indicate the continuing presence of the ecologically important macrophyte species (*Ruppia*) within Waituna Lagoon (present at 35 of 48 sites sampled). However, the results also indicate widespread presence of nuisance macroalgal species, particularly the slimy filamentous brown macroalgae *Bachelotia antillarum*, and accompanying black, anoxic, sulphide-rich surface sediments. Such results indicate a shift away from the relatively cleaner conditions measured in 2007 (Stevens and Robertson 2007), and towards more eutrophic conditions in 2009.

A summary of the conditions that existed in both 2007 and 2009 is presented in the table below. This table clearly shows the shift away from the more pristine (but still Stage 2) conditions that existed in 2007 towards the advanced Stage 2 situation in 2009 - that is; increased nuisance macroalgae, poorer water and sediment quality, and a decline in the condition of the *Ruppia* beds. Such a shift indicates a substantial risk of losing *Ruppia* from the lagoon in the future unless the major causes of the eutrophication symptoms in the lagoon are addressed. Towards this end, a section on possible management options follows.

Indicators	March 2007	February 2009
Macrophytes	<i>Ruppia polycarpa</i> dominant in shallower waters and <i>Ruppia megacarpa</i> in the deeper waters. <i>Myriophyllum</i> presence very low.	<i>Ruppia polycarpa</i> dominant growing and fruiting at moderate levels within the lagoon. <i>R. megacarpa</i> less apparent. Increased presence of <i>Myriophyllum</i> .
Macroalgae and Epiphytic Growth	Green filamentous <i>Enteromorpha</i> sp. present around edge in localised areas. Brown filamentous slime algae <i>Bachelotia antillarum</i> present but in low abundance.	Bloom growths of the nuisance macroalgae <i>Bachelotia antillarum</i> were found throughout much of the lagoon. It was most dense in the lagoon bottom water but was also present as epiphytic growth over <i>Ruppia</i> and other macrophyte species. <i>Enteromorpha</i> was common around lagoon margins.
Sediment Quality	Clean, well-oxygenated sediments throughout most of lagoon. Sand and gravels dominant. Black, anoxic, sulphide rich layer only at surface in a few localised areas.	Eutrophic sediments; poorly oxygenated, often muddy on surface but still dominated by sands and gravels. Black, anoxic, sulphide rich layer often at surface or close to surface.
Water Quality	Moderately high water clarity. Secchi Disc 1.5-2m. But at other times it has been reported as low.	Brackish (salinity 0.4-3.2 ppt). Temperature 12-16 deg. C. Low water clarity. Secchi Disc 0.5m (range 0.2-0.72m). Likely low concentrations of dissolved nutrients available for plant growth based on previous months WQ data. High concentrations of total N (likely organic). DIN < 0.014 mg/l, TN 0.73 mg/l. DRP < 0.004 mg/l, TP 0.03 mg/l.
Lagoon Open/Closed	Lagoon closed since 2 June 2006 (272 days).	Lagoon closed since 7 October 2008 (144 days).
Trophic Stage	MARCH 2007 Stage 2. Towards the PRISTINE side of Stage 2.	FEBRUARY 2009 Stage 2. Towards the increasing eutrophication side of Stage 2.

5. MANAGEMENT RECOMMENDATIONS



Restoration of Waituna Lagoon towards a pristine condition is considered important if the high ecological status of the lagoon is to be maintained. At present, the monitoring evidence suggests that the lagoon is moving further towards the point to which a switch to an algal dominated system is likely. If Waituna follows the recent pattern shown in other coastal lagoons where nutrient inputs have increased (e.g. Lake Ellesmere, Gerbeaux and Ward 1991), and a switch occurs, it is likely to result in the loss of *Ruppia* from the lagoon, probably for good. The two main drivers are nutrient supply, and the opening regime of the lagoon, with light levels another compounding factor in the shift from a macrophyte-dominated to algal-dominated lagoon. The key management options for restoration of the lagoon are therefore to limit the nutrients, and/or control the opening regime to the length of time the lagoon is closed to the sea. These options are discussed below.

1. Guideline Limits for Nutrient Inputs to Waituna Lagoon

The two key nutrients that fertilize algal growth are nitrogen and phosphorus (N and P). By limiting the concentration of the nutrient in shortest supply, the growth of nuisance algae can be reduced. TN:TP ratios in the lagoon for January 2008 to January 2009 (Environment Southland data) ranged from 13:1 to 84:1 which suggests P as the limiting nutrient. In addition, very low levels of dissolved reactive P (DRP) (<0.005 mg/l) during the whole period confirm P as being in shortest supply. However, the very low levels of both dissolved inorganic N (DIN) (<0.01 mg/l) and DRP (<0.005 mg/l) in the 2 months leading up to the high nuisance algal growth event in late February 2009, suggest that either nutrient could be targeted for management.

Guideline nutrient loads for ensuring no eutrophication of coastal lagoons are currently unavailable for New Zealand. However, Heggie (2006) suggested an areal loading upper limit of 50 mgN.m⁻².d⁻¹ for ensuring no eutrophication of temperate Australian tidal lagoon type estuaries (i.e. large lagoon type estuaries that are permanently open to the sea and hence are well-flushed). Such a guideline, although inappropriate for intermittently open coastal lagoons (given their low dilution with tidal seawater and limited flushing to the sea), does provide us with the knowledge that a coastal lagoon guideline must be significantly less than 50 mgN.m⁻².d⁻¹.

The current nitrogen supply has been estimated as 700 kgN/day (based on landuse runoff estimates, Stevens and Robertson 2007) which equates to an areal N loading to the lagoon (area 1,350ha) of 50 mgN.m⁻².d⁻¹ for the total N load. Another approach is to use available river flow and concentration data as follows; at a mean surface freshwater inflow of around 2 m³.s⁻¹ and a mean input N concentration of 2 mgTN/l (range 0.6-5 mg/l TN, based on Environment Southland monitoring data) the mean TN input is ~345 kgN/day. Such an estimate, however, likely underestimates the influence of flood loadings and groundwater inputs. Note that both calculations ignore likely internal N loading from the sediments (i.e. ammonia release from anoxic sediments). **These estimates indicate that the current Waituna N load likely exceeds the guideline for tidal lagoon estuaries.**

To provide guidance on appropriate nutrient loads from the catchment, specific yields under more pristine conditions have been estimated. Assuming a primarily sheep and beef landuse for a more pristine situation where *Ruppia* is likely to be maintained, **a realistic catchment specific N yield is estimated to be 160 kgN/day, which equates to an areal N load to the lagoon of around 12 mgN.m⁻².d⁻¹.**

Similarly, estimates can be made for phosphorus. Stevens and Robertson (2007a) reported a likely P loading to the lagoon of 46 kgP/day or as an areal load to the lagoon of 3.5 mgP.m⁻².d⁻¹. Again guideline values are not available for phosphorus, but based on non-intensive loadings prior to the upsurge in dairying in the catchment and when the lagoon was in much better condition, **a realistic guideline P loading for Waituna Lagoon is likely to be around 25 kgP/day or an areal load of 1.9 mgP.m⁻².d⁻¹.**

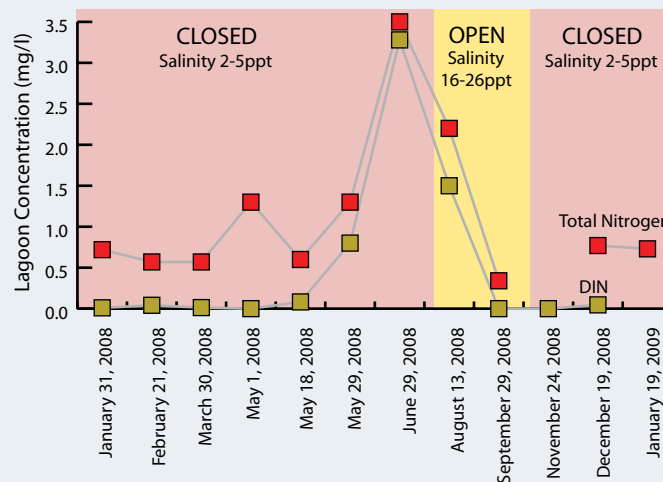
5. Management Recommendations (continued)



2. Decreasing the Period of Lagoon Closure

The other approach to lagoon restoration is to increase flushing and dilution by increasing the period when the lagoon is open. Figure 10 shows a buildup in N concentrations during the colder winter months (likely attributable to lowered plant uptake and increased inputs from the catchment), followed by a large decline (3 mgN/l to less than 0.5 mg/l TN) when the lagoon was opened on 25 August 2008.

Figure 10. Measured nitrogen concentrations in Waituna Lagoon 2008 and 2009.



After it closed again 43 days later on 7 October 2008, the lagoon N concentrations remained low (likely attributable to high nuisance plant uptake). By February 2009, the lagoon had widespread nuisance macroalgal growths and anoxic bottom sediments.

The question therefore arises, if the lagoon mouth was opened in January and left open till March (i.e. during the main growing season), would the lagoon be restored to good condition and nuisance macroalgal growth return to low levels? Without much doubt, the answer would be that the lagoon response would be; dilution of the brackish lagoon water with low nutrient seawater, loss of nutrients to the sea via tidal exchange, and consequently less N available in the lagoon for nuisance plant growth.

However, such an approach is likely to risk damage to the *Ruppia* beds through excessive salinity effects and exposure of some of the beds. Recent Environment Southland monitoring (Figure 10) shows that salinities during the last 43 day opening were high (16-26 ppt, note that 33ppt is full strength seawater) throughout the lagoon. Various studies indicate that optimum salinity range for *Ruppia* seed germination, establishment and growth is 4 to 8ppt so extended periods of lagoon opening may expose *Ruppia* to suboptimal conditions (Schallenberg and Tyrrell 2006). In addition, Stevens and Robertson (2007) showed that the exposure of the lagoon bed, as a result of prolonged opening, would decrease the likely area of *Ruppia* cover in the lagoon by approximately one third. Therefore there are likely to be high risks to the continued success of *Ruppia* and the Waituna Lagoon ecology if the increased lagoon opening option is taken.

In conclusion, there are likely to be high risks to the continued viability of *Ruppia* under the current conditions in Waituna Lagoon. Further investigation of management options is recommended, although the lowest risk option addressed in this report, is to set Total Daily Maximum Nutrient (N and P) Loads to the lagoon.

6. MONITORING RECOMMENDATIONS

The changing patterns of submerged aquatic vegetation, water and sediment quality and the apparent shift towards increased eutrophication in Waituna Lagoon emphasises the importance of the following monitoring:

- Annual monitoring during likely worst case conditions (February to March), of:
 - * Aquatic macrophytes (including *Ruppia*) and nuisance macroalgae presence, location, percentage cover, and life stage.
 - * Sediment quality - depth to RPD layer, sediment type.
 - * Water clarity and depth.
- Monthly monitoring of water quality within the lagoon, including chlorophyll a (optimising sites is recommended).
- Targeted monitoring of streams and groundwater to determine daily N and P loads to the lagoon.
- Monitor intensive landuse in the catchment and identify hotspots where high N and P loadings originate from.

At present, salinity, light level, and exposure tolerances of *Ruppia* in Waituna are not known, but are necessary to be able to understand and optimise seed germination and seed survival requirements.

Ultimately, the monitoring information will contribute to a model or set of equations to describe the relationship between the major variables that drive the macrophyte/algal switch-point (e.g. water residence time, wind fetch, nutrient concentrations, substrate type, extent of saltmarsh, and water depth). Currently, such tools do not exist for NZ lagoons and shallow lakes, and prediction of the switch-point is difficult.

7. ACKNOWLEDGEMENTS



This survey and report has been undertaken with help from various people, Greg Larkin (Coastal Scientist, Environment Southland) who provided and skippered the boat, staff of the Department of Conservation, particularly Dr Hugh Roberston, Wetland Scientist, Aquatic & Threats Unit, Research & Development Group, who helped with the field survey and who made it all happen, and Maz Robertson (Wriggle) for editing. Thanks also to Hugh Robertson and Emily Atkinson (DOC - Southland) for their comments on the draft report, and Environment Southland for the use of existing aerial photos and GIS layers of depth and substrate.

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APPENDIX 1

Aquatic Vegetation, and Site Details Waituna Lagoon 25 February 2009

Note: Dense bloom of brown filamentous macroalgae, *Bachelotia antillarum* also covered the bed of almost all sites, and was not present on most photographs because it had slid off as it was brought above the surface.



Appendix 1

WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Secchi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
513	2/25/09	2:03:43PM	2177865	5395520	T1-1		0.0	12.87	3.05	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
513	2/25/09	2:03:43PM	2177865	5395520	T1-1	i	1.8	12.84	3.05	0.5	gravel,muddySAND	surface	Ruppia megacarpa	15-30	v	1-5	3129
513	2/25/09	2:03:43PM	2177865	5395520	T1-1	ii	1.8	12.84	3.05	0.5	muddysand/GRAVEL	surface	Ruppia megacarpa	15-30	v	1-5	3130
513	2/25/09	2:03:43PM	2177865	5395520	T1-1	iii	1.8	12.84	3.05	0.5	gravel,muddySAND	surface	Ruppia megacarpa	15-30	v	1-5	3131
513	2/25/09	2:03:43PM	2177865	5395520	T1-1	iv	1.8	12.84	3.05	0.5	sandygravel/MUD	surface	Ruppia megacarpa	30-50	v	80-100	3132
510	2/25/09	1:45:19PM	2177014	5395517	T2-1		0.0	14.00	1.87	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
510	2/25/09	1:45:19PM	2177014	5395517	T2-1	i	0.4	14.00	1.87	bottom	gravel,muddySAND	1	Ruppia polycarpa	5-15	v	20-50	3114
510	2/25/09	1:45:19PM	2177014	5395517	T2-1	ii	0.4	14.00	1.87	bottom	gravel,muddySAND	1	Ruppia polycarpa	5-15	v	1-5	3115
510	2/25/09	1:45:19PM	2177014	5395517	T2-1	iii	0.4	14.00	1.87	bottom	gravel,muddySAND	1	Enteromorpha	1-5	n/a	1-5	3116
510	2/25/09	1:45:19PM	2177014	5395517	T2-1	iv	0.4	14.00	1.87	bottom	gravel,muddySAND	1	Enteromorpha	1-5	n/a	1-5	3117
511	2/25/09	1:49:10PM	2177033	5395373	T2-2		0.0	12.65	2.99	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
511	2/25/09	1:49:10PM	2177033	5395373	T2-2	i	0.8	12.66	2.99	0.5	muddygravel/SAND	1	Ruppia polycarpa	15-30	v	80-100	3120
511	2/25/09	1:49:10PM	2177033	5395373	T2-2	ii	0.8	12.66	2.99	0.5	muddygravel/SAND	1	Ruppia polycarpa	15-30	v	80-100	3121
511	2/25/09	1:49:10PM	2177033	5395373	T2-2	iii	0.8	12.66	2.99	0.5	muddygravel/SAND	1	Ruppia polycarpa	15-30	v	80-100	3122
511	2/25/09	1:49:10PM	2177033	5395373	T2-2	iv	0.8	12.66	2.99	0.5	muddygravel/SAND	1	Ruppia polycarpa	15-30	v	80-100	3123
512	2/25/09	1:54:31PM	2177067	5395234	T2-3		0.0	12.52	3.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
512	2/25/09	1:54:31PM	2177067	5395234	T2-3	i	0.4	12.52	3.09	bottom	muddysand/GRAVEL	surface	nil	nil	nil	nil	3124
512	2/25/09	1:54:31PM	2177067	5395234	T2-3	ii	0.4	12.52	3.09	bottom	muddysand/GRAVEL	surface	nil	nil	nil	nil	3125
512	2/25/09	1:54:31PM	2177067	5395234	T2-3	iii	0.4	12.52	3.09	bottom	muddysand/GRAVEL	surface	nil	nil	nil	nil	3126
512	2/25/09	1:54:31PM	2177067	5395234	T2-3	iv	0.4	12.52	3.09	bottom	muddysand/GRAVEL	surface	nil	nil	nil	nil	3127
509	2/25/09	1:32:55PM	2176005	5395562	T3-1		0.0	14.60	3.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
509	2/25/09	1:32:55PM	2176005	5395562	T3-1	i	0.5	14.60	3.01	bottom	gravel,muddySAND	1	Ruppia polycarpa	5-15	v	50-80	3109
509	2/25/09	1:32:55PM	2176005	5395562	T3-1	ii	0.5	14.60	3.01	bottom	gravel,muddySAND	surface	nil	nil	nil	nil	3110
509	2/25/09	1:32:55PM	2176005	5395562	T3-1	iii	0.5	14.60	3.01	bottom	gravel,muddySAND	surface	nil	nil	nil	nil	3111
509	2/25/09	1:32:55PM	2176005	5395562	T3-1	iv	0.5	14.60	3.01	bottom	gravel,muddySAND	surface	nil	nil	nil	nil	3112
508	2/25/09	1:29:10PM	2176009	5395432	T3-2		0.0	12.68	3.12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
508	2/25/09	1:29:10PM	2176009	5395432	T3-2	i	2.1	12.67	3.12	0.55	muddySAND	surface	nil	nil	nil	nil	3105
508	2/25/09	1:29:10PM	2176009	5395432	T3-2	ii	2.1	12.67	3.12	0.55	muddySAND	surface	nil	nil	nil	nil	3106
508	2/25/09	1:29:10PM	2176009	5395432	T3-2	iii	2.1	12.67	3.12	0.55	muddySAND	surface	nil	nil	nil	nil	3107
508	2/25/09	1:29:10PM	2176009	5395432	T3-2	iv	2.1	12.67	3.12	0.55	muddySAND	surface	nil	nil	nil	nil	3108

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WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Sechi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
507	2/25/09	1:20:46PM	2176048	5395245	T3-3		0.0	13.16	2.99	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
507	2/25/09	1:20:46PM	2176048	5395245	T3-3	i	0.4	13.16	2.99	bottom	muddysand/GRAVEL	surface	Ruppia polycarpa	5-15	v	5-10	3099
507	2/25/09	1:20:46PM	2176048	5395245	T3-3	ii	0.4	13.16	2.99	bottom	muddysand/GRAVEL	surface	Ruppia polycarpa	5-15	v	20-50	3100
507	2/25/09	1:20:46PM	2176048	5395245	T3-3	iii	0.4	13.16	2.99	bottom	muddysand/GRAVEL	surface	Ruppia polycarpa	5-15	v	20-50	3101
507	2/25/09	1:20:46PM	2176048	5395245	T3-3	iv	0.4	13.16	2.99	bottom	muddysand/GRAVEL	surface	Ruppia polycarpa	5-15	v	1-5	3102
502	2/25/09	12:01:58PM	2175050	5396183	T4-1		0.0	13.64	2.59	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
502	2/25/09	12:01:58PM	2175050	5396183	T4-1	i	0.4	13.64	2.59	bottom	muddygrave/SAND	1	Ruppia polycarpa	5-15	v	10-20	3064
502	2/25/09	12:01:58PM	2175050	5396183	T4-1	ii	0.4	13.64	2.59	bottom	muddygrave/SAND	1	Ruppia polycarpa	1-5	v	1-5	3065
502	2/25/09	12:01:58PM	2175050	5396183	T4-1	iii	0.4	13.64	2.59	bottom	muddygrave/SAND	1	Ruppia polycarpa	5-15	v	20-50	3066
502	2/25/09	12:01:58PM	2175050	5396183	T4-1	iv	0.4	13.64	2.59	bottom	muddygrave/SAND	1	Ruppia polycarpa	1-5	v	1-5	3067
503	2/25/09	12:30:14PM	2175047	5396001	T4-2		0.0	12.84	2.57	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
503	2/25/09	12:30:14PM	2175047	5396001	T4-2	i	0.8	12.79	2.58	0.6	muddySAND	1	nil	nil	nil	nil	3070
503	2/25/09	12:30:14PM	2175047	5396001	T4-2	ii	0.8	12.79	2.58	0.6	muddySAND	1	nil	nil	nil	nil	3071
503	2/25/09	12:30:14PM	2175047	5396001	T4-2	iii	0.8	12.79	2.58	0.6	muddySAND	1	nil	nil	nil	nil	3072
503	2/25/09	12:30:14PM	2175047	5396001	T4-2	iv	0.8	12.79	2.58	0.6	muddySAND	1	nil	nil	nil	nil	3073
504	2/25/09	12:46:08PM	2175050	5395363	T4-3		0.0	12.68	3.12	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
504	2/25/09	12:46:08PM	2175050	5395363	T4-3	i	1.5	12.69	3.12	0.5	sandyMUD	surface	Ruppia megacarpa	30-50	F/PF	80-100	3078
504	2/25/09	12:46:08PM	2175050	5395363	T4-3	ii	1.5	12.69	3.12	0.5	sandyMUD	surface	Ruppia megacarpa	30-50	F/PF	80-100	3081
504	2/25/09	12:46:08PM	2175050	5395363	T4-3	iii	1.5	12.69	3.12	0.5	sandyMUD	surface	Ruppia megacarpa	30-50	F/PF	80-100	3085
504	2/25/09	12:46:08PM	2175050	5395363	T4-3	iv	1.5	12.69	3.12	0.5	sandyMUD	surface	Ruppia megacarpa	30-50	F/PF	80-100	3086
505	2/25/09	12:59:22PM	2174994	5394989	T4-4		0.0	12.92	3.13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
505	2/25/09	12:59:22PM	2174994	5394989	T4-4	i	0.7	12.95	3.13	0.45	gravel,muddySAND	3	Ruppia polycarpa	5-15	v	50-80	3087
505	2/25/09	12:59:22PM	2174994	5394989	T4-4	ii	0.7	12.95	3.13	0.45	gravel,muddySAND	3	Ruppia polycarpa	5-15	v	50-80	3088
505	2/25/09	12:59:22PM	2174994	5394989	T4-4	iii	0.7	12.95	3.13	0.45	gravel,muddySAND	3	Ruppia polycarpa	5-15	v	50-80	3089
505	2/25/09	12:59:22PM	2174994	5394989	T4-4	iv	0.7	12.95	3.13	0.45	gravel,muddySAND	3	Ruppia polycarpa	15-30	v	50-80	3090
506	2/25/09	1:05:23PM	2175035	5394643	T4-5		0.0	13.15	3.14	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
506	2/25/09	1:05:23PM	2175035	5394643	T4-5	i	0.5	13.15	3.14	0.35	muddygrave/SAND	surface	Filamentous algae	n/a	n/a	80-100	3094
506	2/25/09	1:05:23PM	2175035	5394643	T4-5	i	0.5	13.15	3.14	0.35	muddygrave/SAND	surface	Ruppia polycarpa	5-15	v	1-5	3094
506	2/25/09	1:05:23PM	2175035	5394643	T4-5	ii	0.5	13.15	3.14	0.35	muddygrave/SAND	surface	Filamentous algae	n/a	n/a	80-100	3095
506	2/25/09	1:05:23PM	2175035	5394643	T4-5	iii	0.5	13.15	3.14	0.35	muddygrave/SAND	surface	Ruppia polycarpa	5-15	v	20-50	3096
506	2/25/09	1:05:23PM	2175035	5394643	T4-5	iv	0.5	13.15	3.14	0.35	muddygrave/SAND	surface	Ruppia polycarpa	5-15	v	5-10	3097

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WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Secchi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
501	2/25/09	11:49:23AM	2174118	5395889	T5-1		0.0	13.00	2.88	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
501	2/25/09	11:49:23AM	2174118	5395889	T5-1	i	0.4	13.00	2.88	bottom	gravel,muddySAND	1	Nitella	5-15	n/a	1-5	3056
501	2/25/09	11:49:23AM	2174118	5395889	T5-1	ii	0.4	13.00	2.88	bottom	gravel,muddySAND	1	nil	nil	nil	nil	3057
501	2/25/09	11:49:23AM	2174118	5395889	T5-1	iii	0.4	13.00	2.88	bottom	gravel,muddySAND	1	Ruppia polycarpa	5-15	v	10-20	3058
501	2/25/09	11:49:23AM	2174118	5395889	T5-1	iv	0.4	13.00	2.88	bottom	gravel,muddySAND	1	nil	nil	nil	nil	3059
500	2/25/09	11:40:15AM	2174129	5395817	T5-2		0.0	12.11	3.13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
500	2/25/09	11:40:15AM	2174129	5395817	T5-2	i	0.8	12.10	3.13	0.45	gravel,muddySAND	1	Ruppia polycarpa	15-30	v	20-50	3052
500	2/25/09	11:40:15AM	2174129	5395817	T5-2	i	0.8	12.10	3.13	0.45	gravel,muddySAND	1	Myriophyllum	15-30	n/a	20-50	3052
500	2/25/09	11:40:15AM	2174129	5395817	T5-2	ii	0.8	12.10	3.13	0.45	gravel,muddySAND	1	Ruppia polycarpa	15-30	v	20-50	3053
500	2/25/09	11:40:15AM	2174129	5395817	T5-2	ii	0.8	12.10	3.13	0.45	gravel,muddySAND	1	Myriophyllum	15-30	n/a	20-50	3053
500	2/25/09	11:40:15AM	2174129	5395817	T5-2	iii	0.8	12.10	3.13	0.45	gravel,muddySAND	1	Ruppia polycarpa	15-30	v	50-80	3054
500	2/25/09	11:40:15AM	2174129	5395817	T5-2	iv	0.8	12.10	3.13	0.45	gravel,muddySAND	1	Ruppia polycarpa	15-30	v	80-100	3055
499	2/25/09	11:30:40AM	2174104	5395284	T5-3		0.0	12.24	3.16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
499	2/25/09	11:30:40AM	2174104	5395284	T5-3	i	1.7	12.20	3.15	0.3	sandyMUD	surface	Ruppia polycarpa	5-15	v	1-5	3048
499	2/25/09	11:30:40AM	2174104	5395284	T5-3	ii	1.7	12.20	3.15	0.3	sandyMUD	surface	Ruppia polycarpa	5-15	v	20-50	3049
499	2/25/09	11:30:40AM	2174104	5395284	T5-3	iii	1.7	12.20	3.15	0.3	sandyMUD	surface	nil	nil	nil	nil	3050
499	2/25/09	11:30:40AM	2174104	5395284	T5-3	iv	1.7	12.20	3.15	0.3	sandyMUD	surface	Ruppia polycarpa	5-15	v	10-20	3051
498	2/25/09	11:22:29AM	2174060	5394866	T5-4		0.0	12.29	3.13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
498	2/25/09	11:22:29AM	2174060	5394866	T5-4	i	0.9	12.37	3.14	0.45	muddygravel/SAND	1	nil	nil	nil	nil	3044
498	2/25/09	11:22:29AM	2174060	5394866	T5-4	ii	0.9	12.37	3.14	0.45	muddygravel/SAND	surface	Myriophyllum	15-30	n/a	1-5	3045
498	2/25/09	11:22:29AM	2174060	5394866	T5-4	iii	0.9	12.37	3.14	0.45	SAND	surface	nil	nil	nil	nil	3046
498	2/25/09	11:22:29AM	2174060	5394866	T5-4	iv	0.9	12.37	3.14	0.45	muddygravel/SAND	surface	Myriophyllum	5-15	n/a	5-10	3047
497	2/25/09	11:13:34AM	2174017	5394771	T5-5		0.0	12.00	3.15	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
497	2/25/09	11:13:34AM	2174017	5394771	T5-5	i	0.4	12.00	3.15	bottom	muddygravel/SAND	2	nil	nil	nil	nil	3040
497	2/25/09	11:13:34AM	2174017	5394771	T5-5	ii	0.4	12.00	3.15	bottom	muddysand/GRAVEL	1	Myriophyllum	15-30	n/a	5-10	3041
497	2/25/09	11:13:34AM	2174017	5394771	T5-5	iii	0.4	12.00	3.15	bottom	muddysand/GRAVEL	1	Myriophyllum	15-30	n/a	1-5	3042
497	2/25/09	11:13:34AM	2174017	5394771	T5-5	iv	0.4	12.00	3.15	bottom	muddysand/GRAVEL	1	nil	nil	nil	nil	3043

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WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Secchi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
492	2/25/09	10:18:43AM	2173090	5396803	T6-1		0.0	11.69	2.98	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
492	2/25/09	10:18:43AM	2173090	5396803	T6-1	i	0.4	11.69	2.98	bottom	muddySAND	1	nil	nil	nil	nil	3014
492	2/25/09	10:18:43AM	2173090	5396803	T6-1	ii	0.4	11.69	2.98	bottom	muddySAND	1	nil	nil	nil	nil	3016
492	2/25/09	10:18:43AM	2173090	5396803	T6-1	iii	0.4	11.69	2.98	bottom	muddySAND	1	nil	nil	nil	nil	3019
492	2/25/09	10:18:43AM	2173090	5396803	T6-1	iv	0.4	11.69	2.98	bottom	muddySAND	1	nil	nil	nil	nil	3020
493	2/25/09	10:25:20AM	2173085	5396617	T6-2		0.0	11.65	2.79	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
493	2/25/09	10:25:20AM	2173085	5396617	T6-2	i	0.5	11.65	2.97	bottom	muddygravel/SAND	3	Ruppia polycarpa	1-5	v	1-5	3021
493	2/25/09	10:25:20AM	2173085	5396617	T6-2	ii	0.5	11.65	2.97	bottom	muddygravel/SAND	1	Nitella	5-15	n/a	5-10	3022
493	2/25/09	10:25:20AM	2173085	5396617	T6-2	iii	0.5	11.65	2.97	bottom	muddygravel/SAND	1	Ruppia polycarpa	1-5	v	1-5	3023
493	2/25/09	10:25:20AM	2173085	5396617	T6-2	iii	0.5	11.65	2.97	bottom	muddygravel/SAND	1	Nitella	5-15	n/a	1-5	3023
493	2/25/09	10:25:20AM	2173085	5396617	T6-2	iv	0.5	11.65	2.97	bottom	muddygravel/SAND	1	Ruppia polycarpa	1-5	v	1-5	3024
493	2/25/09	10:25:20AM	2173085	5396617	T6-2	iv	0.5	11.65	2.97	bottom	muddygravel/SAND	1	Myriophyllum	5-15	n/a	1-5	3024
494	2/25/09	10:40:25AM	2173087	5396013	T6-3		0.0	11.51	3.09	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
494	2/25/09	10:40:25AM	2173087	5396013	T6-3	i	1.0	11.50	3.08	0.6	muddysand/GRAVEL	1	Ruppia polycarpa	15-30	v	80-100	3025
494	2/25/09	10:40:25AM	2173087	5396013	T6-3	ii	1.0	11.50	3.08	0.6	muddysand/GRAVEL	1	Ruppia polycarpa	15-30	v	80-100	3026
494	2/25/09	10:40:25AM	2173087	5396013	T6-3	iii	1.0	11.50	3.08	0.6	muddysand/GRAVEL	1	Ruppia polycarpa	15-30	v	80-100	3027
494	2/25/09	10:40:25AM	2173087	5396013	T6-3	iv	1.0	11.50	3.08	0.6	muddysand/GRAVEL	2	Ruppia polycarpa	5-15	v	5-10	3028
495	2/25/09	10:47:31AM	2173102	5395536	T6-4		0.0	11.74	3.00	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
495	2/25/09	10:47:31AM	2173102	5395536	T6-4	i	1.3	11.65	3.04	0.45	muddygravel/SAND	1	nil	nil	nil	nil	3030
495	2/25/09	10:47:31AM	2173102	5395536	T6-4	ii	1.3	11.65	3.04	0.45	muddygravel/SAND	1	nil	nil	nil	nil	3031
495	2/25/09	10:47:31AM	2173102	5395536	T6-4	iii	1.3	11.65	3.04	0.45	muddygravel/SAND	>5	Ruppia polycarpa	30-50	v	80-100	3032
495	2/25/09	10:47:31AM	2173102	5395536	T6-4	iv	1.3	11.65	3.04	0.45	muddygravel/SAND	1	nil	nil	nil	nil	3033
496	2/25/09	10:56:29AM	2173134	5395398	T6-5		0.0	12.06	3.17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
496	2/25/09	10:56:29AM	2173134	5395398	T6-5	i	0.4	12.06	3.17	bottom	muddygravel/SAND	1	Ruppia polycarpa	5-15	v	80-100	3034
496	2/25/09	10:56:29AM	2173134	5395398	T6-5	ii	0.4	12.06	3.17	bottom	muddygravel/SAND	1	Nitella	1-5	n/a	1-5	3035
496	2/25/09	10:56:29AM	2173134	5395398	T6-5	iii	0.4	12.06	3.17	bottom	muddygravel/SAND	1	Ruppia polycarpa	5-15	v	10-20	3036
496	2/25/09	10:56:29AM	2173134	5395398	T6-5	iv	0.4	12.06	3.17	bottom	muddygravel/SAND	1	Ruppia polycarpa	5-15	v	20-50	3037
496	2/25/09	10:56:29AM	2173134	5395398	T6-5	iv	0.4	12.06	3.17	bottom	muddygravel/SAND	1	Nitella	1-5	n/a	1-5	3037
491	2/25/09	9:57:10AM	2172004	5397069	T7-1		0	12.11	2.98	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
491	2/25/09	9:57:10AM	2172004	5397069	T7-1	i	0.4	12.11	2.98	bottom	gravel/SAND	2	nil	nil	nil	nil	3002

Appendix 1

WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Sechi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
491	2/25/09	9:57:10AM	2172004	5397069	T7-1	ii	0.4	12.11	2.98	bottom	gravel/SAND	3	nil	nil	nil	nil	3004
491	2/25/09	9:57:10AM	2172004	5397069	T7-1	iii	0.4	12.11	2.98	bottom	gravel/SAND	3	nil	nil	nil	nil	3005
491	2/25/09	9:57:10AM	2172004	5397069	T7-1	iv	0.4	12.11	2.98	bottom	gravel/SAND	3	nil	nil	nil	nil	3006
490	2/25/09	9:52:14AM	2172017	5396657	T7-2		0.0	11.83	3.07	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
490	2/25/09	9:52:14AM	2172017	5396657	T7-2	i	1.1	11.78	3.07	0.55	sand/GRAVEL	2	nil	nil	nil	nil	2997
490	2/25/09	9:52:14AM	2172017	5396657	T7-2	ii	1.1	11.78	3.07	0.55	sand/GRAVEL	2	nil	nil	nil	nil	2998
490	2/25/09	9:52:14AM	2172017	5396657	T7-2	iii	1.1	11.78	3.07	0.55	sand/GRAVEL	2	nil	nil	nil	nil	2999
490	2/25/09	9:52:14AM	2172017	5396657	T7-2	iv	1.1	11.78	3.07	0.55	sand/GRAVEL	2	nil	nil	nil	nil	3000
488	2/25/09	9:45:12AM	2172050	5395872	T7-3		0.0	11.83	3.04	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
488	2/25/09	9:45:12AM	2172050	5395872	T7-3	i	1.1	11.81	3.04	0.3	SAND	>5	Ruppia polycarpa	5-15	v	20-50	2993
488	2/25/09	9:45:12AM	2172050	5395872	T7-3	ii	1.1	11.81	3.04	0.3	SAND	>5	Ruppia polycarpa	15-30	PF	20-50	2994
488	2/25/09	9:45:12AM	2172050	5395872	T7-3	iii	1.1	11.81	3.04	0.3	sand/GRAVEL	1	nil	nil	nil	nil	2995
488	2/25/09	9:45:12AM	2172050	5395872	T7-3	iv	1.1	11.81	3.04	0.3	sand/GRAVEL	1	nil	nil	nil	nil	2996
487	2/25/09	9:38:43AM	2172047	5395297	T7-4		0.0	11.55	3.10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
487	2/25/09	9:38:43AM	2172047	5395297	T7-4	i	1.2	11.56	3.10	0.62	muddySAND	>5	Ruppia polycarpa	15-30	v	20-50	2986
487	2/25/09	9:38:43AM	2172047	5395297	T7-4	ii	1.2	11.56	3.10	0.62	muddySAND	>5	Ruppia polycarpa	15-30	v	20-50	2987
487	2/25/09	9:38:43AM	2172047	5395297	T7-4	iii	1.2	11.56	3.10	0.62	muddySAND	>5	Ruppia polycarpa	15-30	v	20-50	2988
487	2/25/09	9:38:43AM	2172047	5395297	T7-4	iv	1.2	11.56	3.10	0.62	muddySAND	>5	nil	nil	nil	nil	2989
486	2/25/09	9:30:48AM	2172012	5394838	T7-5		0.0	11.78	2.84	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
486	2/25/09	9:30:48AM	2172012	5394838	T7-5	i	1.3	11.78	2.85	0.25	muddySAND	1	Ruppia polycarpa	30-50	v	80-100	2982
486	2/25/09	9:30:48AM	2172012	5394838	T7-5	ii	1.3	11.78	2.85	0.25	SAND	2	Ruppia polycarpa	5-15	v	1-5	2983
486	2/25/09	9:30:48AM	2172012	5394838	T7-5	iii	1.3	11.78	2.85	0.25	muddySAND	1	Ruppia polycarpa	15-30	v	20-50	2984
486	2/25/09	9:30:48AM	2172012	5394838	T7-5	iv	1.3	11.78	2.85	0.25	muddySAND	1	Ruppia polycarpa	15-30	v	20-50	2985
485	2/25/09	9:08:51AM	2172010	5394041	T7-6		0.0	11.58	3.16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
485	2/25/09	9:08:51AM	2172010	5394041	T7-6	i	1.1	11.58	3.16	0.6	muddySAND	2	Ruppia polycarpa	30-50	AF/PF	80-100	2977
485	2/25/09	9:08:51AM	2172010	5394041	T7-6	ii	1.1	11.58	3.16	0.6	muddySAND	1	Ruppia polycarpa	15-30	AF/PF	50-80	2979
485	2/25/09	9:08:51AM	2172010	5394041	T7-6	iii	1.1	11.58	3.16	0.6	muddySAND	1	Ruppia polycarpa	15-30	AF/PF	50-80	2980
485	2/25/09	9:08:51AM	2172010	5394041	T7-6	iv	1.1	11.58	3.16	0.6	muddySAND	1	Ruppia polycarpa	15-30	AF/PF	80-100	2981
484	2/25/09	9:04:11AM	2172000	5393900	T7-7		0.0	12.18	3.17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
484	2/25/09	9:04:11AM	2172000	5393900	T7-7	i	0.3	11.69	3.16	bottom	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	5-10	2973
484	2/25/09	9:04:11AM	2172000	5393900	T7-7	ii	0.3	11.69	3.16	bottom	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	20-50	2974

Appendix 1

WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Sechi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
484	2/25/09	9:04:11AM	2172000	5393900	T7-7	iii	0.3	11.69	3.16	bottom	muddysand/GRAVEL	>5	nil	nil	nil	nil	2975
484	2/25/09	9:04:11AM	2172000	5393900	T7-7	iv	0.3	11.69	3.16	bottom	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	10-20	2976
476	2/25/09	8:06:29AM	2171028	5396501	T8-1		0.0	11.62	2.90	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
476	2/25/09	8:06:29AM	2171028	5396501	T8-1	i	0.3	11.62	2.90	0.27	gravel/SAND	>5	nil	nil	nil	nil	2946
476	2/25/09	8:06:29AM	2171028	5396501	T8-1	ii	0.3	11.62	2.90	0.27	gravel/SAND	>5	Enteromorpha	1-5	n/a	1	2947
476	2/25/09	8:06:29AM	2171028	5396501	T8-1	iii	0.3	11.62	2.90	0.27	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	20-50	2948
476	2/25/09	8:06:29AM	2171028	5396501	T8-1	iv	0.3	11.62	2.90	0.27	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	20-50	2949
476	2/25/09	8:06:29AM	2171028	5396501	T8-1	iv	0.3	11.62	2.90	0.27	muddysand/GRAVEL	>5	Enteromorpha	1-5	n/a	1	2949
477	2/25/09	8:19:31AM	2171042	5396368	T8-2		0.0	11.48	2.92	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
477	2/25/09	8:19:31AM	2171042	5396368	T8-2	i	1.0	11.60	2.96	0.6	SAND	>5	Ruppia polycarpa	5-15	v	20-50	2950
477	2/25/09	8:19:31AM	2171042	5396368	T8-2	ii	1.0	11.60	2.96	0.6	SAND	>5	nil	nil	nil	nil	2951
477	2/25/09	8:19:31AM	2171042	5396368	T8-2	iii	1.0	11.60	2.96	0.6	SAND	>5	Ruppia polycarpa	5-15	v	20-50	2952
477	2/25/09	8:19:31AM	2171042	5396368	T8-2	iv	1.0	11.60	2.96	0.6	SAND	3	Ruppia polycarpa	5-15	v	5-10	2953
478	2/25/09	8:27:02AM	2171049	5396071	T8-3		0.0	11.77	2.79	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
478	2/25/09	8:27:02AM	2171049	5396071	T8-3	i	1.1	11.76	2.79	0.35	muddySAND	1	nil	nil	nil	nil	2954
478	2/25/09	8:27:02AM	2171049	5396071	T8-3	ii	1.1	11.76	2.79	0.35	muddySAND	1	nil	nil	nil	nil	2955
478	2/25/09	8:27:02AM	2171049	5396071	T8-3	iii	1.1	11.76	2.79	0.35	muddySAND	2	nil	nil	nil	nil	2956
478	2/25/09	8:27:02AM	2171049	5396071	T8-3	iv	1.1	11.76	2.79	0.35	muddySAND	1	Ruppia polycarpa	15-30	v	20-50	2957
480	2/25/09	8:41:30AM	2171048	5395470	T8-4		0.0	11.81	2.72	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
480	2/25/09	8:41:30AM	2171048	5395470	T8-4	i	1.4	11.81	2.73	0.27	muddySAND	1	nil	nil	nil	nil	2959
480	2/25/09	8:41:30AM	2171048	5395470	T8-4	ii	1.4	11.81	2.73	0.27	muddySAND	1	nil	nil	nil	nil	2960
480	2/25/09	8:41:30AM	2171048	5395470	T8-4	iii	1.4	11.81	2.73	0.27	muddySAND	1	nil	nil	nil	nil	2961
480	2/25/09	8:41:30AM	2171048	5395470	T8-4	iv	1.4	11.81	2.73	0.27	muddySAND	1	nil	nil	nil	nil	2962
482	2/25/09	8:47:47AM	2171120	5394893	T8-5		0.0	11.55	2.83	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
482	2/25/09	8:47:47AM	2171120	5394893	T8-5	i	1.2	11.55	2.86	0.25	muddySAND	1	nil	nil	nil	nil	2964
482	2/25/09	8:47:47AM	2171120	5394893	T8-5	ii	1.2	11.55	2.86	0.25	muddySAND	1	nil	nil	nil	nil	2965
482	2/25/09	8:47:47AM	2171120	5394893	T8-5	iii	1.2	11.55	2.86	0.25	muddySAND	1	nil	nil	nil	nil	2666
482	2/25/09	8:47:47AM	2171120	5394893	T8-5	iv	1.2	11.55	2.86	0.25	muddySAND	1	nil	nil	nil	nil	2967
483	2/25/09	8:54:16AM	2171195	5394495	T8-6		0.0	12.18	3.17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
483	2/25/09	8:54:16AM	2171195	5394495	T8-6	i	0.3	12.18	3.17	bottom	sand/GRAVEL	3	nil	nil	nil	nil	2969
483	2/25/09	8:54:16AM	2171195	5394495	T8-6	ii	0.3	12.18	3.17	bottom	sand/GRAVEL	3	Enteromorpha	1-5	n/a	1-5	2970

Appendix 1

WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Sechi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
483	2/25/09	8:54:16AM	2171195	5394495	T8-6	iii	0.3	12.18	3.17	bottom	sand/GRAVEL	3	nil	nil	nil	nil	2971
483	2/25/09	8:54:16AM	2171195	5394495	T8-6	iv	0.3	12.18	3.17	bottom	sand/GRAVEL	3	nil	nil	nil	nil	2972
516	2/25/09	4:01:13PM	2170958	5393126	T8-7		0.0	15.85	3.16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
516	2/25/09	4:01:13PM	2170958	5393126	T8-7	i	0.4	15.85	3.16	bottom	muddygrave/SAND	1	Ruppia polycarpa	5-15	v	20-50	3148
516	2/25/09	4:01:13PM	2170958	5393126	T8-7	ii	0.4	15.85	3.16	bottom	muddygrave/SAND	1	Ruppia polycarpa	5-15	v	20-50	3149
516	2/25/09	4:01:13PM	2170958	5393126	T8-7	iii	0.4	15.85	3.16	bottom	muddygrave/SAND	1	Ruppia polycarpa	5-15	PF	10-20	3150
516	2/25/09	4:01:13PM	2170958	5393126	T8-7	iii	0.4	15.85	3.16	bottom	muddygrave/SAND	1	Enteromorpha	15-30	n/a	20-50	3150
516	2/25/09	4:01:13PM	2170958	5393126	T8-7	iv	0.4	15.85	3.16	bottom	muddygrave/SAND	1	Ruppia polycarpa	15-30	v	20-50	3151
515	2/25/09	3:52:30PM	2170989	5393047	T8-8		0.0	13.95	3.16	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
515	2/25/09	3:52:30PM	2170989	5393047	T8-8	i	1.0	13.98	3.15	0.72	muddygrave/SAND	4	Ruppia megacarpa	30-50	PF/AF	80-100	3144
515	2/25/09	3:52:30PM	2170989	5393047	T8-8	ii	1.0	13.98	3.15	0.72	muddygrave/SAND	4	Ruppia megacarpa	30-50	PF/AF	80-100	3145
515	2/25/09	3:52:30PM	2170989	5393047	T8-8	iii	1.0	13.98	3.15	0.72	muddygrave/SAND	4	Ruppia megacarpa	30-50	PF/AF	80-100	3146
515	2/25/09	3:52:30PM	2170989	5393047	T8-8	iv	1.0	13.98	3.15	0.72	muddygrave/SAND	4	Ruppia megacarpa	30-50	PF/AF	80-100	3147
514	2/25/09	3:45:13PM	2171015	5392974	T8-9		0.0	13.39	3.19	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
514	2/25/09	3:45:13PM	2171015	5392974	T8-9	i	0.5	13.39	3.19	bottom	sandyGRAVEL	>5	Ruppia polycarpa	1-5	v	1-5	3133
514	2/25/09	3:45:13PM	2171015	5392974	T8-9	ii	0.5	13.39	3.19	bottom	sandyGRAVEL	>5	Enteromorpha	15-30	n/a	5-10	3134
514	2/25/09	3:45:13PM	2171015	5392974	T8-9	iii	0.5	13.39	3.19	bottom	sandyGRAVEL	>5	Enteromorpha	15-30	n/a	1-5	3135
514	2/25/09	3:45:13PM	2171015	5392974	T8-9	iv	0.5	13.39	3.19	bottom	sandyGRAVEL	>5	Enteromorpha	15-30	n/a	1-5	3136
523	2/25/09	5:34:37PM	2170021	5396268	T9-1		0.0	15.56	2.84	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	i	0.5	15.56	2.84	0.25	muddysand/GRAVEL	2	Enteromorpha	15-30	n/a	80-100	3180
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	i	0.5	15.56	2.84	0.25	muddysand/GRAVEL	2	Ruppia polycarpa	5-15	v	10-20	3180
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	ii	0.5	15.56	2.84	0.25	muddysand/GRAVEL	1	Enteromorpha	30-50	n/a	80-100	3181
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	ii	0.5	15.56	2.84	0.25	muddysand/GRAVEL	1	Ruppia polycarpa	5-15	v	10-20	3181
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	iii	0.5	15.56	2.84	0.25	muddysand/GRAVEL	1	Enteromorpha	5-15	n/a	5-10	3182
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	iii	0.5	15.56	2.84	0.25	muddysand/GRAVEL	1	Ruppia polycarpa	5-15	v	20-50	3182
523	2/25/09	5:34:37PM	2170021	5396268	T9-1	iv	0.5	15.56	2.84	0.25	muddysand/GRAVEL	1	Enteromorpha	15-30	n/a	80-100	3183
522	2/25/09	5:29:09PM	2169973	5395831	T9-2		0.0	12.33	1.37	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
522	2/25/09	5:29:09PM	2169973	5395831	T9-2	i	1.1	12.33	1.37	0.2	muddySAND	1	nil	nil	nil	nil	3176
522	2/25/09	5:29:09PM	2169973	5395831	T9-2	ii	1.1	12.33	1.37	0.2	muddySAND	1	nil	nil	nil	nil	3177
522	2/25/09	5:29:09PM	2169973	5395831	T9-2	iii	1.1	12.33	1.37	0.2	muddySAND	1	nil	nil	nil	nil	3178

Appendix 1

WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Sechi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
522	2/25/09	5:29:09PM	2169973	5395831	T9-2	iv	1.1	12.33	1.37	0.2	muddySAND	1	nil	nil	nil	nil	3179
521	2/25/09	5:21:57PM	2169946	5395338	T9-3		0.0	16.28	3.10	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
521	2/25/09	5:21:57PM	2169946	5395338	T9-3	i	0.5	16.28	3.10	bottom	muddygravel/SAND	1	Myriophyllum	5-15	n/a	1-5	3172
521	2/25/09	5:21:57PM	2169946	5395338	T9-3	ii	0.5	16.28	3.10	bottom	sand,muddyGRAVEL	3	Myriophyllum	15-30	n/a	50-80	3173
521	2/25/09	5:21:57PM	2169946	5395338	T9-3	iii	0.5	16.28	3.10	bottom	sand,muddyGRAVEL	3	nil	nil	nil	nil	3174
521	2/25/09	5:21:57PM	2169946	5395338	T9-3	iv	0.5	16.28	3.10	bottom	sand,muddyGRAVEL	3	Myriophyllum	1-5		1-5	3175
520	2/25/09	5:08:02PM	2169832	5395189	T9-4		0.0	15.50	2.98	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	i	0.8	15.03	2.99	0.65	MUD	surface	Myriophyllum	30-50	n/a	80-100	3166
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	ii	0.8	15.03	2.99	0.65	MUD	surface	Myriophyllum	30-50	n/a	80-100	3167
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	iii	0.8	15.03	2.99	0.65	MUD	2	Ruppia megacarpa	30-50	v	20-50	3168
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	iii	0.8	15.03	2.99	0.65	MUD	2	Charophyte	5-15	n/a	1-5	3168
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	iv	0.8	15.03	2.99	0.65	MUD	2	Myriophyllum	30-50	n/a	50-80	3169
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	iv	0.8	15.03	2.99	0.65	MUD	2	Ruppia megacarpa	30-50	v	20-50	3169
520	2/25/09	5:08:02PM	2169832	5395189	T9-4	iv	0.8	15.03	2.99	0.65	MUD	2	Charophyte	5-15	n/a	1-5	3169
518	2/25/09	4:42:16PM	2169946	5394950	T9-5		0.0	14.90	2.98	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	i	0.8	14.97	2.98	0.65	muddySAND	3	Charophyte	5-15	n/a	20-50	3156
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	i	0.8	14.97	2.98	0.65	muddySAND	3	Ruppia polycarpa	5-15	v	10-20	3156
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	ii	0.8	14.97	2.98	0.65	muddySAND	3	Charophyte	5-15	n/a	20-50	3157
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	ii	0.8	14.97	2.98	0.65	muddySAND	3	Ruppia polycarpa	5-15	v	1-5	3157
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	iii	0.8	14.97	2.98	0.65	muddySAND	2	Charophyte	5-15	n/a	20-50	3158
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	iii	0.8	14.97	2.98	0.65	muddySAND	2	Ruppia polycarpa	5-15	v	5-10	3158
518	2/25/09	4:42:16PM	2169946	5394950	T9-5	iv	0.8	14.97	2.98	0.65	muddySAND	2	Charophyte	5-15	n/a	20-50	3159
519	2/25/09	4:55:03PM	2170245	5394350	T9-6		0.0	15.55	2.91	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
519	2/25/09	4:55:03PM	2170245	5394350	T9-6	i	0.5	15.55	2.91	bottom	muddySAND	>5	Ruppia polycarpa	5-15	v	10-20	3162
519	2/25/09	4:55:03PM	2170245	5394350	T9-6	ii	0.5	15.55	2.91	bottom	muddySAND	>5	Ruppia polycarpa	5-15	v	10-20	3163
519	2/25/09	4:55:03PM	2170245	5394350	T9-6	iii	0.5	15.55	2.91	bottom	muddySAND	>5	Ruppia polycarpa	5-15	v	20-50	3164
519	2/25/09	4:55:03PM	2170245	5394350	T9-6	iv	0.5	15.55	2.91	bottom	muddySAND	>5	Charophyte	5-15	n/a	10-20	3165
519	2/25/09	4:55:03PM	2170245	5394350	T9-6	iv	0.5	15.55	2.91	bottom	muddySAND	>5	Ruppia polycarpa	5-15	v/PF	20-50	3165
517	2/25/09	4:09:20PM	2170280	5392766	T9-7		0.0	14.20	3.29	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
517	2/25/09	4:09:20PM	2170280	5392766	T9-7	i	0.8	14.20	3.30	0.55	muddygravel/SAND	1	Ruppia megacarpa	15-30	PF/AF	80-100	3151
517	2/25/09	4:09:20PM	2170280	5392766	T9-7	ii	0.8	14.20	3.30	0.55	muddygravel/SAND	1	Ruppia megacarpa	15-30	PF/AF	80-100	3152

Appendix 1

WAY-POINT	DATE	TIME	NZMG EAST	NZMG NORTH	SITE	Rep	Depth m	Temp C	Sal_ppt	Sechi_cm	Substrate	cm_to_Sulphide	Species	Height_cm	Stage	Percent Cover	Photo Number
517	2/25/09	4:09:20PM	2170280	5392766	T9-7	iii	0.8	14.20	3.30	0.55	muddygrave/SAND	1	Ruppia megacarpa	15-30	PF/AF	80-100	3153
517	2/25/09	4:09:20PM	2170280	5392766	T9-7	iv	0.8	14.20	3.30	0.55	muddygrave/SAND	1	Ruppia megacarpa	15-30	PF/AF	80-100	3154
524	2/25/09	5:48:27PM	2169042	5396141	T10-1		0.0	15.74	0.43	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	i	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Enteromorpha	15-30	n/a	20-50	3185
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	i	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Ruppia polycarpa	15-30	v	80-100	3185
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	ii	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Enteromorpha	5-15	n/a	10-20	3186
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	ii	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Ruppia polycarpa	15-30	v	80-100	3186
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	iii	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Ruppia polycarpa	15-30	v	80-100	3187
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	iv	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Enteromorpha	5-15	n/a	10-20	3188
524	2/25/09	5:48:27PM	2169042	5396141	T10-1	iv	0.4	15.74	0.43	0.2	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	50-80	3188
525	2/25/09	5:55:12PM	2169028	5395949	T10-2		0.0	14.91	0.39	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
525	2/25/09	5:55:12PM	2169028	5395949	T10-2	i	0.9	14.93	0.38	0.2	muddySAND	1	Ruppia polycarpa	5-15	v	10-20	3189
525	2/25/09	5:55:12PM	2169028	5395949	T10-2	i	0.9	14.93	0.38	0.2	muddySAND	1	Myriophyllum	5-15	n/a	10-20	3189
525	2/25/09	5:55:12PM	2169028	5395949	T10-2	ii	0.9	14.93	0.38	0.2	muddySAND	1	Myriophyllum	30-50	n/a	80-100	3190
525	2/25/09	5:55:12PM	2169028	5395949	T10-2	iii	0.9	14.93	0.38	0.2	muddySAND	1	Ruppia polycarpa	15-30	v	1-5	3191
525	2/25/09	5:55:12PM	2169028	5395949	T10-2	iii	0.9	14.93	0.38	0.2	muddySAND	1	Myriophyllum	30-50	n/a	20-50	3191
525	2/25/09	5:55:12PM	2169028	5395949	T10-2	iv	0.9	14.93	0.38	0.2	muddySAND	1	nil	nil	nil	nil	3192
526	2/25/09	6:00:46PM	2169050	5395759	T10-3		0.0	12.04	0.86	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
526	2/25/09	6:00:46PM	2169050	5395759	T10-3	i	0.3	12.04	0.86	0.2	muddysand/GRAVEL	2	Ruppia polycarpa	5-15	v	10-20	3193
526	2/25/09	6:00:46PM	2169050	5395759	T10-3	ii	0.3	12.04	0.86	0.2	muddysand/GRAVEL	2	Ruppia polycarpa	5-15	v	10-20	3194
526	2/25/09	6:00:46PM	2169050	5395759	T10-3	iii	0.3	12.04	0.86	0.2	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	20-50	3195
526	2/25/09	6:00:46PM	2169050	5395759	T10-3	iii	0.3	12.04	0.86	0.2	muddysand/GRAVEL	>5	Enteromorpha	5-15	n/a	20-50	3195
526	2/25/09	6:00:46PM	2169050	5395759	T10-3	iv	0.3	12.04	0.86	0.2	muddysand/GRAVEL	>5	Ruppia polycarpa	5-15	v	20-50	3196