NIWA
Taihoro Nukurangi

Vegetation survey of aquatic and wetland sites in Gisborne District

Prepared for Gisborne District Council

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Executive summary

Gisborne District Council (GDC) engaged NIWA to assist with the development of the Regional Policy Statement for Freshwater by identifying outstanding or high value waterbodies with regard to aquatic vegetation, and also documenting biosecurity risk species established within the district. This report outlines the results of a baseline vegetation survey of aquatic and wetland habitats with information on 26 sites and compares these findings with previous surveys.

A total of 161 plant species or hybrids were recorded during the survey. Of these, 106 were native species. Forty six species were aquatic (submerged, free-floating, floating leaved or emergent) and 111 were wetland dependent (including some emergent aquatic species).

There are an estimated 1.75% of the original wetlands remaining in Gisborne District and few of the water bodies examined sustained aquatic vegetation, and even fewer were without invasive species. Of the sites investigated, no nationally endangered species were recorded. However, an unpublished 2011 Department of Conservation report lists two populations of the Nationally Critical wetland herb *Mazus novaezeelandiae* subsp. *impolitus* f. *hirtus* near East Cape. Several at risk taxa were found in the NIWA survey including the 'Declining' species swamp nettle, the fern *Cyclosorus interruptus* and freshwater mussel; 'Data Deficient' swamp buttercup *Ranunculus macropus*; 'Recovering' New Zealand dabchick; and 'Naturally Uncommon' sea musk, fennel-leaved pondweed and marsh fern (*Thelypteris confluens*). These are the only known Gisborne District records of swamp nettle and the pondweed. The survey also recorded the first Gisborne District record of *Machaerina arthropylla*, with only one previous record of the pondweed *Potamogeton ochreatus*.

Fifteen invasive or potentially invasive aquatic and/or wetland plants were reported. These included the Unwanted Organisms (UO) hornwort, egeria, parrot's feather and yellow flag iris and two other species that are not UOs (reed sweet grass and water celery) identified as potential problem weeds in a 2016 NIWA report to GDC. Additional problem species included the UO grey willow, alder, gypsywort, monkey musk and water speedwell. Proactive management of these species is advocated once a more detailed delimitation of their distribution has been undertaken. In many cases, district-wide distributions of these species appear limited and eradication/exclusion programmes are recommended. Of those species identified as problematic, four were found in only one location and only grey willow was widespread throughout Gisborne District. Even where a high-risk species like grey willow is well established, protection of high value sites should be undertaken by removing all local sources of propagules.

1 Introduction

Gisborne District Council engaged NIWA to conduct a baseline vegetation survey of open water and wetland habitats that included:

- Inventory of plant species present at each site.
- Identification of endangered or near threatened plant populations.
- Identification of introduced plant species, and assessment of their weed threat.

This survey will assist Gisborne District Council's (GDC) Regional Policy Statement for Freshwater by identifying outstanding or high value waterbodies with regard to aquatic vegetation and also documenting biosecurity risk species already established within the district.

2 Site selection and methods

A list of sites to visit within Gisborne District was prepared by GDC staff who also attempted to contact all landowners and arrange access. Table 1 and Figure 1 show the location of sites and NZTM map references for each. A total of 23 of the GDC prioritised sites were visited during the week of 27 March 2017 and we provide plant records for an additional three sites. Unfortunately, four sites; Noble Campbell Wetland (Tiniroto), Pond Bush (Tokomaru), Whareponga Road wetlands (Ruatoria) and Lake Opotehetehe were not visited as either landowners could not be contacted, and/or access was not possible.

Sites were sampled by snorkel or wading. Species lists were created for each site and compared with previous records (NZ Plant Conservation Network and NIWA consultancy reports). These are presented in Appendix 1. Species distributions were accessed using via the NZ Virtual Herbarium and NZ Plant Conservation Network. Threatened species were classified according to de Lange et al. (2013), Grainger et al. (2014) or Robertson et al. (2017). Introduced plant species were assessed for their weed potential. Bird species encountered were also recorded.

Table 1: Water body and wetland sites scheduled for vegetation surveys within Gisborne District.

Site No.	Location	NZTM E	NZTM N
1	Te Aroha Station Bush, Pehiri Road, Tiniroto	2008320	5713535
2	Noble Campbell Wetland, Tiniroto Road, Tiniroto	1998491	5697913
3	Lake Kaikiore, Berry Road, Tiniroto	1994445	5699150
4	Lake Karangata, Berry Road, Tiniroto	1994400	5698685
5	Lake Waihau, Ruakaka Road, Tiniroto	1995675	5700470
6	Lake Kaikereru, Ruakaka Road, Tiniroto	1995490	5700475
7	Green Lake, Ruakaka Road, Tiniroto	1994225	5701305
8	Lake Rotokaha, Tiniroto Road, Tiniroto	1996270	5698470
9	Roadside pond, Tiniroto Road, Tiniroto	1999910	5703340
10	Spring in Lower Kukupara Stream Bush, Davis Road, Matawai	2003843	5740337
11	Kukupara Stream crossing, roadside wetlands, Whakarau Road, Motu	2002750	5742570
12	Alciun Wetland, Motu Road, Motu	1994795	5750895
13	Waimare Stream, Matawai	1998315	5740875
14	Lake Repongaere, Patutahi	2024260	5716760
15	Orongo Station Wetlands, Coop Road, Muriwai	2029699	5698039
16	Te Wherowhero Lagoon, Muriwai Beach Road, Muriwai	2028837	5701018
17	Awapuni Road pond, Gisborne	2035170	5708030
18	Cedenco Foods pond, Innes Road, Gisborne	2034955	5708785
19	Waikanae Creek, Gisborne Airport, Gisborne	2033780	5708985
20	Waihau Road pond, Whangara	2061145	5729285
21	Waihau Road swamp, Whangara	2061250	5729535
22	Waihau Road fen, Whangara	2061085	5729545
23	Lake Waitawa, Whangara Road, Whangara	2059730	5728760
24	Emirau Wetland, Whangara Road, Whangara	2059970	5729215
25	Kaitawa Stream, Wharf Road, Tolaga Bay	2064499	5737936
26	Pond Bush, Pond Road, Tokomaru	2041967	5767287
27	Ratahi Lagoon, Te Puia Springs	2065700	5775010
28	Whareponga Road wetlands, Ruatoria	2066860	5786660
29	Lake Opotehetere, Potaka	2053700	5824470

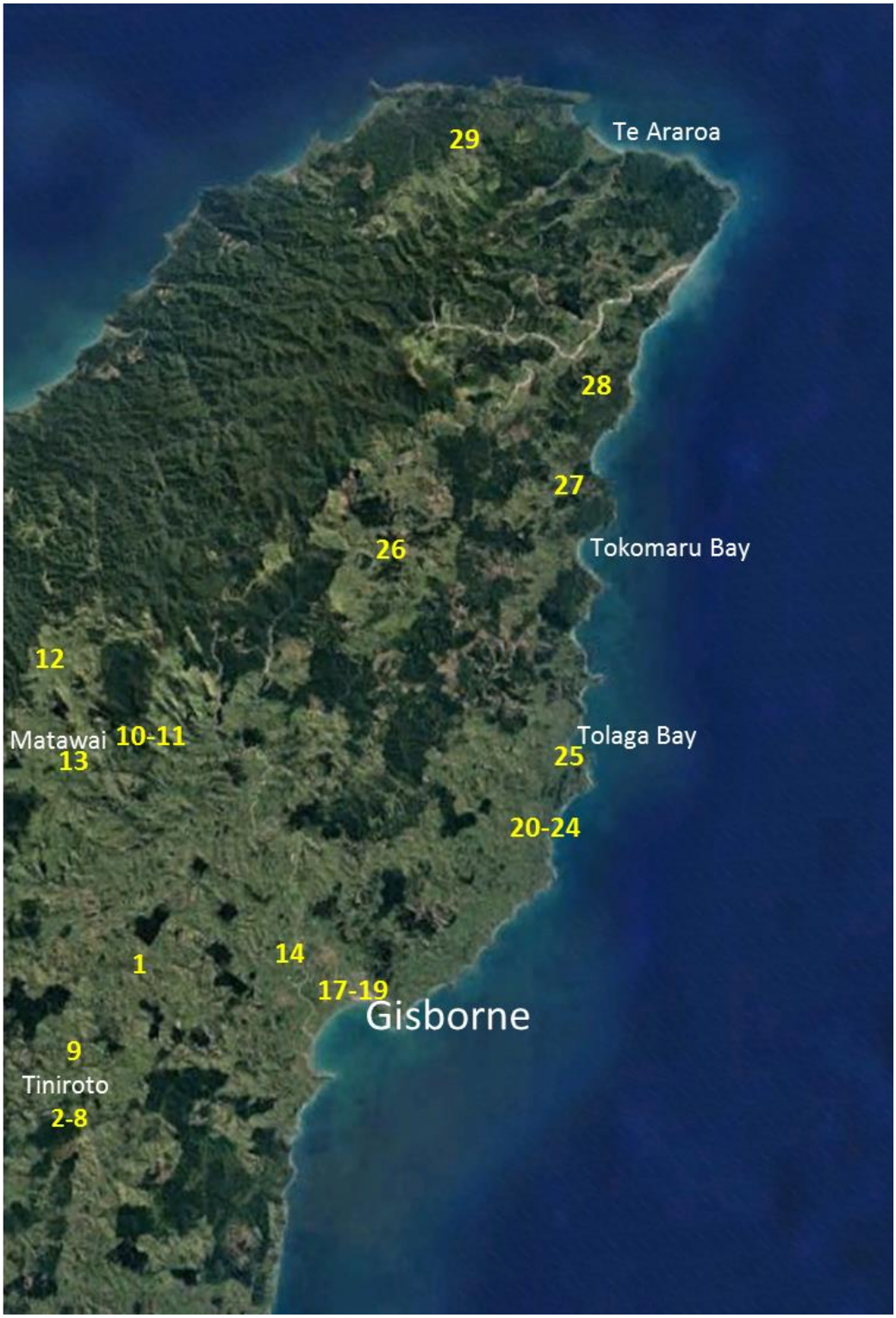

Figure 2-1: Satellite image of Gisborne District. Numbers refer to sample sites in Table 1.

3 Results

A total of 160 plant species or hybrids were recorded during the survey. Of these, 105 were native species. Forty five species were aquatic (submerged, free-floating, floating leaved or emergent) and 110 were wetland dependent (including some emergent aquatic species). Plants and their distribution are listed in Appendix 1. The following sections provide descriptions of the water bodies and wetlands surveyed.

3.1 Te Aroha Station Bush, Pehiri Road, Tiniroto

Figure 3-1: Te Aroha Bush Lake and surrounding kahikatea/matai dominated forest.

This site was a small 1.8 ha lake surrounded by indigenous forest to the north and west, crack willow (*Salix xfragilis*) to the south west and pasture to the south east. This wetland was fully fenced. Flooding of the adjacent Waikura River frequently occurs and large deposits of alluvium were noted on the southern margin of the wetland (Phillip Steel, landowner, pers. comm.)

The lake is very shallow and turbid, with a few fragments of the native *Potamogeton ochreatus* found at a depth of 0.3 m. The landowner Phillip Steel, reports that this macrophyte usually completely covers the pond during winter-spring but dies off after flowering in December. This seasonal cycle of abundance is typical of this group of pondweeds.

The lake margins were dominated by tussocks of *Carex* species including *C. secta, C. virgata, C. maorica* and localised patches of the sward forming *C. lessoniana*. The most abundant marginal species was the introduced invasive gypsywort (*Lycopus europaeus*) which scrambled over most other lake edge species to a height exceeding 1 m tall (Figure 3-2). Other introduced plants seen on the lake margin included beggar's ticks (*Bidens frondosa*), water purslane (*Ludwigia palustris*) and water speedwell (*Veronica anagallis-aquatica*). Crack willow was common at the western margin of the lake.

Aquatic birds noted were black shag (*Phalacrocorax carbo*), mallard duck (*Anas platyrhynchos*), paradise shelduck (*Tadorna variegata*), scaup (*Aythya novaezeelandiae*) and a pair of the At Risk Recovering dabchick (*Poliocephalus rufopectus*).

Figure 3-2: Gypsywort (*Lycopus europaeus*) on the margin of Te Aroha Bush Lake. forming a dense marginal mat.

Only the low lying area of indigenous forest that would be frequently flooded was examined. This area was dominated by kahikatea (*Dacrycarpus dacrydioides*), matai (*Prumnopitys taxifolia*) and lesser amounts of totara (*Podocarpus totara*) in the canopy. There was a dense understorey of divaricating shrubs including *Melicytus micranthus, Neomyrtus pedunculatus, Myrsine divaricata*, juvenile pokaka (*Elaeocarpus hookerianus*) and several *Coprosma* species. There was also a diverse assemblage of climbers including *Fuchsia perscandens, Parsonsia capillaris, Rubus schmidelioides* and *Muehlenbeckia* spp. Woody weeds noted included Chinese privet (*Ligustrum sinense*) and barberry (*Berberis glaucocarpa*).

The vegetation of the Te Aroha forest had been previously botanised by Clarkson & Druce (1992/3) and Thorsen (2002). Both lists were accessed from the NZ Plant Conservation Network. Species of note included the Nationally Vulnerable *Pittosporum obcordatum* and three At-Risk Declining species *Teucridium parviflorum, Coprosma pedicellata* and *C. virescens*.

3.2 Noble Campbell Wetland, Tiniroto Road, Tiniroto

Figure 3-3: Noble Campbell Wetland photographed from the north.

Access to the site, on the eastern side of Tiniroto Road at Tiniroto, was not possible due to a steep slippery driveway and no landowner could be contacted.

3.3 Lake Kaikiore, Berry Road, Tiniroto

Figure 3-4: Lake Kaikiore. Note marginal raupo (*Typha orientalis*) and water lilies (*Nymphaea alba*).

Lake Kaikiore is one of the Tiniroto group of lakes and is situated amongst the Hackfalls Arboretum on Berry Road on the property of Diane Playle. The lake is 5.2 ha in area, was shallow and turbid with very flocculent loose bottom sediments and was unfenced.

No submerged vegetation was seen, apart from a single shoot of elodea (*Elodea canadensis*) found on the northern side of the lake in 0.8 m water depth.

The lake was mostly surrounded by a fringe of emergent vegetation, dominated by raupo (*Typha orientalis*) extending to 2 m deep, with lesser amounts of *Schoenoplectus tabernaemontani*, harakeke (*Phormium tenax*) and tussocks of *Carex secta, C. maorica* and *Cyperus ustulatus.* Localised areas of the invasive yellow flag iris (*Iris pseudacorus*) were also noted on the southern side of the lake. Large beds of water lilies (*Nymphaea* hybrids) extended into lake outside of the erect emergent vegetation to a maximum depth of 2.3 m. Sprawling mats of the invasive parrot's feather (*Myriophyllum aquaticum*) were also common amongst the tall emergent vegetation. Native species seen on the marginal areas of the lake included *Myriophyllum propinquum, Eleocharis acuta, Azolla rubra* and *Lemna disperma*. The At-Risk Declining swamp nettle, *Urtica perconfusa* was previously sampled in the marginal vegetation in 2003 (Hofstra et al. 2004), but was not relocated in 2017.

The only birds seen on the current visit were mallard duck (*Anas platyrhynchos*).

This lake had been visited previously by the NIWA aquatic plant survey team in 2003 and 2011 (Hofstra et al. 2004; Hofstra 2011) as part of the hydrilla surveillance programme, with this species targeted for national eradication. The lake was recorded as turbid with few or no submerged plants present on all sample occasions. In these reports Lake Kaikiore was referred to as Berry Lake.

3.4 Lake Karangata, Berry Road, Tiniroto

Figure 3-5: Lake Karangata.

Lake Karangata is one of the Tiniroto group of lakes and is situated amongst the Hackfalls Arboretum on the property of Diane Playle, accessed from farm tracks off Berry Road. The lake is 10.1 ha in area.

Unlike all other Tiniroto lakes examined, Lake Karangata supported a dense submerged vegetation, dominated by the invasive hornwort (*Ceratophyllum demersum*) forming a nearly 100% cover to maximum depth of 2.3 m. The only other submerged species sampled was elodea (*Elodea canadensis*), which was uncommon but had the same depth range.

The margins of the lake were strewn with felled willow trees at the north western end and there was a sparsely developed emergent vegetation of raupo (*Typha orientalis*) and tussocks of *Carex secta* and *C. virgata,* with localised patches of the sward forming *C. lessoniana* and the sprawling *Isolepis prolifera.* Seedlings and saplings of the invasive woody wetland plants grey willow (*Salix cinerea*) and alder (*Alnus glutinosa*) were common in the disturbed lake margins.

The invasive parrot's feather (*Myriophyllum aquaticum*) was not observed in the lake, but it was observed in the outlet stream, a tributary of the Mangemate Stream, close to the confluence with the Lake Kaikiore outlet stream.

No birds were observed.

This lake had been visited previously by Howard-Williams et al. (1983) and the NIWA aquatic plant survey team in 2003 and 2011 (Hofstra et al. 2004; Hofstra 2011). In 1983 the lake was reported as eutrophic with the indigenous *Chara australis* and introduced *Potamogeton crispus* growing to a maximum depth of 3.25 and 1.5 m respectively. Emergent species reported were raupo, *Eleocharis acuta* and *Schoenoplectus tabernaemontani*. The lake was very turbid in 2003 and 2011. Only elodea was noted in the submerged vegetation in 2003, whereas both hornwort and elodea were noted in 2011.

3.5 Lake Waihau, Ruakaka Road, Tiniroto

Figure 3-6: Lake Waihau. Taken from Waihau Station farmhouse

Lake Waihou is one of the Tiniroto group of lakes and is situated to the northern side of Ruakaka Road. The lake is 10.1 ha in area.

The lake was very turbid, with no underwater visibility, a 1 m maximum depth and no submerged vegetation was seen.

The lake was steep sided, with no fencing evident and emergent marginal vegetation development was limited, being best developed on the eastern shoreline. Emergent species included raupo (*Typha orientalis*), *Schoenoplectus tabernaemontani, Carex secta* and *C. virgata.*

Despite the lack of vegetation the lake supported an unusually large population of At Risk Recovering dabchick (*Poliocephalus rufopectus*), with over 20 seen. Other aquatic birds noted were black swan (*Cygnus atrata*), mallard duck (*Anas platyrhynchos*) and paradise shelduck (*Tadorna variegata*).

This lake had been visited previously by Howard-Williams et al. (1983) and the NIWA aquatic plant survey team in 2003 and 2011 (Hofstra et al. 2004; Hofstra 2011). In 1983 the lake was reported as eutrophic with the indigenous *Chara australis* and *Potamogeton cheesemani* and introduced *P. crispus* all growing between 1 and 2 m deep. Emergent species reported were raupo and kuta (*Eleocharis sphacelata*). In 2003 the lake had a large algal bloom and the submerged weed elodea (*Elodea canadensis*) was found. In 2011 the lake was turbid with no submerged vegetation.

3.6 Lake Kaikereru, Ruakaka Road, Tiniroto

Figure 3-7: Lake Kaikereru.

Lake Kaikereru is one of the Tiniroto group of lakes and is situated to the northern side of Ruakaka Road to the west of Lake Waihau and the Waihau homestead. The lake was fenced to exclude livestock and is 7 ha in area.

No submerged vegetation was seen, with a flocculent organic lake sediment noted in the lake adjacent to emergent vegetation. Emergent vegetation was abundant around the lake, dominated by raupo (*Typha orientalis*), *Carex secta, Schoenoplectus tabernaemontani* and scattered *C. maorica* tussocks. The native grass swamp millet (*Isachne globosa*) was common within raupo beds.

There were remnants of native forest on the northern shore of the lake, with kahikatea (*Dacrycarpus dacrydioides*) a dominant species. This area was not botanised.

This lake had been visited previously by Howard-Williams et al. (1983) and the NIWA aquatic plant survey team in 2003 and 2011 (Hofstra et al. 2004; Hofstra 2011). In 1983 the lake was reported as eutrophic with the indigenous *Chara australis* and *Potamogeton cheesemani* and introduced *P. crispus* all growing between 1 and 5 m deep. Emergent species reported were raupo and kuta (*Eleocharis sphacelata*). In 2003 the lake had a well-developed submerged vegetation, dominated by the introduced elodea *(Elodea canadensis,* with the native charophyte (*Chara australis)* and the introduced curled pondweed (*Potamogeton crispus*) also common to depths exceeding 3 m. Hornwort (*Ceratophyllum demersum*), was noted as a likely recent incursion. In 2011, a few plants of elodea grew to depths of 1.7 m but no other submerged plants were noted.

3.7 Green Lake, Ruakaka Road, Tiniroto

Green Lake is one of the Tiniroto group of lakes and is situated to the northern side of Ruakaka Road. It is a 2.4 ha lake. This lake was not visited in 2017, but a 2011 NIWA aquatic plant survey (Hofstra 2011) recorded the lake as almost 100% covered in the invasive hornwort (*Ceratophyllum demersum*), which formed dense sub-surface reaching beds. Raupo (*Typha orientalis*) and *Carex secta* were noted on the lake margins.

3.8 Lake Rotokaha, Tiniroto Road, Tiniroto

Figure 3-8: Lake Rotokaha.

Lake Rotokaha is one of the Tiniroto group of lakes and is situated to the northern side of Tiniroto Road. As no landowner could be contacted, the lake was not surveyed in 2017, but this lake had been visited previously by Howard-Williams et al. (1983) and the NIWA aquatic plant survey team in 2003 and 2011 (Hofstra et al. 2004; Hofstra 2011), and also as part of the 2016 GDC aquatic plant identification course run by NIWA.

The lake is 9.1 ha in area but apparently very shallow, with no areas deeper than 2.5 m encountered. In 1983 the lake was reported as eutrophic and dominated by the invasive hornwort (*Ceratophyllum demersum*) and introduced curled pondweed (*Potamogeton crispus*) growing to a maximum depth of 2 and 2.5 m respectively. The only native submerged plant was *Myriophyllum triphyllum* growing to a maximum depth of 0.2 m. Emergent species reported were raupo and kuta (*Eleocharis sphacelata*) and the invasive weed reed sweet grass (*Glyceria maxima*) also present. In 2003, the lake had a sparse submerged vegetation, with scattered shoots of elodea *(Elodea canadensis),* hornwort and curled pondweed. The invasive algae water net (*Hydrodictyon reticulatum*) was also recorded amongst submerged plants, the only record of this plant in Gisborne District and not seen since 2003. In 2011, the same submerged species were recorded as sparsely present. Reed sweet grass has not been recorded since the 1983 survey, but only the eastern end of the lake was explored on these visits.

Large numbers of black swan (*Cygnus atrata*), mallard duck (*Anas platyrhynchos*) and paradise shelduck (*Tadorna variegata*) were noted on each visit. A large population of the At Risk – Declining kakahi or freshwater mussel (*Echyridella menziesii*) was noted in lake sediments on each of the three visits.

The lake margins were unfenced and a sparse marginal vegetation was present including raupo (*Typha orientalis*), *Carex maorica* and clumps of the native swamp willow weed (*Persicaria decipiens*) and the introduced water pepper (*P. hydropiper*). The introduced water speedwell (*Veronica anagallis-aquatica*) was noted for the first time in 2016 when it was recorded as common in the inflowing stream and establishing on the lake margin.

3.9 Roadside pond, Tiniroto Road, Tiniroto

A small (0.6 ha) pond was noted on the 2016 GDC aquatic plant identification course field trip run by NIWA. This pond was unfenced and dominated by a large floating mat of the invasive weed reed sweet grass (*Glyceria maxima*).

3.10 Spring in Lower Kukupara Stream Bush, Davis Road, Matawai

Figure 3-9: Spring in Lower Kukupara Stream Bush. Note the emergent *Machaerina arthrophylla* in foreground and kuta (*Eleocharis sphacelata*) on opposite side of spring.

This small (0.4 ha) spring is located within an area of manuka (*Leptospermum scoparium*) dominated scrub with scattered radiata pines (*Pinus radiata*), situated off Davis and Whakarau Roads near Matawai, adjacent to the Waikohu River gorge.

This spring had very clear, blue water of high transparency. The only submerged macrophyte noted was the moss *Sphagnum falcatulum*, which dominated a zone from the spring margin to a depth of 4.5 m. It was frequently smothered by what appeared to be a cyanobacterial floc, especially in the deeper part of its range (Figure 3-10). The sphagnum moss also grew as a marginal cushion around the spring.

Common emergent species growing to depths of 1.5 m, were kuta (*Eleocharis sphacelata*) and *Machaerina arthrophylla* with small patches of spike rush (*E. acuta*), *Isolepis prolifera* and small pale raupo (*Typha orientalis*) plants.

Figure 3-10: Submerged vegetation in Lower Kukupara Stream Bush spring . Note *Sphagnum falcatulum* smothered by a cyanobacterial mat.

Other indigenous species noted in the manuka dominated scrub surrounding the spring were a single sapling of kahikatea (*Dacrycarpus dacrydioides*), the ferns *Blechnum novae-zelandiae, Histiopteris incisa, Pteridium esculentum, Pteris tremula* and *Paesia scaberula,* the rush *Juncus planifolius* and the creeping herbs *Nertera depressa* and *Centella uniflora*. A few introduced plants were recorded including fireweed (*Erechtites heiraciifolia*) and one plant of the weedy sedge *Carex divulsa*. Of major concern was the discovery of three seedling grey willows (*Salix cinerea* - Figure 3-11), which were hand weeded.

Figure 3-11: Grey willow (*Salix cinerea*) seedling on the margin of Lower Kukupara Stream Bush spring.

3.11 Kukupara Stream crossing, roadside wetlands, Whakarau Road, Motu

Figure 3-12: *Potamogeton crispus* in the Kukupara Stream crossing, Whakarau Road.

The introduced submerged curled pondweed (*Potamogeton crispus*) was abundant in the tributary of the Kukupara Stream crossing a ford on the Whakarau Road heading from Davis Bush to Motu. The floating leaves of the introduced aquatic grass *Glyceria declinata* were also present at this site. Other aquatic/wetland species noted further towards Motu were a roadside pond filled with the native red pondweed (*Potamogeton cheesemanii*) and a gully choked with the invasive grey willow (*Salix cinerea*).

3.12 Alcuin Wetland, Motu Road, Motu

Figure 3-13: Alcuin Wetland.

Alcuin Wetland has been identified as one of the few largely intact wetlands along the upper Motu River and is designated a Regionally Significant Wetland (GDC 2013: 2015), with slightly more than 6 ha of wetland being fenced and covenanted under the QE II Trust in 2005 by owners Mark and Jane Johnson. Prior to this the entire area was grazed by cattle. The wetland has two ponded areas, separated by a causeway, an area of rough grassland/sedgeland and remnant riparian forest,

The submerged vegetation of the ponds was dominated by the introduced curled pondweed (*Potamogeton crispus*) growing to 2 m deep forming average covers of 40% up to 90% in some places, with this vegetation up to 1.7 m tall. Mark Johnston described the ponds as being choked by this plant during late winter/spring. Emergent vegetation in ponds included the introduced starwort (*Callitriche stagnalis*), *Glyceria declinata,* one-rowed watercress (*Nasturtium microphyllum*), water purslane (*Ludwigia palustris*) and the often invasive water celery (*Apium nodiflorum*).

The grassland/sedgeland contained a number of native species including sedges *Carex secta, C. virgata, C. maorica, C. lessoniana* and *Eleocharis acuta*; rushes *Juncus sarophorus* and *J. edgariae* and the herbs *Myriophyllum propinquum* and *Persicaria decipiens*. Introduced plants included the invasive grey willow (*Salix cinerea*) and introduced herbs, the most abundant being creeping buttercup (*Ranunculus repens*).

The swamp forest contained kahikatea (*Dacrycarpus dacrydioides*), matai (*Prumnopitys taxifolia*) and smaller trees dominated by houhere (*Hoheria sexstylosa*), kaikomako (*Pennantia corymbosa*) and *Coprosma rotundifolia*. Other small-leaved shrubs included *Coprosma areolata, C. rigida, Streblus heterophylla* and *Melicytus micranthus*, with the larger leaved *Griselinia littoralis, Pittosporum tenuifolium* and *P. eugenioides*. The tree-fern wheki (*Dicksonia squarrosa*) was common. The ground cover was quite weedy with creeping buttercup, woundwort (*Stachys sylvatica*), *Selaginella kraussiana* and *Carex divulsa* all common.

3.13 Waimare Stream, Matawai

Figure 3-14: Waimare Stream.

The Waimare Stream crosses State Highway 2 south of Matawai. This is a GDC stream monitoring site. The stream was less than 1 m across and supported a few submerged curled pondweed (*Potamogeton crispus*) plants. Sprawling emergent species included the introduced *Glyceria declinata,* water purslane (*Ludwigia palustris*), *Myosotis laxa* and water pepper (*Persicaria hydropiper*). The only native wetland species seen was the sward forming sedge *Carex lessoniana*.

3.14 Lake Repongaere, Patutahi

Figure 3-15: Lake Repongaere. Note crack willow (*Salix* x*fragilis*) in foreground and dense floating mat of reed sweet grass (*Glyceria maxima*) behind the lake.

Lake Repongaere is a large (60 ha) and shallow lake situated amongst farm land. The lake is turbid and supported a thick algal bloom at the time of the visit. There was no submerged vegetation seen.

The lake was completely encircled by emergent vegetation, exceeding 100 m wide on much of the western boundary and occupying a total area of 23 ha. Willow species dominated the landward fringe of the western side of the lake, at their greatest extent at the woolshed near the lake access channel. The most abundant species was crack willow (*Salix* x*fragilis*) with some planted weeping willows (*S. babylonica*) and shorter grey willow (*S. cinerea*) stands.

The emergent vegetation was dominated by a dense floating mat of the invasive reed sweet grass (*Glyceria maxima*). This plant was only seen at a roadside pond on Tiniroto Road (Section 3.9) visited during the Gisborne District aquatic/wetland plant survey but has the potential to be a major weed in other lowland alluvial water bodies and wetlands. Interspersed in the emergent mat were clumps of native species including raupo (*Typha orientalis* – locally dominating some areas), *Carex secta* and *Persicaria decipiens* along with occasional introduced short-lived perennial species such as *Conyza sumatrensis* and *Erechtites hieraciifolia*.

Water fowl seen included eight shoveler (*Anas rhynchotis*), more than 20 and similar numbers of paradise shelduck (*Tadorna variegata*).

Overall, the lake was in poor condition, and was highly impacted by introduced species.

3.15 Orongo Station Wetlands, Coop Road, Muriwai

Figure 3-16: Freshwater pond in Orongo Station Wetland. *Schoenoplectus tabernaemontani* (centre and right) and *Cyperus ustulatus* (between).

The Orango Station wetlands occupy a total area of 30 ha, encompassing both freshwater and saline-influenced ponds separated by ribbons of land and a series of islands. The area is the site of a massive restoration project initiated in the early 2000's involving predator control, recontouring water bodies to meet the conservation needs of a range of species and also restoration plantings (Gordon 2014). The freshwater pond, used for nutrient stripping was comprised of a range of freshwater species including raupo (*Typha orientalis*), and the sedges *Cyperus ustulatus, Schoenoplectus tabernaemontani* and *Eleocharis acuta*.

Species on the pathways between the ponds included the native sedges three square (*Schoenoplectus pungens*), *Bolboschoenus caldwellii* and *Carex geminata*, the rushes *Juncus sarophorus* and *J. kraussii,* the introduced grasses sea couch (*Elytrigia pycnantha*) and Mercer grass (*Paspalum distichum*), and Californian thistle (*Cirsium arvense*). Three-square, *B. caldwellii* and Mercer grass lined many of the saline channels, whereas a shorter stature salt meadow vegetation occurred on the more open exposed sites. Species found in this vegetation included the native saltmarsh plants sea musk (*Thyridia repens*), *Limosella lineata, Lilaeopsis novae-zelandiae,* bachelor's buttons (*Cotula coronopifolia*) and the introduced *Atriplex prostrata*. Sea musk is classed as an At Risk - Naturally Uncommon species.

Mike Thorsen botanised this area in 2002 (NZ Plant Conservation Network), recording a similar range of species to this survey.

3.16 Te Wherowhero Lagoon, Muriwai Beach Road, Muriwai

Figure 3-17: Te Wherowhero Lagoon. Oioi (*Apodasmia similis*) - yellow green and sea rush (*Juncus kraussii*) - grey-green.

Te Wherowhero Lagoon is a large (~160 ha) saltmarsh area formed where the Wherowhero Stream discharges into Poverty Bay at Muriwai.

Vegetation encountered included the woody native species ngaio (*Myoporum laetum*), saltmarsh ribbonwood (*Plagianthus divaricatus*) and karo (*Pittosporum crassifolium*), the sedges knobby clubrush (*Ficinia nodosa*) and three-square (*Schoenoplectus pungens*), sea rush (*Juncus kraussii*) and oioi (*Apodasmia similis*). Smaller salt meadow species common amongst the taller vegetation included the native *Sarcocornia quinqueflora, Samolus repens* and *Selliera radicans* and the introduced *Atriplex prostrata*.

Mike Thorsen botanised this area in 2003 (NZ Plant Conservation Network), recording a similar range of species to this survey.

3.17 Awapuni Road pond, Gisborne

Figure 3-18: Awapuni Road pond.

Awapuni Road pond sits in a recreational reserve between Awapuni Road and Centennial Marine Drive in Gisborne. It is shallow occupying an area of 0.5 ha.

No submerged vegetation was observed, but there was large masses of filamentous green algae throughout the water body. The pond was fringed by an up to 5 m fringe of the introduced sprawling emergent grasses Mercer grass (*Paspalum distichum*) and kikuyu (*Cenchrus clandestinus*). There were occasional patches of the taller native sedges *Schoenoplectus tabernaemontani* and *Bolboschoenus fluviatilis*, especially around the islands in the pond.

Around 20 mallard duck (*Anas platyrhynchos*), including some domestic white or partially white birds were noted along with a single dabchick (*Poliocephalus rufopectus*).

3.18 Cedenco Foods pond, Innes Road, Gisborne

The Cedenco pond (0.6 ha) was visited as part of the 2016 GDC aquatic plant identification course field trip run by NIWA. The pond was shallow, with dense submerged vegetation comprised of patches of the introduced elodea (*Elodea canadensis*) and curled pondweed (*Potamogeton crispus*), but also the At Risk Naturally Uncommon native pondweed *Stuckenia pectinata*. Patches of emergent vegetation including Mercer grass (*Paspalum distichum*), *Schoenoplectus tabernaemontani* and *Bolboschoenus fluviatilis* were common across the pond.

3.19 Waikanae Creek, Gisborne Airport, Gisborne

Figure 3-19: Waikanae Creek near Gisborne Airport.

Waikanae Creek is a small stream flowing through agricultural land and urban Gisborne discharging into Poverty Bay. The creek was sampled where it crosses the entrance to Gisborne Airport. The creek was subject to high and turbid flow on the day sampled. It had an average width of 3 m. No submerged vegetation was noted. Emergent species noted was the native species *Bolboschoenus fluviatilis* and swamp willow weed (*Persicaria decipiens*) and the introduced Mercer grass (*Paspalum distichum*) and arum lily (*Zantedeschia aethiopica* 'Green Goddess').

3.20 Waihau Road pond, Whangara

Figure 3-20: Waihau Road pond. Note fodder brassica crop in foreground.

Waihau Road pond was situated on the eastern side of Waihau Road, a recently constructed duck shooting pond (Marty, farm manager pers. comm.). The area of the pond has decreased since its construction based on Google Earth images from 2002 to 2017, with an open water area reducing from 4.1 to 1 ha.

The pond was shallow, with no submerged macrophytes. Emergent vegetation was sparse with patches of raupo (*Typha orientalis*), *Schoenoplectus tabernaemontani, Carex maorica, Eleocharis acuta, Isolepis prolifera* and *Bolboschoenus fluviatilis,* with common introduced species including *Ludwigia palustris* and *Bidens frondosa*. The land surrounding the pond was waterlogged and dominated by the rushes *Juncus edgariae* and the introduced *J. effusus*. The invasive grey willow (*Salix cinerea*) formed a distinct patch of vegetation on the eastern side of the pond and seedlings were observed elsewhere in the marginal vegetation.

Black swan (*Cygnus atrata*), mallard duck (*Anas platyrhynchos*) and paradise shelduck (*Tadorna variegata*) were noted.

3.21 Waihau Road swamp, Whangara

Figure 3-21: Waihau Road raupo swamp. Note tall raupo fans (*Typha orientalis*), *Cyclosorus interruptus* and swamp millet (*Isachne globosa*).

This swamp occupied the hill slope running between a fen wetland complex adjacent to the Waihau Road (Section 3.22) and the pond described in Section 3.20. It is comprised of a small stream with a larger ~50 m ribbon of wetland dominated by raupo (*Typha orientalis*). This wetland complex (4 ha total area) is designated a Regionally Significant Wetland (GDC 2013).

Species noted in the stream included the introduced invasive herbs water celery (*Apium nodiflorum*) and monkey musk (*Erythranthe guttata*).

The raupo dominated area supported a diverse assemblage of mostly indigenous plants including some rare species. These included the fern *Cyclosorus interruptus* (At Risk Declining), maru (*Sparganium subglobosum*), *Epilobium chionanthum, E. pallidiflorum*, swamp millet (*Isachne globosa*) and the At Risk Data Deficient buttercup *Ranunculus macropus*. There are few previous records of some of these species from Gisborne District as discussed in Section 4.

3.22 Waihau Road fen, Whangara

Figure 3-22: Waihau Road fen. Note manuka (*Leptospermum scoparium*), harakeke (*Phormium tenax*) and *Machaerina rubiginosa* (blue green reed in foreground).

Waihau Road fen is situated on the eastern side of a 2 ha wetland, designated a Regionally Significant Wetland (GDC 2013). Around 2/3 of the wetland being dominated by raupo (*Typha orientalis*), *Carex secta* and harakeke (*Phormium tenax*). This area was not botanised, but is likely to be similar to the vegetation described in Section 3.21.

The fen was dominated by manuka (75% cover) and harakeke (10% cover), with lower stature vegetation dominated by *Machaerina rubiginosa*. Other species noted were the indigenous liverwort (*Marchantia berteroana*), swamp millet (*Isachne globosa*) and marsh fern (*Thelypteris confluens*). This fern has the conservation status of At Risk Naturally Uncommon, and is apparently the first record within Gisborne District. Occasional plants of the invasive grey willow (*Salix cinerea*) were noted in this vegetation.

3.23 Lake Waitawa, Whangara Road, Whangara

Figure 3-23: Lake Waitawa. Note floating island of raupo (*Typha orientalis*) and manuka (*Leptospermum scoparium*) to left side of lake.

Lake Waitawa is a 4.5 ha shallow lake situated to the southwest of Emirau Wetland, adjacent to Whangara Road. The site was accessed through farmland from Waihau Road.

No submerged vegetation was seen. The lake was completely fenced off and a dense tall margin of raupo (*Typha orientalis*) surrounded the lake. *Bolboschoenus fluviatilis, Isolepis prolifera* and *Persicaria decipiens* were also common indigenous emergent species and the invasive grey willow (*Salix cinerea*) was also noted.

Aquatic birds recorded were black swan (*Cygnus atrata*), mallard duck (*Anas platyrhynchos*) and Canada geese (*Branta canadensis maxima*).

Four floating islands of wetland vegetation (with a total area of 0.5 ha) were noted on the lake, apparently regularly changing position with wind direction (Marty, Farm manager pers. comm.). The closest (and largest) island had a tall (3 m) raupo margin, with manuka (*Leptospermum scoparium* – 4 m tall) and harakeke (*Phormium tenax* – 2.5 m tall) dominating the central portion of the island. Grey willow, *Carex virgata, Coprpsma tenuicaulis* and *Dicksonia squarrosa* were also present on the island.

3.24 Emirau Wetland, Whangara Road, Whangara

Figure 3-24: Emirau Wetland. Dominated by manuka (*Leptospermum scoparium*) with local areas of raupo (*Typha orientalis*).

Emirau Wetland off Whangara Road is a 12 ha wetland complex and designated a Regionally Significant Wetland (GDC 2013).

The vegetation is a complex of raupo (*Typha orientalis*) swamp and manuka (*Leptospermum scoparium*) and harakeke (*Phormium tenax*) dominated fen. Manuka formed a relatively uniform canopy 4 m tall. Apart from occasional small invasive grey willow shrubs, the vegetation was predominantly indigenous, with *Coprosma tenuicaulis, Machaerina rubiginosa, Isachne globosa, Epilobium pallidiflorum* and *Carex secta* commonly growing in wetter manuka. The margins of the manuka wetland were more diverse with the woody karamu (*Coprosma robusta*), hangehange (*Geniostoma ligustrifolium*), wheki (*Dicksonia squarrosa*), mapou (*Myrsine australis*) and five-finger (*Pseudopanax arboreus*) and pohuehue (*Muehlenbeckia*) climbers, with *M. australis, M. complex* and their hybrid all present. Interesting plants seen in the wet margins were the At Risk Data Deficient *Ranunculus macropus* and a seep dominated by the normally coastal or aquatic *Triglochin striata*.

3.25 Kaitawa Stream, Wharf Road, Tolaga Bay

Figure 3-25: Roadside clump of giant reed (*Arundo donax*) in Tolaga Bay.

Tall clumps of the invasive giant reed (*Arundo donax*) were noted in highly disturbed sites in Gisborne, Tolaga Bay and Tokomaru Bay. The Tolaga Bay site was adjacent to the Kaitawa Stream that was dominated by the introduced water cress (*Nasturtium officinale*) and water celery (*Apium nodiflorum*).

3.26 Pond Bush, Pond Road, Tokomaru

The landowner could not be contacted so this site was not visited.

3.27 Ratahi Lagoon, Te Puia Springs

Figure 3-26: Ratahi Lagoon. Note bubbles on surface of this thermal lake.

Ratahi Lagoon, the largest of the Te Puia Springs was 3.2 ha in area. The water was brown stained and had what appeared to be a bacterial film at the surface trapping many small bubbles. Water temperature was 20°C. No submerged vegetation was found.

Marginal vegetation included scattered emergent beds of raupo (*Typha orientalis*), occasional clumps of harakeke (*Phormium tenax*) and the sward forming sedge *Carex geminata*.

Two pairs of the At Risk Recovering dabchick (*Poliocephalus rufopectus*) were seen along with shoveler (*Anas rhynchotis*), mallard duck (*Anas platyrhynchos*), paradise shelduck (*Tadorna variegata*) and black shag (*Phalacrocorax carbo*).

3.28 Whareponga Road wetlands, Ruatoria

The landowner could not be contacted so this site was not visited.

3.29 Lake Opotehetere, Potaka

GDC conducted a recent visit to this site and advised there was no submerged or wetland vegetation and therefore we did not visit this site.

4 Endangered species

No nationally endangered species (sensu Townsend et al. 2007) were recorded during the survey. However, an unpublished Department of Conservation (DOC 2011) report lists two populations of the Nationally Critical wetland herb dwarf swamp musk (*Mazus novaezeelandiae* subsp. *impolitus* f. *hirtus*) near East Cape with a population of > 10 plants at Waipapa Stream camp site (NZTM 2084915E: 5818095N) and a larger population containing hundreds of plants near Nohomanga Stream (2084217E: 5818868N). These are two of the last three known remaining populations of this species (NZ Plant Conservation Network website). Threats to these populations were identified as decreasing water table and weed incursion (Don McLean, DOC pers. comm. 20 July 2017).

Several near threatened species were noted, some apparently first records for Gisborne District.

4.1 At Risk Declining

Two plants and one mollusc were in the highest risk category (At Risk Declining).

Urtica perconfusa (previously known as *U. linearifolia*) is a wetland nettle (Figure 4-1) that typically grows associated with emergent plants, forming scrambling growths around the water line. It was collected from Lake Kaikereru in 2003 (AK281805 – coll. P. Champion). Despite a thorough search of the *Carex secta* tussocks that previously supported this plant it was not found at the lake in 2017. No other Gisborne District records are known for this species (NZ Virtual Herbarium, Plant Conservation Network websites).

Figure 4-1: ***Urtica perconfusa*.**

Cyclosorus interruptus (Figure 4-2) is a swamp fern that only known from two populations in Gisborne District. There is a previous record of this species from a raupo (*Typha orientalis*), cabbage tree (*Cordyline australis*) and mingimingi (*Coprosma propinquua*) swamp at Tokata, near Te Araroa (Jonas et al. 2005), additional to the 2017 record in the Waihau Wetlands.

It is a species of geothermal habitats, and frost-free coastal and lowland wetlands, especially those dominated by raupo and swamp millet grass (*Isachne globosa*) (NZ Plant Conservation Network). It has been found in thermal areas as far south as Tongariro National Park, but was previously only found in non-thermal wetlands as far south as the Bay of Plenty (Brownsey and Perrie 2016).

Figure 4-2: ***Cyclosorus interruptus*.**

The freshwater mussel or kakahi (*Echyridella menziesii*) are widely distributed in flowing and still waters throughout New Zealand, but have only been previously reported from the Hangaroa River and Wheao Stream in Gisborne District (NZ Mollusca website). GDC have records of this bivalve from the Wharekopae River, Mangaheia River (Uawa Catchment) and Waikohu and Mangaoai Streams (Waipaoa catchment) (Harriet Roil pers. comm.).

Large specimens of this species have been found in Lake Rotokaka (Figure 4-3) but were not found in other similar lakes within the Tiniroto area.

Figure 4-3: Freshwater mussel (*Echyridella menziesii*) from Lake Rotokaha.

4.2 At Risk Data Deficient

The swamp buttercup *Ranunculus macropus* is classified as Data Deficient as it seemingly hybridises with another species waioriki (*R. amphitrichus*). Flowering material is needed to be certain of its identity but the size and stature of the sterile plants seen at the Waihau and Emirau Wetlands (Figure 4-4) are most likely this plant. There are at least ten previous records of this plant from Gisborne District (NZ Virtual Herbarium, Plant Conservation Network websites, Jonas et al. 2005).

Figure 4-4: *Ranunculus macropus* in Waihau Wetland.

4.3 At Risk Recovering

The New Zealand dabchick or weweia (*Poliocephalus rufopectus*) was ranked as nationally endangered (Nationally Vulnerable) until the most recent threat risk assessment (Robertson et al. 2017). This species is slowly recovering from a population collapse in the 20th Century. The largest populations are concentrated around the Central North Island in Taupo and Rotorua and birds were seen in four of the lakes surveyed, including a single bird seen in Awapuni Park in Gisborne.

Figure 4-5: Dabchick or weweia (*Poliocephalus rufopectus*) with chick.

4.4 At Risk naturally uncommon

Three naturally uncommon plants were found during the survey. Sea musk (*Thyridia repens*, previously known as *Mimulus repens*) (Figure 4-6) has become very rare in northern North Island but is relatively common in salt marsh habitats further south.

Figure 4-6: Sea musk (*Thyridia repens*).

Fennel-leaved pondweed (*Stuckenia pectinata*, previously known as *Potamogeton pectinatus*) (Figure 4-7) is apparently restricted to water bodies with either a saline influence, or occasionally in high conductivity water due to geothermal activity. It has been previously recorded from Pukeamaru Ecological District in the north of Gisborne District (NZ Plant Conservation Network), with the additional 2016 record from the Cedenco pond in Gisborne. It is abundant in coastal Hawkes Bay drains and streams.

Figure 4-7: Fennel-leaved pondweed (*Stuckenia pectinata*).

Marsh fern (*Thelypteris confluens*) (Figure 4-8) has a similar distribution to *Cyclosorus interruptus*, being found in northern lowland wetlands, but also thermally influenced areas (Brownsey and Perrie 2016). It is a rare plant apart from large populations occurring on the north head of the Kaipara Harbour in Northland. The Waihau Wetlands location is the second record of this fern in Gisborne District, with a 2011 record from near East Cape with a population of > 10 plants associated with a small poplation of dwarf swamp musk (*Mazus novaezeelandiae* subsp. *impolitus* f. *hirtus*) at Waipapa Stream camp site (DOC 2011).

Figure 4-8: Marsh fern (*Thelypteris confluens*).

4.5 Locally rare species

Perhaps it is not surprising that a number of the indigenous aquatic/wetland species are poorly recorded in Gisborne District, as only 1.75% of the original wetlands remain (GDC 2013) and there are few water bodies sustaining aquatic vegetation. There are apparently no previous records of *Machaerina arthrophylla* in Gisborne District and less than five records of *Chara australis*, *Potamogeton ochreatus*, *Sparganium subglobosum* and *Epilobium chionanthum* (NZ Virtual Herbarium, Plant Conservation Network websites).

5 Biosecurity risk species

NIWA was contracted to GDC to produce a booklet of potential aquatic weed threats to Gisborne District that occur in neighbouring regions (Burton and Champion 2016). Of the 23 species listed, five were located on this survey including hornwort, parrot's feather, reed sweet grass, water celery and yellow flag iris. Additional invasive weeds also identified on this survey were the wetland weeds grey willow, alder, gypsywort, monkey musk and *Carex divulsa*.

The aquatic weed egeria (*Egeria densa*) was reported from a dune lake near Tupuni Drain, Te Araroa (Jonas et al. 2005). This apparently the only record of this species from Gisborne District although it is common in all adjacent regions.

5.1 Hornwort (*Ceratophyllum demersum*)

Hornwort is New Zealand's worst submerged weed (apart from *Hydrilla verticillata* which is close to eradication from all known sites). It is widespread in all regions surrounding Gisborne District, but appears to be confined to four of the Tiniroto lakes, first recorded in Lake Rotokaka in 1983 (Howard-Williams et al. 1983). Howard-Williams et al. (1983) discussed the introduction of this species would likely have been via contaminated boat, as the lake was open for recreational boat use. It is most likely to have spread into the other affected lakes by contaminated eel fishing nets (fyke nets) as those lakes aren't readily accessible to boat traffic. Spread to new waterbodies only occurs via water movement, or human activities such as contaminated boats, drainage machinery and nets. It is a designated unwanted organism under the Biosecurity Act 1993.

5.2 Parrot's feather (*Myriophyllum aquaticum*)

Parrot's feather is a problem sprawling emergent weed that is common in the Bay of Plenty but far less common in Hawkes Bay and parts of Waikato and Horizons Regions nearest to Gisborne District. It has only been found in the Tiniroto lakes in Lake Kaikiore and the outlet stream of the nearby Lake Karangata. It was likely introduced as a contaminant of water lilies planted in Lake Kaikiore, or a deliberate ornamental planting prior to this plant being declared an unwanted organism under the Biosecurity Act. It is predominantly spread by via water movement or contaminated drainage machinery.

5.3 Reed sweet grass (*Glyceria maxima*)

Reed sweet grass is a problem sprawling emergent weed that is abundant in the Bay of Plenty but far less common in Hawkes Bay and parts of Waikato and Horizons Regions nearest to Gisborne District. It was first noted in Gisborne District in Lake Rotokaka (Howard-Williams et al. 1983) but has not been recorded there since. Other sites include the roadside pond on the Tiniroto Road and a huge infestation on the margins of Lake Repongare. However, no other sites of this plant were seen elsewhere. Although seed set occurs, seed do not appear to be effectively spread by water fowl and is spread via water movement or by contaminated drainage machinery.

5.4 Water celery (*Apium nodiflorum*)

Water celery, a sprawling emergent weed, appeared to be quite widely spread in Gisborne District occurring in Alcuin Wetland, Waihau Wetland and Tolaga Bay. It is often problematic in drain situations and is abundant in coastal Hawkes Bay and Bay of Plenty spreading via water movement or contaminated gear (and potential by water fowl over short distances). It did not appear to be a major weed at any of the Gisborne District sites.

5.5 Yellow flag iris (*Iris pseudacorus*)

Yellow flag iris is a problem erect emergent weed occurring in all regions adjacent to Gisborne District. It has only been found in Lake Kaikiore in the Tiniroto lakes, probably planted as an ornamental there. It can be a major problem in still and flowing waters also spreading into saline influenced areas. Spread appears to be by water movement, contaminated drainage machinery or deliberate spread. It is a designated unwanted organism under the Biosecurity Act 1993.

5.6 Grey willow (*Salix cinerea*)

Grey willow (Figure 5-1) is New Zealand's worst wetland weed and it can completely dominate swamp and fen habitats, excluding most other species and completely changing habitat. It is found throughout most regions of the North and South Islands and is effectively spread by wind dispersed seed. Grey willow was seen throughout the region, in ten of the sites visited. It appeared to be in an early colonisation phase in the Davis Road spring (Section 3.10 and Figure 3-11) and should be actively targeted for removal in high value sites. . It is a designated unwanted organism under the Biosecurity Act 1993.

Figure 5-1: A small Grey willow (*Salix cinerea*) tree.

5.7 Alder (*Alnus glutinosa*)

Alder (Figure 5-2) is another invasive wetland tree and particularly problematic on the lower Waikato River floodplain and around Lake Wairarapa. It can form a dense tall forest and is a nitrogen fixer, so potentially could alter wetland nutrient dynamics. It was only found on the margins of Lakes Kaikiore and Karangata in the Tiniroto lakes. It is spread by wind dispersed winged seeds, but dispersal appears to be much more limited than is the case for grey willow. Unlike grey willow, it is not an unwanted organism.

Figure 5-2: Sapling alder (*Alnus glutinosa*).

5.8 Gypsywort

Gypsywort is in the mint family but lacks the typical minty smell. This species was first recorded as naturalised in New Zealand in 1935, from near Haast in Westland, but is mostly found in the Waikato Region and around the Rotorua lakes, with one record from Hawkes Bay and Horizons RC (Champion et al. 2013). There are no previous records of this plant in Gisborne District and it was only found at the Te Aroha Station pond (Figure 3-2) and also the adjacent Waikura River.

Gypsywort is a summer-green perennial, producing masses of thin far-reaching stolons and tends to invade lake margins and disturbance prone wetlands, colonising other emergent vegetation and smothering beds of sedges and raupo. The small buoyant seed have long viability and are effectively spread by water movement, but spread by water fowl is apparently limited. Long-distance dispersal is likely to be a result of contaminated drainage machinery, contaminated clothing, footwear of hunters etc. It is a biosecurity concern for GDC and a systematic survey of nearby wet areas should be undertaken to delimit the extent of its distribution. The first incursion of this species in Northland (near Te Paki) has led to an eradication programme, and if sufficiently limited in extent, a similar approach may be warrantied in GDC.

5.9 Monkey musk (*Erythranthe guttata*)

Monkey musk (Figure 5-3) is a sprawling emergent weed that is often problematic in drain situations and is abundant in wetter parts of regions adjacent to Gisborne District, especially the central volcanic plateau. Only one small plant was seen in the stream adjacent to Waihau raupo swamp. The small buoyant seed have long viability and are effectively spread by water movement, but spread by water fowl is apparently limited. Long-distance dispersal is likely to be a result of contaminated drainage machinery, contaminated clothing, footwear of hunters etc. It is not as problematic as parrot's feather or reed sweet grass but may be worth controlling if it proves to be localised.

Figure 5-3: A drain blocked by monkey musk (*Erythranthe guttata*).

5.10 *Carex divulsa*

Carex divulsa is an invasive tussock-forming sedge (Figure 5-4) that appears to be rapidly spreading through the North Island and parts of the South Island of New Zealand. It was only seen in Davis Road Bush and Alcuin Wetland, but NZ Plant Conservation Network map many additional sites within Gisborne District. Spread appears to be either by contaminated footwear, or deliberate planting. It can be mistaken for a native sedge such as *C. virgata* and is still available for sale (as a native! https://www.plantrescue.co.nz/product/1228595), but usually is shorter with a drooping flower spike.

Figure 5-4: *Carex divulsa*.

5.11 Additional species

Water speedwell (*Veronica anagallis-aquatica* Figure 5-5) was found in two of the Tiniroto lakes (Karangata and Rotokaha) and also Te Aroha Station pond. It is a moderately invasive species and appears to have undergone a recent expansion in much of the North Island. Giant reed (*Arundo donax*) was found in several settlements within Gisborne District forming discrete tall clumps (often over 4 m tall). This plant is an unwanted organism but only appears to be a weed of waste areas probably arising from dumped garden refuse. Lesser invasive weed risks are posed by the submerged weed elodea (*Elodea canadensis*), which appeared to be a relatively recent incursion (not present in 1983 - Howard-Williams et al. 1983) and restricted to the Tiniroto lakes and in Gisborne. Curled pondweed (*Potamogeton crispus*) a bird-dispersed species, was common throughout the district and well established in the Tiniroto lakes in 1983 (Howard-Williams et al. 1983).

Figure 5-5: Water speedwell (*Veronica anagallis-aquatica*).

5.12 Recommendations

Proactive management of hornwort, parrot's feather, yellow flag iris, reed sweet grass, grey willow, alder, gypsywort, monkey musk and water speedwell is advocated. A delimitation of their distribution should be undertaken. For most species, district-wide distributions of these species appears limited and eradication/exclusion programmes are recommended. Even where a high-risk species like grey willow is well established, protection of high value sites should be undertaken by removing all local sources of propagules.

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Appendix A Species list for all sites visited in Gisborne District

Numbers refer to the sites listed in Table 1, * denote naturalised species.

Species	Sites where recorded
**Agrostis stolonifera*	1,4,10,12
Alectryon excelsus	24
**Alnus glutinosa*	3,4
**Apium nodiflorum*	12,21,25
**Arundo donax*	25
**Atriplex prostrata*	15,16
Austroderia toetoe	12
Azolla rubra	1,3,5,12
**Berberis glaucocarpa*	1
**Bidens frondosa*	1,3,4,12,24
Blechnum minus	3,24
Blechnum novae-zelandiae	1,4
Bolboschoenus caldwellii	15
Bolboschoenus fluviatilis	17,18,19,20,23
**Callitriche stagnalis*	3,4,6,12,14
Calystegia sepium	1,14,21
Cardamine debilis	3
**Carex divulsa*	10,12
Carex geminata	1,13,15,27
Carex lessoniana	1,4,10,12
Carex maorica	1,3,6,8,12,20,21,24
Carex secta	1,3,4,5,6,7,12,14,20,21,24
Carex virgata	1,4,5,12,21,23
**Cenchrus clandestinus*	17
Centella uniflora	3,10
**Ceratophyllum demersum*	4,6,7,8

Species	Sites where recorded
Chara australis	4,5,6
Clematis forsteri	12
**Conyza sumatrensis*	14
Coprosma areolata	12
Coprosma propinqua	1
Coprosma rigida	12
Coprosma robusta	12,25
Coprosma rotundifolia	1,12
Coprosma tenuicaulis	24,25
Cordyline australis	21
**Cortaderia selloana*	20
Cotula coronopifolia	15
Cyclosorus interruptus	21
Cyperus ustulatus	3,15,20
Dacrycarpus dacrydioides	1,10,12
**Dactylis glomerata*	12
Dicksonia squarrosa	12,23,24
Elaeocarpus hookerianus	1,12
Eleocharis acuta	3,4,10,12,20,21
Eleocharis sphacelata	5,6,8,10
**Elodea canadensis*	3,4,5,6,7,18
**Elytrigia pycnantha*	15,16
Epilobium chionanthum	21
Epilobium pallidiflorum	21,24
**Erechtites hieraciifolia*	10,14
**Erythranthe guttata*	21
Ficinia nodosa	16
Fuchsia perscandens	1

Species	Sites where recorded
**Galium palustre*	1
Geniostoma ligustrifolium	24
**Glyceria declinata*	11,13,20
**Glyceria maxima*	8,9,14
Griselinia littoralis	12
Histiopteris incisa	3,4,6,10
Hoheria sexstylosa	12
**Holcus lanatus*	10,12
Hydrocotyle elongata	1
**Hydrodictyon reticulatum*	8
**Iris pseudacorus*	3
Isachne globosa	6,21,22,24
Isolepis prolifera	4,10,20,21,23,24
**Juncus acuminatus*	21
**Juncus articulatus*	3,12
Juncus australis	14
Juncus edgariae	12,20
**Juncus effusus*	6,12,20
Juncus kraussii	15,16
Juncus planifolius	10
Juncus sarophorus	12,15
Lemna disperma	1,3,4,6,8,12,20,23,24
Leptospermum scoparium	10,21,22,23,24
Leucopogon fascicularis	12
**Ligustrum sinense*	1
Lilaeopsis novae-zelandiae	15
Limosella lineata	15
**Lotus pedunculatus*	10,20,21,22,23,24

Species	Sites where recorded
**Ludwigia palustris*	1,3,4,5,8,12,13,14,20,23
**Lycopus europaeus*	1
Machaerina arthrophylla	10
Machaerina articulata	3
Machaerina rubiginosa	22,24
Marchantia berteroana	22
Melicytus micranthus	1,12
Melicytus ramiflorus	1,12,22,24
**Mentha spicata*	1
Muehlenbeckia australis	1,6,12,24
Muehlenbeckia complexa	1,24
Muehlenbeckia australis x *complexa*	24
Myoporum laetum	16
**Myosotis laxa*	3,4,13,14,23
**Myriophyllum aquaticum*	3,4
Myriophyllum propinquum	3,4,5,12,20
Myriophyllum triphyllum	8
Myrsine australis	1,24
Myrsine divaricata	1
**Nasturtium microphyllum*	1,4,12
**Nasturtium officinale*	8,20,25
Neomyrtus pedunculata	1
Nertera depressa	10
**Nymphaea alba*	3
Paesia scaberula	10
Parsonsia capillaris	1,12
Paspalum distichum	1,3,8,12,15,17,19,20,23
Pellaea rotundifolia	1

Species	Sites where recorded
Pennantia corymbosa	12
Persicaria decipiens	3,4,6,8,12,19,20,21,23
**Persicaria hydropiper*	1,3,4,6,8,13,14,20
Phormium tenax	1,3,15,16,22,23,24,27
Pinus radiata (plantation)	10
Pittosporum crassifolium	16
Pittosporum eugenioides	12
Pittosporum tenuifolium	1,12
Plagianthus divaricatus	16
Podocarpus totara	1
Potamogeton cheesemanii	5,6,11
**Potamogeton crispus*	3,5,6,8,11,12,13,18
Potamogeton ochreatus	1,8
Prumnopitys taxifolia	1,12
Pseudopanax arboreus	24
Pteris tremula	4,10,12
Pyrrosia eleagnifolia	12
Ranunculus macropus	21,24
**Ranunculus repens*	1,12
**Ranunculus sceleratus*	3,4,14
Raukaua anomalus	1
Rubus cissoides	10
**Rubus fruticosus*	25
Rubus schmidelioides	1,12
**Rumex conglomeratus*	20
**Salix babylonica*	6,14,24
**Salix cinerea*	4,10,11,12,14,20,21,22,24,25
**Salix xfragilis*	1,12,14,24

Species	Sites where recorded
Samolus repens	16
Sarcocornia quinqueflora	16
**Schedonorus arundinaceus*	1
Schoenoplectus pungens	15,16
Schoenoplectus tabernaemontani	1,3,4,5,15,17,18,20,21
**Selaginella kraussiana*	12
Selliera radicans	16
Senecio bipinnatisectus	14
Sparganium subglobosum	21
Sphagnum falcatulum	10
**Stachys sylvatica*	12
**Stellaria alsine*	3,12
Streblus heterophylla	12
Stuckenia pectinata	18
**Symphyotrichum subulatum*	15
Triglochin striata	25
**Veronica anagallis-aquatica*	1,4,8
**Taxodium distichum*	3
Thelypteris confluens	22
Thyridia repens	15
Typha orientalis	3,4,5,6,7,8,10,14,15,20,21,23,24,27
Urtica perconfusa	3
**Zantedeschia* 'Green Goddess'	19

161 species	46 aquatic species
55 introduced species	111 wetland species
106 native species	34 predominantly terrestrial species