Report on Debris Flood Recovery and Rehabilitation of Matata Wildlife Refuge Reserve (Te Awa O Te Atua Lagoon)

TECHNICAL REPORT SERIES 3

Department of Conservation
Te Papa Atawhai

Report on Debris Flood Recovery and Rehabilitation of Matata Wildlife Refuge Reserve (Te Awa O Te Atua Lagoon)

Technical Report Series 3

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Cover photograph: View of western lagoon, with white heron in foreground. Taken from Domain roadway, at Matata Wildlife Refuge Reserve following May 2005 debris flood. Photo: Sarah Crump, 31 May 2005.

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Abstract

Approximately 300 mm of rain fell in the vicinity of Matata during the 24hrs from 1800 hrs on the 17th May 2005 until 1800 hrs on the 18th May 2005. This deluge and associated conditions created a debris flood that had a huge effect on the Matata Wildlife Refuge Reserve. Debris, siltation, infilling and subsequent lowering of the lagoon's water levels, especially the western lagoon and to a far lesser extent the eastern lagoon and compromised the ecosystem and its associated natural processes.

The DOC reporting group considered five options for the sustainable restoration and long term management of the Reserve. These ranged from managing what was there directly post-flood, to re-establishing a similar situation that which existed prior to May 2005 flood. An inter-agency partnership, supported by the community, resulted in one restoration option being chosen. Although looking very different to the pre-flood lagoon landscape, the restoration programme for the western lagoon and surrounds within the Reserve has now been completed.

The western lagoon provides suitable habitats for a range of native and introduced species but is lacking some habitat elements. To improve this attractiveness, the following key recommendations were made:

- Provide sufficient all year round water flow in and out of the two large dense raupo reed lands areas (c3.6 ha and c3 ha respectively).
- Any restoration areas require a high level of initial maintenance around plantings along with further planting as well as ongoing pest plant control.
- Provide improved access for freshwater fish from the Tarawera River into the Reserve at the eastern end.

This report is an updated record of the original DOC unpublished interim 2005 report of the debris flood effects on the biological values of the Reserve. It describes a number of options for its restoration. It has been reformatted and updated with 2010 postscript and photos.

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1 Introduction

Approximately 300 mm of rain fell in the vicinity of Matata during the 24hrs from 1800 hrs on the 17th May 2005 until 1800 hrs on the 18th May 2005. The result of this storm event was intensive flooding and a major debris flow from the Awatarariki Stream catchment within the Matata Scenic Reserve and to a much lesser extent from the Waitepuru and Waimea Streams into the Matata Lagoon Wildlife Refuge Reserve (WRR) (hereafter called the Reserve) (particularly the western lagoon). This is illustrated on the cover and in Figure 1.

The Reserve was at risk to continuing degradation from further flooding and debris flows unless preventive action was taken upstream of the Reserve. Interagency cooperation between the Department of Conservation (DOC), Bay of Plenty Regional Council, Whakatane District Council, Transit New Zealand (now New Zealand Transport Agency) and Toll New Zealand (now Kiwi Rail) was formalized by establishment of the Matata Hazard Steering Group. Consideration was given to diverting future floods including (as much as reasonable) debris flows entering the western end of the Reserve. Disposal of most of this material was directed north to the Crown land managed by Land Information New Zealand (LINZ).

Without interagency cooperation the Department can only manage the risks in the Reserve within its jurisdiction and respond to major events by cleaning up and repairing damage. This has resulted in an environment that is suitable for native and introduced flora and fauna that tolerate or adapt to the evolving situation from time to time.

Figure 1. The result of the intensive May 2005 flood on the Reserve (western lagoon) is illustrated (Ian Smith, 31 May 2005).

The Department's reporting group, comprising of coordinator Ian Smith Project Services, Taupo, an Independent Consultant Engineer, and DOC technical staff, Keith Owen, Paul Cashmore, Sarah Crump, Brendon Christensen and Chris Staite were given a brief to determine the effects of the flood on the biological values of the Reserve and to provide a number of options for restoration of these values.

The reporting group sought community advice in managing the situation after the flood. At a hui in Matata the community indicated to the group that they were particularly concern about the existence of toxic waste in the bed of the lagoon.

The Department's post-flooding vision for the Reserve was:

> 'A coastal wetland of high conservation and biodiversity significance that the local community value and is actively involved in it's management. It is managed to protect and enhance native flora and fauna, the natural landscape and as a habitat for freshwater fish, while respecting natural processes'

1.1 CONTEXT OF REPORT

A number of reports were prepared for the Hazards Project Steering Group formed under the auspices of the Whakatane District Council following the May 2005 storm at Matata.

This report prepared specifically for the Reserve by the DOC reporting group was to cover the following aspects:

- To address relevant hydrological, hydraulic, social, iwi, cultural, community, ecological and water quality aspects of a sustainable management regime for the Reserve
- To develop a plan for the Reserve's rehabilitation following the flood event and widespread deposition of silt and debris material
- To identify the nature and extent of the short and long term risks to the ecological processes of the Reserve
- To identify what actions need to be undertaken immediately to address these risks
- To consult with the Matata community, tangata whenua, other public interest groups and agencies
- To identify the statutory processes which the Department will be required to comply with and,
- To develop a plan for the sustainable restoration, rehabilitation and long term management of the Reserve

2 Matata Wildlife Reserve – An overview

2.1 HISTORY, LOCATION & ADMINISTRATION

Before European settlement, the Rangitaiki Plains was an area of extensive swamps, rivers and streams supporting large populations of wildlife including native fresh water fish and water birds. Wetland drainage schemes changed the face of the land, and today only 2 percent of the original wetland on the Plains remains. Surviving populations of water birds are confined to a few hundred hectares of wetland reserves and un-drained private wetlands, together with marginal habitats provided by canals, rivers and streams.

Matata Lagoon (Te Awa O Atua Lagoon) was established in 1917 after the Tarawera River was diverted directly to sea. The Reserve is located in the previous river bed adjacent to the coast with two open lagoons and a complex wetland system around them. The lagoons are today divided into eastern and western by a causeway giving access to the Matata Recreation Reserve, known as the Domain Camping Ground with the sea beyond.

The Reserve is located 25 km north-western of Whakatane between Awaateatua Beach and State Highway No.2. The Reserve extends from the Tarawera River mouth to Matata Township (see Figure 2).

Since the lagoons were established, the streams draining from the deep incised bush clad coastal cliffs to the south and south west have deposited fine sediments and debris in them. They have silted up, to the extent that the western lagoon was prior to the flood largely a shallow open water area in front of Matata dominated by a raupo wetland with some open water. Following the 2005 flood the western lagoon was almost entirely in-filled from silt following the major debris flow and flooding that caused wide spread damage.

The Reserve is managed by DOC pursuant to the Wildlife Act 1953, Reserve Act 1977 and the Conservation Act 1987.

A comprehensive draft Reserve Conservation Management Plan (DOC 1989) was previously prepared with recommendations for control of siltation, planting and wildlife management but this plan was never approved. Apart from small silt traps built at the two main stream entries to the lagoons in 1994 that were maintained, the Reserve has been managed more or less as nature dictated through storm events from time to time and ongoing infilling from sand drift from the nearby exposed coastal dunes.

The Department also complies with the BOP Conservancy Conservation Management Strategy 1997–2007 (Anon 1997) with respect to its management. This includes maintaining water levels in wetland reserves by obtaining or renewing resource consents under the Resource Management Act 1991. In addition there is a non-statutory plan for the "Ecological restoration of wetlands on the Rangitaiki Plains-Matata Wildlife Refuge" that provides management guidance for the Reserve (Wildlands Consultants 2002).

The Reserve and the nearby Matata Scenic Reserve are managed by the Department in close collaboration with a Joint Advisory Committee, established in June 2006 as an outcome of Treaty of Waitangi settlements for Ngati Awa and Ngati Tuwharetoa (B.O.P). A DOC Operational Plan 2008-2013 provides guidance to both parties for their management. The adjacent Matata Recreation Reserve is currently managed by the Department following the cessation of the Matata Recreation Reserve Board. A second recreation reserve lies adjacent to Richmond and Arawa Streets on the southern side of the western lagoon and is managed by Whakatane District Council.

The Operational Plan's vision for the Reserve and adjacent Matata Scenic Reserve is:

- To work with the Joint Advisory Committee, Bay of Plenty Regional Council, Whakatane District Council, Tangata Whenua and the local community to restore the western lagoon of Te Awa o Te Atua to a semi-open water indigenous wetland habitat,
- To work with the Joint Advisory Committee to protect the eastern lagoon in its unmodified state,
- To showcase the wetland, creating a distinctive focal point and a gateway to the coast.

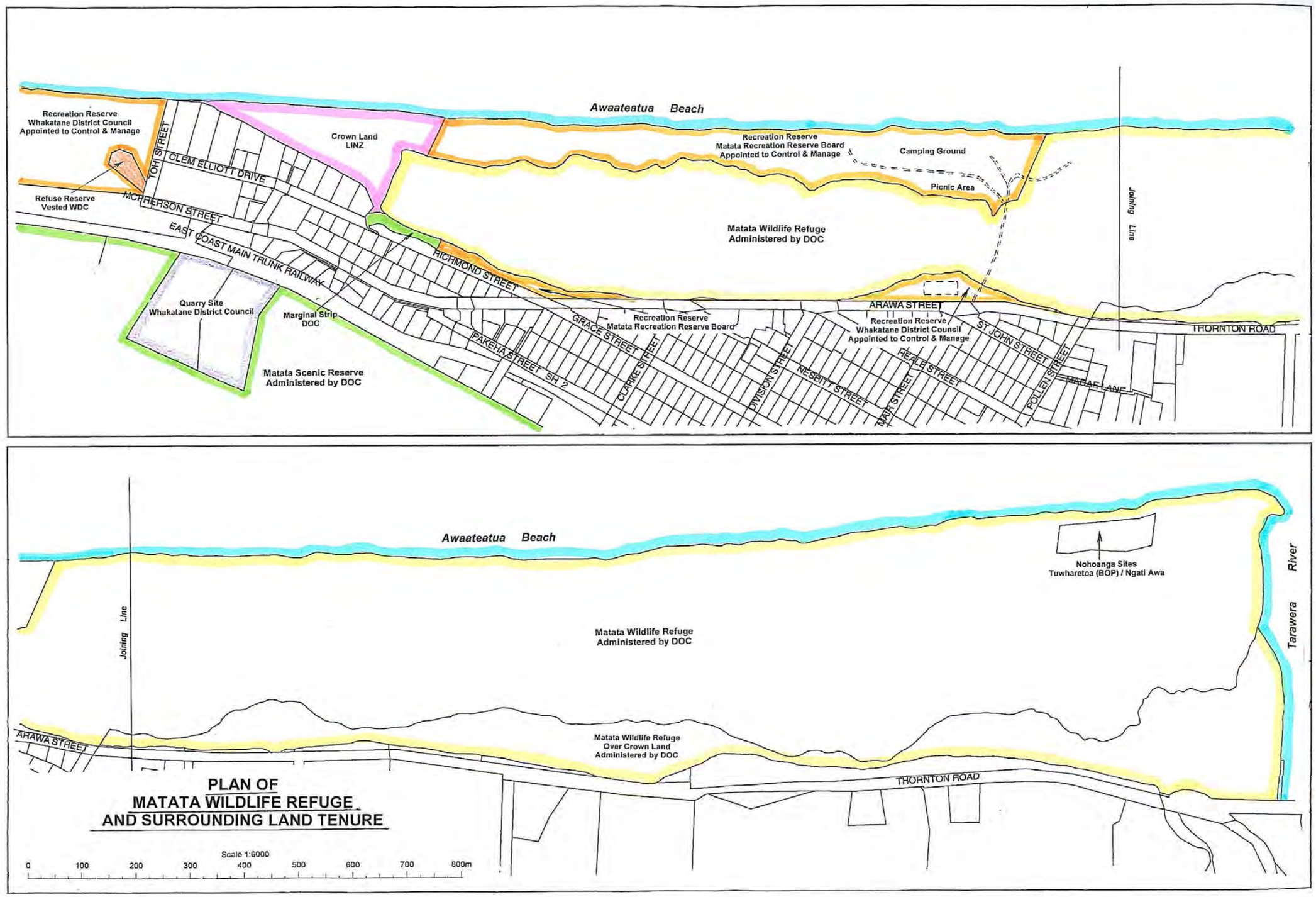

Figure 2. Plan of Matata Wildlife Refuge Reserve and surrounding land tenure.

2.1.1 Legal Status

The Reserve is classified as part Government Purpose (Wildlife Refuge) Reserve pursuant to the Reserves Act 1977 (NZ Gazette 1988, p 2195) and part Wildlife Refuge pursuant to the Wildlife Act 1953 (NZ Gazette 1958, p 465), being Section 6, Block VI, Awaateatua Survey District, Whakatane County, South Auckland Land District.

Legal control of the Reserve is vested in the Minister of Conservation. Day to day administration is the responsibility of the DOC, East Coast Bay of Plenty Conservancy. The adjoining areas of recreation Reserve (11.121 ha), until recently vested in the Matata Recreation Reserve Board, is now administration by DOC.

2.1.2 Climate

The nearest climate data recording point to Matata is located at Pikowai, some 9 kilometres north-west of the Reserve. The rainfall in the Matata area is generally higher than at Pikowai or on the Rangitaiki Plains due to the presence of nearby coastal hills and cliffs. These intercept northerly storm clouds coming off the sea. Annual rainfall at Pikowai averages 1429 mm and 1207 mm at Whakatane (NIWA 2005).

Occasionally from November to April tropical cyclones (i.e. Cyclone Bernie) can cause intensive downpours (up to 25 mm per day) and high winds (< 60 knots). The Matata foredune was reported as being over washed in the "Wahine" storm (April 1968) and the July 1978 storms with a return rate of 1 in 10 years and again by Cyclone Bola (March 1988) with a return rate of 1 in 5 years (Healy 1989).

Intense rainfall events (≥ 200mm/48 hours) are infrequent in the Bay of Plenty but are often “forgotten” by the public and land managing agencies due to their periodicity e.g. Pikowai has recorded 4 rainfall events greater than 200 mm in 48 hours since 1968, Tauranga Airport 12 events since 1910. Whakatane had 1 event since 1975, Rotorua 2 events since 1967, and Opouriao 2 events since 1962 (see Appendix 1 for charts of rain events for 1 and 2 day intervals). Less intense rain events, 100mm to 150mm in 48 hours, are relatively common in the Bay of Plenty.

There is a need to plan for some climatic change in the future especially given the impact of the May 2005 flood event (124 mm in 1.5 hours) was 30% more than the 1% annual exceedance probability. The future scenarios include an increase in the frequency of tropical cyclones along with periods of high rainfall (NIWA 2005).

2.1.3 Geology

The Reserve is situated within the geologically active zone of faults known collectively as the Matata fault. This defines the western edge of the Whakatane graben, forming the low lying Rangitaiki Plains to the east between Matata and Whakatane. Movement along this fault is extensional. These plains have subsequently in-filled with Taupo volcanic ash, and recent alluvial volcanic ash and peats.

The coastal cliffs of the Kaharoa Plateau have eroded and retreated at a rate of about 1.3 metres/year from 6500 years ago, when sea level reached its current level, until approximately 1800 years ago when sediment accreting on the Rangitaiki Plains formed a narrow coastal plain from Matata to Pukehina. Generally one broad dune ridge separates the cliffs and the beach, backed by a coastal lagoon or wetland, while the Rangitaiki Plains are fronted by a series of parallel dune ridges (Healey *et al.* 1977).

The dunes fronting the Reserve have been adversely affected by adjacent sand mining from the 1950s to 1985, and several blowouts occurred during this period, depositing beach sand in the lagoons. Since the sand mining ceased the incidence of these has been greatly reduced. Currently the beach is fairly steep and relatively narrow with a well vegetated fore dune. A summary of long term coastal retreat rates of the area was carried out as part of the Whakatane District Council Coastal Hazard Analysis (Tonkin & Taylor 2002) and concluded that the retreat rate of the shoreline at Matata from 1868 to 1977 was less than the maximum possible error of 35m. This analysis concluded that the current extreme risk zone at the old sand extraction site is 40.2m. If this degree of erosion was to occur and the fore dunes were breached, both lagoons would be severely compromised.

On the western up thrust side of the fault zone, the Matata Scenic Reserve forms the north-western shoulder of the Kaharoa Plateau. These low coastal cliffs consist of Pleistocene sands, silts, tuffs and marine sediments which are overlain by Matahina Ignimbrite and Rotoiti Breccia. The Matahina Ignimbrite is the most cohesive unit and joints within it control the topography, resulting in a pattern of gentle plateau tops and deeply incised box canyons. The area has been extensively overlain by successive ash fall events.

The soils are formed from Kaharoa ash overlying more weathered ashes interbedded with lapilli. This ash mantle has potential for severe earth slip and moderate gully erosion, increasing with steepness and length of slope (Ministry of Works 1974). Vegetation cover is also an important control on erosion, which occurs where vegetation cover on the slopes has not regenerated sufficiently, such as old logging access tracks or in areas where it has been disturbed, such as existing slips caused by heavy rain or earthquake activity.

The total catchment of the Awatarariki Stream is 614 ha, of which 527 ha is covered in regenerating kanuka (*Kunzea ericoides*) and pohutukawa (*Metrosideros excelsa*) dominated forest and 87 ha is developed farmland.

However, most of the farmland has gentle slopes and is not as prone to erosion. An alluvial fan has formed where the Awatarariki Stream exits its gully to the Matata Plains at the western end of Matata.

2.2 GEOMORPHOLOGY

Prior to the early 1900s the area now occupied by the Reserve formed the Tarawera River estuary. As the Rangitaiki Plains Drainage Scheme proceeded, a new river mouth was created in 1906 and the present lagoon systems formed opposite Matata in 1917. These became fresh water wetlands. Figures 3 and 4 show the extent of the western lagoon and associated wetlands in 1974 and 1982.

On the coastal side of the Reserve is the Matata Domain and campground with the fore dunes behind it. Inland from S.H. 2 is the township of Matata (see Figures 2, 3, 4, 5 and 7).

The Reserve comprises two distinct sections:

(i) The western lagoon and Awatarariki Stream debris fan to the west of the road causeway to the Domain and,

(ii) The Campground causeway east, including the eastern lagoon to the Tarawera River

Prior to the flood event of May 2005, the western lagoon was an open, shallow basin that had previously been considerably in-filled. It was approximately 600m long and 200m wide, with fairly uniform water depth of 20-40 cm. At its western end the lagoon shallowed into an area of raupo reed lands through which the Awatarariki Stream entered. It is believed that much of the past and ongoing infilling was from coastal sand being blown off the fore dunes and deposited in the Reserve. Episodic rain and erosion events in the past have also placed large amounts of material into the lagoon from the stream catchments. The lagoon was almost completely filled with silt, logs and material brought in by the 2005 flood (See Figure 1).

East from the causeway the Reserve extends to the Tarawera River. This section is approximately 2200m long and up to 200m wide. It consists of 400m of relatively open water, the east lagoon, which is similar in depth to the western lagoon, and a further 1800m of enclosed water with numerous small islands separated by narrow channels. This eastern lagoon is also shallow but at the southern end it deepens to about 1m with a controlled outlet to the Tarawera River. The east lagoon is surrounded by wetlands and shrub lands, except where it adjoins the Domain where there is a grassed track alongside the open water. Sand dunes separate the wetland from the beach.

Figure 3. Aerial photograph of western lagoon, Matata 1974.

Figure 4. Aerial photograph of western lagoon, Matata 1982.

2.3 HYDROLOGY

The Reserve occupies a wet and swampy depression in the low-lying coastal area. It forms a natural drainage channel for runoff from the Matata hills to the Tarawera River.

One stream and two small drains supplied the Reserve with fresh water. The main inflow is the Awatarariki Stream. This stream rises in the Matata Scenic Reserve to the south west. Prior to the 2005 flood event it drained into a raupo reed lands swamp at the western end of the Reserve through a cut ending 150m short of the lagoon. The stream has a high sediment load, and the wetland assisted in trapping some of this sediment before the waters reach the actual western lagoon. From where the Awatarariki Stream crosses Richmond Street to the stop bank, it is perched on an old debris fan. When there is a storm it used to overflow into the old sandpit area (site of the former Patterson sand quarry) (see Figure 4, upper left of 1982 aerial photo). In addition the Waimea Stream also flows from Matata Scenic Reserve through the township into the lagoon.

The inflow to the east lagoon is from the western lagoon through a 1200 diameter culvert under the causeway. The Waitepuru Stream had previously entered the Reserve just east of the causeway into the eastern lagoon but has now been diverted. This stream also rises in the Matata Scenic Reserve. The Waitepuru at times also carries high sediment loads and an extensive mud delta has formed where this stream previously flowed into the lagoon basin. When water levels are low, much of this mud is exposed. There is also a drain further east that flows into the lagoon. This mud delta has considerably expanded into the east lagoon due to the 2005 flood.

Prior to the flood the outlet to the Tarawera River comprises a low concrete dam fitted with a flap gated culvert, and a stop logged weir outflow structure. The weir was set to maintain a minimum water level of 0.67m Moturiki Datum, around 0.6m above low tide level. An overflow is provided over the access road at 1.28m Moturiki Datum. In 1963, the lagoon water level was raised to counteract the effects of siltation by inserting another stop log in the outlet weir.

The restriction on water inflow from the Tarawera River into the Reserve had been maintained prior to the May 2005 flood event.

The east lagoon water levels had fluctuated considerably. The reason was that there needs to be considerable water pressure to activate the two control gates. The Tarawera control gate only works when the tide is out and the control gate at the culvert linking the lagoons would only activate when water backed up the Waitepuru Stream. The culvert itself had also been partially silted up and this at times had impeded the opening of the control gate.

2.4 WILDLIFE, BOTANICAL VALUES AND ECOLOGICAL SIGNIFICANCE

The Reserve lies in the Te Teko Ecological District within the Whakatane Ecological Region (McEwen 1987). Nationally, wetlands are a diminishing resource with only 2% remaining on the Rangitaiki Plains.

The Reserve is unique and outstanding as a complex dune land-wetland-open water system on the freshwater - saltwater interface (See Figure 5 and Appendix 2). This is not found anywhere else in the Whakatane Ecological Region.

A botanical assessment of the wetland, lagoons and sand dunes was carried out in 1991 to ascertain community types and species composition. This work identified fourteen vegetation types, the details of which are given in Appendix 2.

The lagoon and wetland areas of the Reserve have exceptional or high botanical values (Beadel 1995) (See Figure 5 and Appendix 2).

A botanical assessment of the Reserve can be summarised into two key community types – wetlands and drylands. A total of 185 higher plant species have been recorded in the Reserve (See Appendix 3). Two threatened plant species are found in the Reserve; the fern *Cylcosorus interuptus* (has a "At Risk-Declining" threat status (de Lange *et. al*. 2009)) and the sand-binding pingao *Ficinia spiralis* (has a "At Risk-Relict" threat status (de Lange *et al*. 2009)).

What is so unique and outstanding about the Reserve is the complex dune land-wetland-open water system on the freshwater-saltwater interface. This is not found anywhere else in the Whakatane Ecological Region (the closest to this type would be Thornton Lagoon Wildlife Management Reserve where water ponds behind fore dunes at the mouth of the Rangitaiki River).

Matata Lagoon is recognised as a Site of Special Wildlife Interest of high wildlife habitat value (Rasch 1989). This ranking was the second highest accorded on a 5 tier ranking system. Details are given in Appendix 2.

A minimum of forty-three species of wetland birds have been recorded at the Reserve (see Appendix 4). These are all fully or partially dependant on the Reserve for their annual and/or seasonal habitat requirements. A total of 22 threatened bird species have been recorded at the Reserve (See Appendix 4).

The vegetation communities most heavily impacted by the storm event were the raupo reed lands, *Carex* sedge lands and grass/vine lands at the western end of the western lagoon. These were destroyed by large deposits of silt and debris. The western lagoon was totally in-filled, replacing the area of open water with a silt pan and debris, leaving only a very limited area of

shallow water remaining. A silt fan was also created at the western end of the east lagoon. Prior to the flood these open water areas were heavily utilised by water birds, while the loss of raupo reed lands and *Carex* sedge lands areas had the greatest impact on the habitats of secretive marsh bird species such as rails.

2.5 PRIOR LAGOON SEDIMENTATION

The two lagoons at Matata were already considerably shallower than at their formation about 90 years ago. This is largely due to siltation from its tributary streams, but was also hastened by sand from the dunes as well as two significant events:

-During the 1960s large quantities of wood fibre were deposited in the east lagoon from the Tarawera River following discharges from the Tasman Pulp and Paper Mill at Kawerau down the river.

-In April 1968 large quantities of sand were washed into the western lagoon following a dune blow-out caused by the Wahine storm. The blow-out occurred where the dunes had been weakened by unauthorised sand extraction.

2.5 RECREATION AND AESTHETIC VALUE

The Reserve itself is only moderately used for recreation, but it adjoins and enhances areas which are more heavily used. This includes the Matata Domain, tennis courts, Tarawera River mouth, and Awaateatua Beach. The western lagoon with its varied bird life also provides a serene and attractive view from Matata Township.

Matata Domain camping grounds is a popular camping spot receiving regular use throughout the year and can be packed during the summer. Most of the visitors are campers who stay at or near the Domain and beach, leaving the eastern lagoon virtually undisturbed. Some people swim at Matata but the beach shelves very steeply and are more suited to surf casting.

Numerous enthusiasts gather at the Tarawera River during the whitebait season. According to local residents, whitebait catches have drastically declined in recent years. This can be linked to the widespread loss of freshwater and wetland habitat for the adult fish in the catchment.

Near the Domain, the road over the causeway extends to the top of the dunes and many people drive up to this point to sit and look out over the sea. There is a matrix of tracks along the dune top behind the Domain, used mainly by ATV riders and some 4WD vehicles seeking access to the Tarawera River mouth. This area of the dunes is perhaps more vulnerable to erosion than the southeast dunes due to the greater public use and disturbance.

There are stunning views out across the Pacific Ocean from the dunes that back the Reserve. A popular activity is to walk, or ride ATVs, along trails on the dune tops. The dunes are vegetated but are showing severe impacts from ATV and vehicle use. Considerable detrimental impacts on the site are occurring and vehicle usage should be prohibited except for emergency purposes.

The major contribution of the Reserve to recreation and quality of life for Matata residents is the scenic quality of the lagoon.

For those interested in watching birds, there is ready access to the western lagoon from State Highway 2 and from the Domain to the east lagoon along a grassed track planted with trees. Some years ago this grassed border was covered with gorse but was later cleared and restored by the NZ Wildlife Service. A short walkway and bird observation platform at the eastern end of the lagoon basin has been provided for public viewing of the lagoon and its wildlife, through a project initiated by the local community resource centre. The Ornithological Society of NZ (Bay of Plenty Branch) carried out twice yearly counts of birds on both lagoons and did so for over 20 years but that has now largely ceased (Owen, *et al.* 2006) except for more casual one off observations. Both western and east lagoons are notable habitats for water birds and for bird watching.

A report following a community survey carried out in 2002 (Cullinan & Hooker 2002) included the following statement:

"*The Department of Conservation should be able to accrue support of the community in the management of the wetland.*

A significant number of residents appreciate the importance of the lagoons to the community. The lagoons are a central feature of both Matata and resident's appreciation of the environment in which they live. This is reflected in the high level of appreciation for the need for preservation work to be carried out on the wetland.

There is significant interest in conservation issues amongst the Matata community. Residents appreciate the vulnerability of the wetland and the marketing foci should be based around the expression of values inherent to a central and integral feature of the area. These values pervade the entire community regardless of personal use of the lagoons and are reflected in the relatively high levels of commitment to a community land care group.

Overall there was a moderate use of the lagoons with respondents being significantly aware of the values and threats to the wetland, as well as expressing strong interest in environment issues".

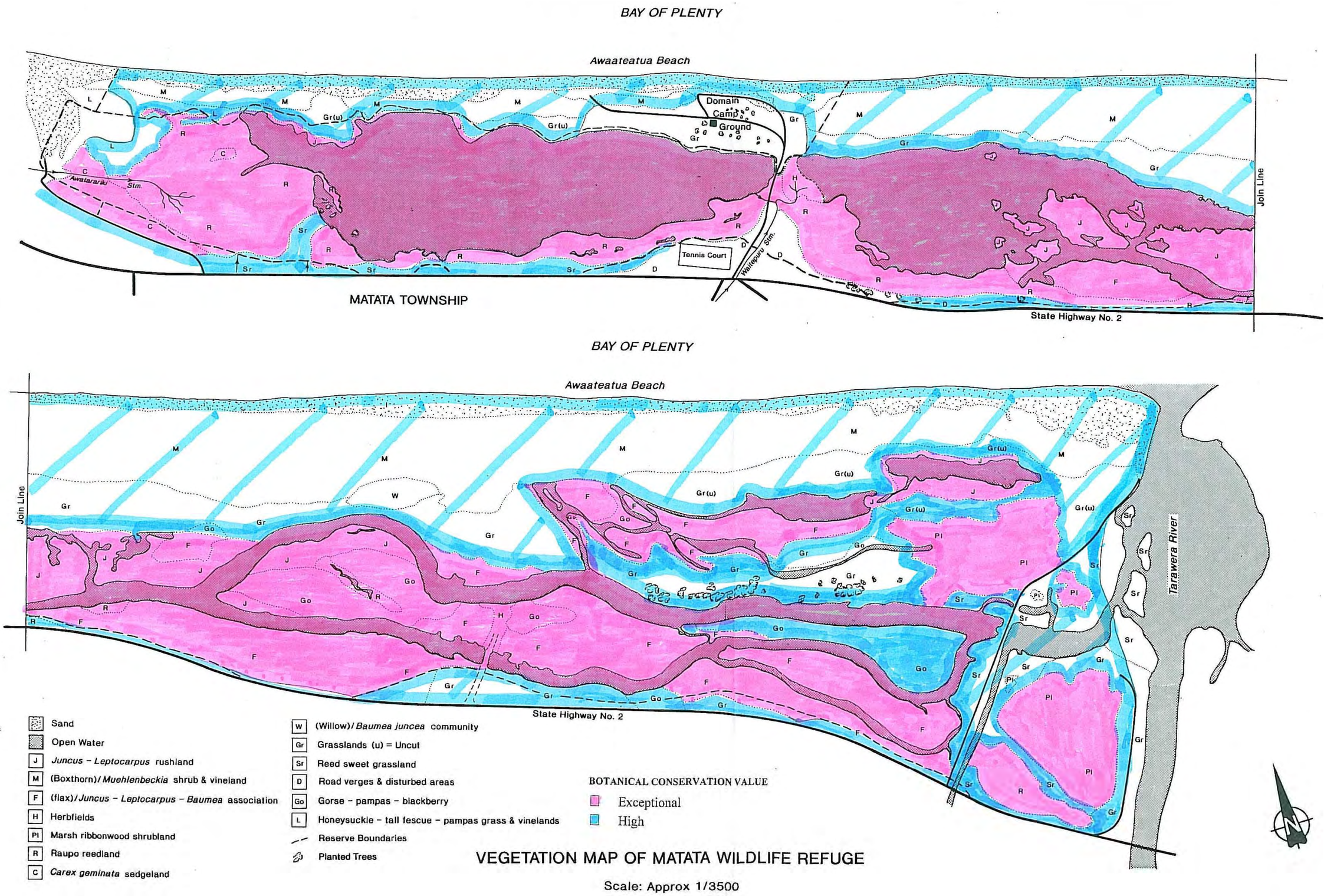

Figure 5 Vegetation map of Matata Wildlife Refuge Reserve (Source, Beadel, 1995).

3 Storm and debris flood damage to Reserve

During the 24 hour period from 1800 hrs on the 17th May 2005 until 1800 hrs on the 18th May 2005, approximately 300 mm of rain fell in the vicinity of Matata. This rate of rainfall has been assessed as being 30% higher than for a 100 year flood event. It peaked at a rate of 124 mm during a 1.5 hour period (1630 – 1800 hrs) late afternoon on the 18th May. It was immediately after this peak that most of the flood damage was caused.

During the height of the storm more flood waters entered the Reserve than could disperse through the floodgate at the eastern end into the Tarawera River. An enormous amount of debris entered the western lagoon with the flood waters and backed up behind the road causeway to the Domain at the eastern end of the lagoon. The existing ecological processes within the western lagoon were seriously compromised by this huge influx of silt, logs, debris, pollutants and other foreign materials (See Figure 6).

Figure 6. Debris including silt, logs, cars, pollutants, and other foreign materials deposited at the west end of the western lagoon (Ian Smith, 31 July 2005).

The road causeway effectively acted as a barrier to the spread of the flotsam from the western lagoon into the eastern lagoon (Figure 7). Significant sedimentation of very fine material occurred in the western part of the east lagoon as well. As the water level lowered within the western lagoon the residual silt was equal and in places higher than the pre-flood water levels.

Figure 7. Aerial photograph of western lagoon, Matata, immediate post flood of 17-18 May 2005.

Emergency work was implemented by breeching the stop bank and bypassing around the flood gate at the eastern end of the eastern lagoon (See Figure 9) to assist clean up operations, and ensure the continued drainage of storm water from both lagoons into the Tarawera River. There was a considerable amount of ground water within the silt which required draining.

With the upper catchments (Matata Scenic Reserve and other lands) being completely water logged, as a result of the storm event, any subsequent rainfall immediately ran off carrying with it high silt loadings which continue to cause problems for the recovery operations downstream (See Appendix 7 photographs).

3.1 RESERVE MANAGEMENT ISSUES

The debris flow and flooding during the May 2005 storm event placed considerable material in the western lagoon and some in the east lagoon. This resulted in major adverse impacts on the biodiversity, social and cultural significance of the Reserve.

The ecological system prior to May 2005 had changed significantly over time (1917-2005), resulting in the loss of open water with impact on flora and fauna and on fishery values.

There was considerable local concern at the impact of the latest flooding event on the lagoons. The call from the residents was to restore both lagoons as soon as possible.

3.2 MANAGEMENT SCENARIOS

There are two broad scenarios to managing the Reserve and associated wetlands:

a. Recognise that the Reserve is an ephemeral geomorphic site that was human created, but has been strongly influenced by natural erosion, transportation and siltation processes. These processes will continue to occur with infilling and modification of the lagoons from the inflowing streams and to a lesser extent by coastal processes. Recognising this, the DOC is required to carry out day to day management to enhance the biodiversity values associated with the Reserve.
b. Recognise the local, regional and national importance of the wetland and endeavour to maintain the lagoons as they were by managing the infilling and the fore dune sand reservoir accordingly.

3.3 SILTATION AND WATER LEVELS

Both lagoons are shallow water bodies that receive a high input of sediments from several sources. The most important ongoing one is the modification of both the vegetation and sand reservoir of the fore dunes. The other major source is input from tributary streams draining the Matata Scenic Reserve and from the town drains. This has both an ongoing and intense erosion potential as has been demonstrated by the May 2005 flood.

With a lack of effective flushing, these sediments have led to sustained and progressive siltation of the lagoons. This has been accompanied by the growth of indigenous vegetation from the edges.

Removing existing infilling sediment and debris to maintain a large area of open water, and controlling future siltation is desirable as it would:

a. Preserve the principle value of the Reserve as a refuge for water birds and as habitat for those birds requiring open water,
b. Protect aesthetic values,
c. Provide continued storage for storm waters, and protecting nearby structures from flood damage.

The goal of management was to maintain and enhance the features of the Reserve that directly and indirectly influence the wildlife and indigenous plant communities of the Reserve.

Management options selected for reducing the problem of siltation included:

1) Undertaking immediate works to restore the lagoon post-flooding.
2) Prevent future infilling of the lagoon and,
3) Stabilise the fore dunes of the Reserve, the Matata Domain and the dunes to the north-western of this area to beyond the far western lagoon (White Sands lagoon), a Whakatane District Council Recreation Reserve (See range of options given in Appendix 5).

3.4 REDUCING SEDIMENT LOADING ON THE RESERVE

A number of proposals have been looked at to reduce sediment loading on the Reserve. These include:

a. Diverting the Awatarariki Stream away from the Reserve. This would have avoided the siltation problem associated with this stream, but had a major disadvantage of cutting off fresh water inflow to the western lagoon basin which was undesirable. This inflow is necessary to keep water levels up in summer, prevent stagnation and maintain habitat for various flora and fauna species that cannot tolerate a saline environment. Water from the Tarawera River with its poor quality and potentially high saline content cannot substitute for the fresh water provided by the stream.
b. Allow the Awatarariki Stream inflow to enter the Reserve, but divert its course so that it flows into a bay in the raupo reed lands where water can

be impounded behind an embankment to create a settling area. A study done by APR consultants entitled "Matata Lagoon Improvement Project" (APR consultants 1993) covered all aspects of the Reserve management including dune improvement. It also contained a proposal for silt control from the Awatarariki Stream - see comment in Section 4.6 and drawings Figures 11 and 12).

c. Use the filtration effect of the wetland itself. This is an approach which has been tried and which has worked reasonably well for normal flows. The stream was diverted through a cut into the raupo reed lands which ended 150 metres short of the lagoon. A slight fall was still gained through this procedure and the raupo trapped some of the silt carried by the stream. But as silt built up drainage became less effective and the raupo had spread further out into the open water. Obviously this was and is not a long term solution to the siltation and associated drainage problems that had occurred in this area.
d. Silt traps. At roughly the same time (1993), at the request of the Department of Internal Affairs (former NZ Wildlife Service), silt traps were excavated in the banks of the Waitepuru Stream by the former Ministry of Works during routine maintenance work on the road culvert. These pits had some effectiveness in a low-flow situation, provided they were periodically cleared, but they were inadequate to cope with the large volumes of silt-laden storm water which can flow through this stream.

Options aimed to improve sediment trapping had to be able to:

a. Effectively remove sediments from storm water. That meant some form of ponding was required, either in the Reserve, or outside it, or both,
b. Not create drainage problems upstream of the Reserve,
c. Allow both ordinary and storm water flows to ultimately drain through the Reserve,
d. Allow the collection and disposal of the settled material to enable long term sediment trapping and,
e. Be within the financial resources available for Reserve management - unless some form of joint funding could be agreed upon between central, regional and local government.

The Waitepuru Stream had presented a special problem as only a small portion of the stream occurred within the Reserve and there was only a short distance within which to trap sediment before its waters reached the lagoon. A deep pit that had been installed in 1994 was overwhelmed by the debris flow of May 2005. During the 2005 storm the stream diverted away from the Reserve and a special study and resource consent application was necessary for its redirection back to the eastern lagoon. The study included the desirability of having this quantity of fresh water back into the lagoon system and balancing this against the continuing problem of siltation.

3.5 DREDGING

It has been suggested in the past that the lagoon might be dredged using a suction dredge. The feasibility of this option depended on the cost of hiring, transporting and operating the dredge. The spoil would also have had to be disposed of and was likely to have had a high organic content. This option was never pursued.

3.6 LAGOON WATER LEVELS AND WATER QUALITY

The water levels in the lagoon required reinstatement to pre-flood levels to preserve the integrity of the lagoon ecosystem. The option of raising the level because of siltation could only be a stopgap measure that would not solve the problem. It also increased the problem of management in times of high intensity storm events.

The long term removal of the control structure, at the junction of the Tarawera River and the Reserve, was not recommended as:

a. The water quality of the Tarawera River has been historically poor.
b. The effects of tidal flushing would be minimal due to the dissection of the Reserve by the Domain road causeway, combined with the vegetated nature of the Reserve margins and,
c. Much of the lagoon bed would be exposed as mudflats at low tide.

The pre-flood event water quality was typical of an enclosed lagoon system receiving runoff from a rural catchment. In order to avoid the water deterioration and enhance it, future degraded inflows from both the surrounding catchment and the Tarawera River had to be minimised or avoided. Sewerage leaching from the Domain toilets was another potential source of contamination but this has been improved by upgrading the septic tank system and could be connected to a proposed Matata sewage reticulation system in the future.

The Department will continue to promote statutory advocacy processes to ensure that the water quality of the lagoon's tributary streams is not degraded. In addition land management practices within the Reserve’s catchment that prevent soil erosion will be advocated.

4 Discussion

4.1 THE RESERVE AS PART OF MATATA TOWNSHIP

It was suggested by the Hazards Steering Group that the remedial work in the Reserve should have been considered as separate from the other hazard areas under study by the Matata Disaster Recovery Hazards Team. However it was the view of the DOC that the Reserve was inextricably intertwined with other aspects in the Matata town environment. Examples of the interdependence are:

- Storm water from the Matata Township ends up in the Reserve.
- Consideration is being given to a new waste water system for Matata. The effects of this will impact on the water quality in the Reserve.
- Siltation in the Reserve had a major impact on the township because of the effect on groundwater and the barrier to storm flows backing up into private properties near the Awatarariki Stream alluvial fan reaching into the top of the western lagoon.
- The railway line culvert for the Awatarariki Stream was very small and was easily blocked by debris (this was subsequently enlarged).
- The aesthetic view from the township is dependant on a healthy and extensive expanse of water in the western lagoon.
- Some of the permanent residents of Matata live at the Domain and the health in the Domain camping ground depends on the quality and level of water in the western lagoon.
- Because of the ongoing deposition of sediment levels in the Awatarariki Stream delta system, some adjacent residential sites will be subject to flooding on a more frequent basis. Further development of residential sites is likely to require the raising of floor levels because of the statutory requirements of the Building Code.
- The main recreational area in Matata is the Reserve and it provides the main access to the beach area beyond.
- A significant amount of detritus came into the Reserve from the adjoining residential sites but was subsequently removed.
- The community at large and tangata whenua, take ownership of issues in the Reserve area and want to take part in its restoration.

4.2 RECURRENCE OF A SIMILAR MAY 2005 WEATHER EVENT

While it is clear from other reports that the flood events of May 2005 were extreme, the flooding of the streams entering the Reserve was by no means unexpected. There is some opinion held that major debris flows recur on up to 400 to 500 year cycles. Consideration of climate records would suggest that rainfall of

an order that led to the 2005 disaster may occur on a number of times each century. However long it is between events, it is nevertheless inevitable that this type of event will be repeated. Also for a combination of smaller floods the cumulative siltation of the lagoons will continue. Perhaps there is a need to consider the potential impacts of global climate change that may accelerate over time?

In the absence of some form of permanent storm barrier or bypass above the lagoons to prevent inflow of sediment and debris from the surrounding catchment, unless there is some other intervention by man, the inevitable conclusion is that the Reserve can only be managed as it changes from time to time.

4.3 OBSERVATIONS AND EMERGENCY WORK

Observations and comparison of the post flood aerial photos of the western lagoon, indicated infilling by up to 1 metre in the western part of the lagoon occurred. There was further encroachment of infilling into the western lagoon itself. Trees and debris accumulated over the full extent of the western lagoon. Timber from the surrounding forest catchment ended up there and protruded over much of the newly exposed western lagoon floor (See Figure 1).

Part of the lawn in front of the Domain silted up to 150 mm deep, so it was likely the lagoon floor had also been raised by this amount (see Figure 8 below).

Figure 8. In front of the Domain at western lagoon. Lawn area silted up to 150 mm deep (Ian Smith, 31 May 2005).

The 1989 draft Matata Refuge Reserve Management Plan (DOC 1989) had identified the need for silt trapping above the western lagoon and ultimately silt removal from the lagoon itself. In the intervening 15 years there has been some action on these proposals in the building of silt traps to both main streams in 1994 but these were not regularly maintained to the level required. Following May 2005 the idea of diversion of the lower Awatarariki Stream further to the west and out to the sea was revisited, to determine if the sustainability of the system and the aesthetic value of the Reserve were to be maintained. This option was not pursued.

Prior to May 2005 there had been considerable community input into weed removal, and replanting with native species. There was a meeting during 2005 to plan for the next planting season.

In the aftermath of May 2005 storm event, there was a fear of further flooding of the embankment at the Tarawera River end of the east lagoon. It was breeched to allow flood water to escape (see Figure 9). It is possible that the tidal flap gate there had been stuck in a closed position. The breech was closed off soon after as a matter of urgency to stop sea water pollution of what is otherwise a fresh water lagoon system and to ensure that pest plants such as water sweetgrass (*Gylceria maxima*) would not invade the Reserve.

Residential property such as cars, caravans, garden sheds, washing machines and other detritus had also ended up in the lagoon predominantly at the western end (see Figure 6). Emergency crews from the DOC removed the bulk of these items with the aid of a helicopter in June 2005.

Figure 9. Embankment breeched at eastern end of the eastern lagoon near Tarawera River. Water sweetgrass (*Gylceria maxima*) infestation beyond (Ian Smith, 31 May 2005).

4.4 OPTIONS

The conservation significance of the Reserve was severely compromised by the debris flow in May 2005. The majority of the western lagoon was in-filled with silt, sediment and debris, the freshwater wetland vegetation was destroyed or buried and the lagoon no longer existed.

The DOC working group considered restoration of the Reserve, in terms of either restoring the values that existed prior to the debris flow, or creating other conservation habitat options. This was accomplished within the constraints that exist such as the current land status; likely cost; the likely presence of contaminated sediments buried in the lagoon; the sustainability and resilience of the restored environment and any statutory requirements.

A range of options was considered, from minimal intervention – leaving the lagoon in-filled and attempting to restore conservation values – to the complete restoration of the Reserve to its former state prior to the flood. Different scenarios were developed between these two extremes to provide a range of realistic restoration options that could restore the ecological significance of the Reserve. They are listed below;

a. Create a terrestrial dry ecosystem
b. Create a lagoon with bird roosting islands
c. Create a wetland environment
d. Restore a smaller area of open lagoon water and,
e. Restore the Reserve as it was before the May 2005 flood

4.5 COMMENTS ON OPTIONS

Analysis of the options for managing the lagoon system by the working group was carried out formally using a strength, weakness, opportunity, and threat (SWOT) analysis. Full details are given in Appendix 5. A summary of the findings is given in Table 1 below.

Table 1. Summary of management options for western lagoon restoration.

Option	Description	Biological Values	Physical Constraints	Social & Community	Other (Misc)
A	Terrestrial Dry Ecosystem	Fair	Very Good	Fair	Good
B	Lagoon with Bird Roosting Islands	Good	Good	Good	Very Good
C	Wetland Environment	Good	Fair	Good	Very Good
D	Smaller Area of Open Water	Good	Fair	Good	Good
E	Restore Reserve as it was before	Very Good	Poor	Good	Fair

To make a sensible selection on the preferred option for management of the lagoon's restoration, input was obtained from stakeholders with respect to the overall catchment and drainage management. The preferred option was in the end dependant on knowing the funding options and plans from all other sources if something different from that naturally evolving as an outcome of sediment and debris accumulation over time was to be implemented. A partnership approach between agencies with community support was needed to ensure the best result was to be obtained.

In addition the reporting group suggested that the DOC work with the Matata community to establish a community care group for the rehabilitation of the Reserve, and that regular communication be maintained with the community to allow for active community involvement in the clean up, planting and ongoing restoration of the Reserve.

There was also a need to undertake restoration of the eastern lagoon as well. The changes that were caused by the debris flow and flooding were; enlargement of the sediment delta just below the culvert; closing off various drainage cuts made to drain the western lagoon; and alleviating future flooding from the Waitepuru Stream. Aside from these there did not appear to be much change in the channels downstream of the delta when compared with 1985 maps. There was considerable

fine grained sediment deposited in these channels, and further consideration needed to be given on how this can be managed or removed, without disturbing the thicker, more extensive underlying noxious wood deposits.

The five options tabled for consideration for the long term restoration of the Reserve were;

Option A: Create a terrestrial dry ecosystem

This would involve leaving the sediment where it was and planting either native coastal forest and/or shrublands to create an indigenous terrestrial ecosystem. The Awatarariki Stream and any incoming drains would be channelled with riparian vegetation planted along the banks. Coastal wetland areas could be established in low-lying or floodable areas.

This option requires no major earthworks, but would have required landscaping, planting, plant and animal pest control, and assessment of the ability of the Reserve to withstand and affect future flooding and debris flows. This would have created a different ecosystem from that existing before the debris flow and would have resulted in considerable change in the composition of species present.

While coastal forest/shrublands are rare in the Te Teko Ecological District, the significant wetland values that existed prior to the debris flow would have been lost, along with the habitat it provided for wetland bird species. Management activities such as plant pest control, recreational opportunities and plantings would needed to be increased from the previous management requirements. The main loss of habitat would be for wading bird species and fish, although the stream might be a suitable passage for whitebait.

Option B: Create a lagoon with bird roosting islands

This involved excavating sediment from the western lagoon to create a shallow water body with a number of small low ‘islands’ formed from the sediment and possibly stabilised by tree stumps and trunks present in the lagoon. The shallow water body, depending on water flows and levels, would have been managed as a shallow lagoon. A shallow lagoon would have provided more open water areas for waders to feed but would have reduced the ability of diving birds such as waterfowl and shags to feed due to its shallow depth. This might have required the raising of the water level of the lagoon slightly after earthworks to provide sufficient water depth. The islands would be managed to provide wader (stilts, dotterels, plover, etc) roosting/nesting sites and would be kept largely free of vegetation with a covering of sand, shell or pebbles.

This would have necessitated the shifting of some sediment. Further studies would have been necessary to determine hydrological behaviour of the system, appropriate designs for habitat creation and maintenance and landscaping and planting requirements. The past management issues with siltation would have continued, although silt traps or raupo reedlands could have been established to manage this. The main advantage was that it largely recreated the wetland and wildlife refuge values that existed before and provided enhanced wader habitat.

Option C: Create a Wetland Environment
This option would have involved excavating sediment to form a shallow water body mostly covered by emergent freshwater wetland vegetation. This would create wetland habitat for secretive wetland bird species and wetland botanical communities. This would have required a lot of landscaping, management of water flows and levels and the planting of wetland plants, as well as pest plant control.

While providing for conservation values, they would have differed from those existing prior to the debris flow, and birds that prefer open water habitats would not have returned. There was a perceived loss of local landscape values to the community due to the loss of open water.

Option D: Restore a smaller area of open lagoon water
This option consisted of moving most of the sediment deposited in the previously open lagoon to the western end of the lagoon, creating an open lagoon smaller than that existing previously and building up a terrestrial area at the western end where the sediment would have been deposited. The relative sizes of the lagoon and dry part would have been dependant on the amount of sediment moved. There was potential for several different uses of this western 'reclaimed' area, including plantings, the development of a channelled stream with riparian vegetation and possible recreational/interpretation uses.

The creation of a lagoon with an area of open water would have provided some open water habitat for waterfowl and waders, and associated ecological and cultural benefits, although the open water habitat value would be reduced due to the reduction in lagoon size. There would have been a continuing issue with the gradual infilling of the lagoon with silt and sediment, the effect of which would be more serious due to the reduced size of the lagoon. The amount of sediment to be moved was much greater than any of the previous options and care would have been required to avoid exposing the layer of contaminated organic wood fibre underlying the sediment.

Option E: Restore the Reserve as it was before the May 2005 flood
This would have been an attempt to restore the Reserve, including the lagoons, to their previous state. Given the changes to the area and the amount of damage done, complete restoration was a difficult and near impossible option to undertake as it was largely dependant on having substantial funding and other available resources beyond that available. Although partial restoration could be attempted, to provide some of the original lagoon open water habitat, there were many issues associated with this that needed resolution. These included regaining suitable water flows and establishing water levels; determining the amount of sediment to be removed and disposed of and the possibility of raising local expectations to a point that was not achievable.

This option would have involved excavating the silt and debris out of the in-filled western lagoon area and moving it to either the western end of the

Reserve or disposal off-site. An assessment of the amount of sediment to be moved, disposal options and costs had to be considered before work could begin. This was the largest amount of sediment to be moved of all the options and therefore the most expensive.

Another issue was, that the lagoon, as it was before the debris flow, was not a completely natural environment, but was artificially managed to some extent to provide wildlife habitat. It was under ongoing threat from gradual infilling from stream sediment, coastal dune blowouts and invasive weeds. Even complete restoration of the Reserve would still result in these pressures continuing.

4.6 OTHER REHABILITATION CONSIDERATIONS

The draft Matata Wildlife Refuge Management Plan (DOC 1989) suggested positive steps to control the build up of silt from the Awatarariki Stream. The proposal was aimed at the annual silt load from that stream rather than the catastrophic debris flow of May 2005. If the Reserve was to be maintained in the long term it was proposed that a more permanent solution would be required.

The study "Matata Lagoon Improvement Project" (APR Consultants 1993) covered all aspects of Reserve management including dune improvement. It also contained a proposal for silt control from the Awatarariki Stream - see diagrams extracted from APR's report below (Figures 11 and 12). A reduced weir was installed in 1994 further upstream but this was overwhelmed in the May 2005 debris flow. It is speculation but the weir might have worked to protect the western lagoon better if it had been located just at the lagoon perimeter where it was proposed by APR Consultants.

Based on this, consideration was given to raising sufficient interest in the community to construct a weir (along the same lines as proposed in the 1993 report) together with the raising of the water level. The cost for the western lagoon weir and walkway was estimated in 1993 at just over $40,000. In 2005 dollars this equated to $51,000.

In 1994 consent was also obtained for a deep pond (silt trap) at the Waitepuru Stream. This was destroyed in the debris flow, as it found a new course. Consideration was needed to be given to the stream being relocation back into the eastern lagoon.

Consideration was given to the maintenance of the Awatarariki Stream through the Reserve for normal flows as above but for major debris flows an overland path more or less straight on from the valley outlet was suggested to the sea via the dunes. Hazard opinion put the return period for a large debris flow at perhaps as much as 475 years and raises the difficulty of managing such a flow in any case. It was suggested that perhaps for an intermediate storm event the railway embankment could be provided with a bigger clear path through it for the stream possibly involving a bridge if high floods and perhaps some of the debris flows were to be diverted unimpeded to the sea.

Considering management of water flows was not easy to achieve without significant input from both Regional and District Councils. It was noted that during the immediate cleanup after the storm, the sediment was cleared from around the houses at the Awatarariki Stream outlet and the stream was channeled into a narrow cut directly towards the remnant area of the western lagoon (See Figure10).

If no further work was done on modification here, then what was likely to happen in the next flood (even a normal fresh) was that the channel would soon block and the overflow sediment will then go directly to where the last lot has been removed i.e around the houses. Any reservoir for debris and sediment collection that pre-existed, has been largely in-filled in the areas adjacent to those houses during the flood and this adjacent infilling has not been removed.

Figure 10. Awatarariki Stream outlet looking upstream (Ian Smith, 31 May 2005). Note, the stream has been channeled into a narrow cut flowing directly towards the remnant area of the western lagoon.

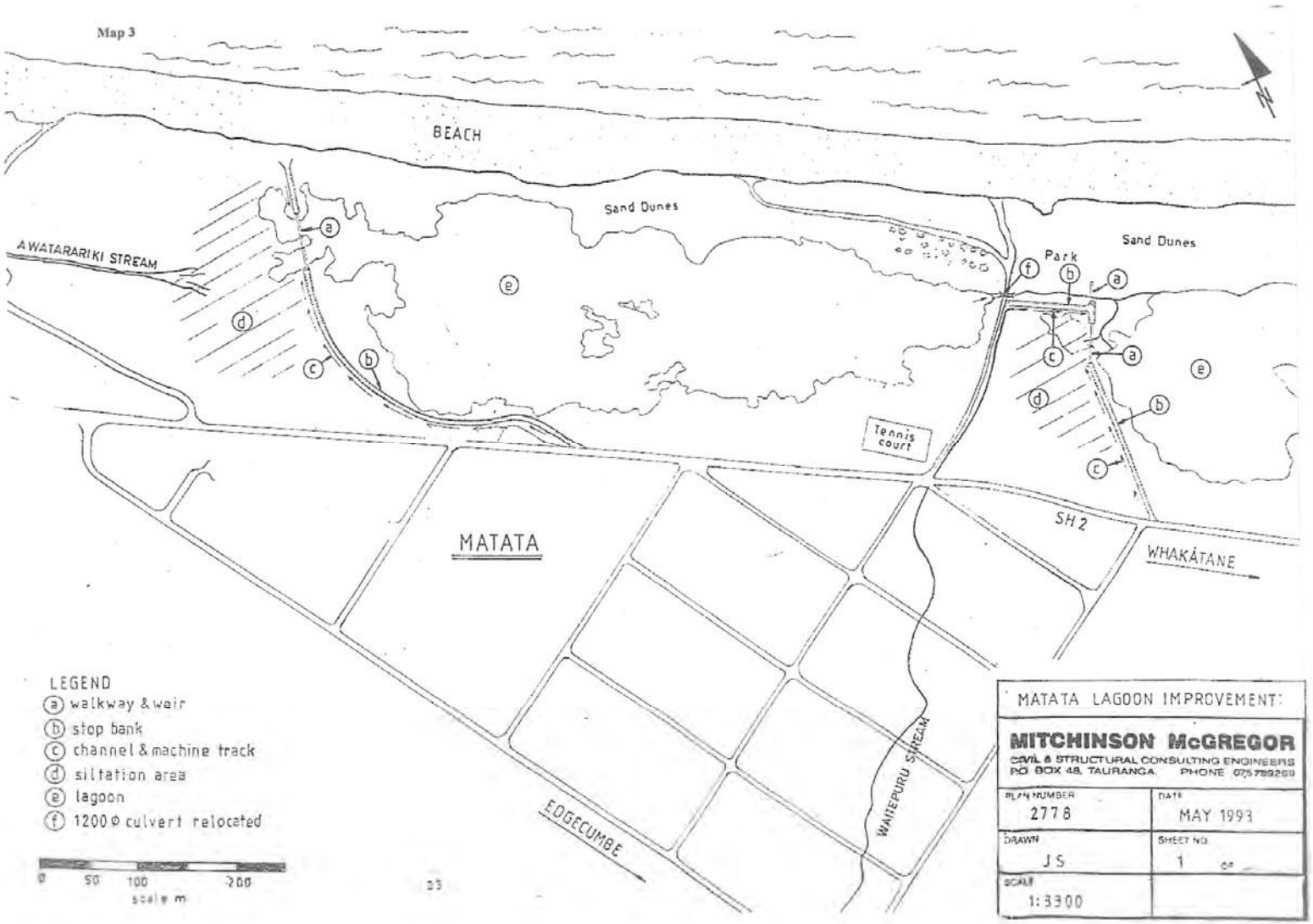

Figure 11. Proposed improvement project, western lagoon, Matata 1993 (APR Consultants, 1993).

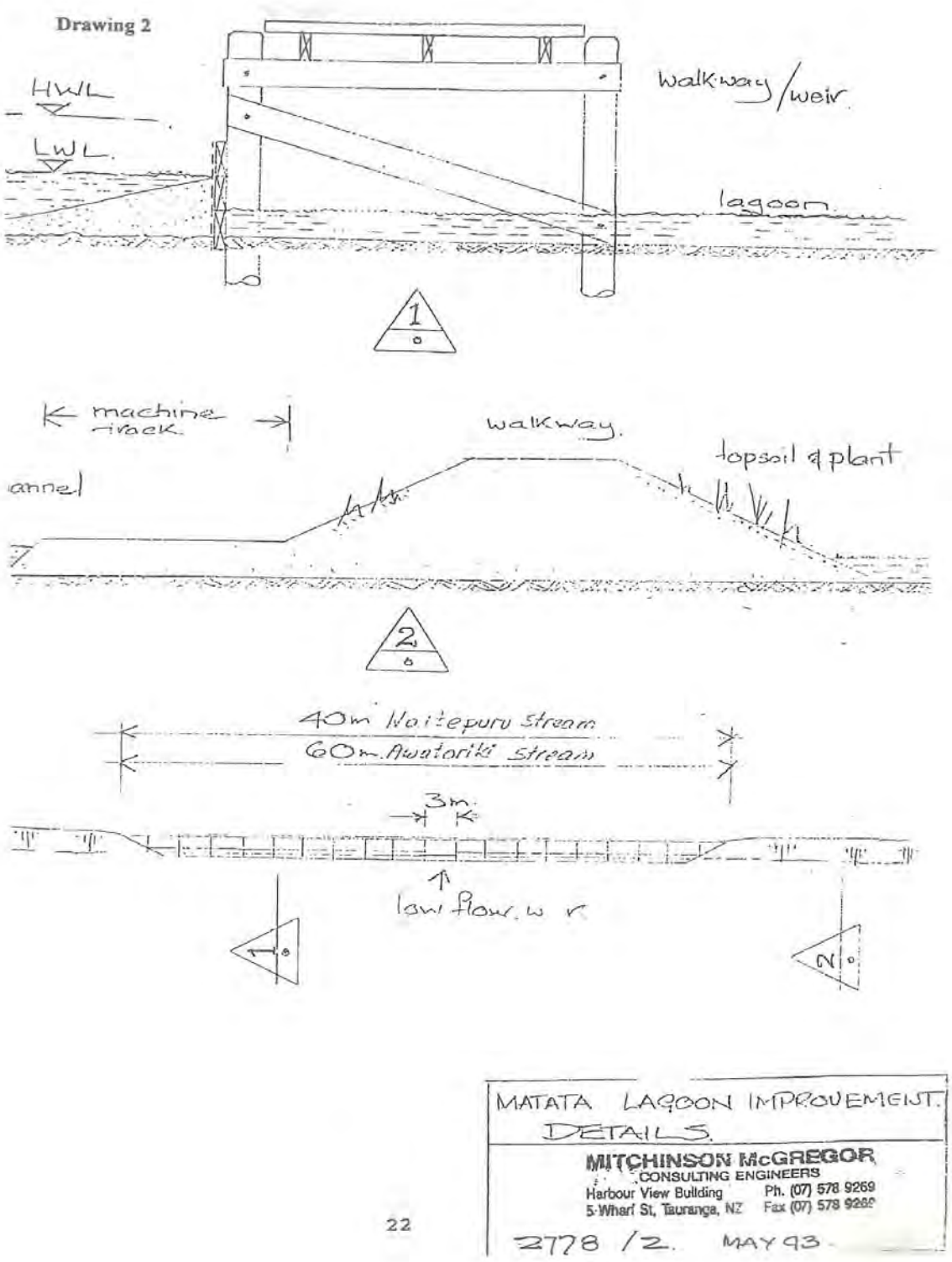

Figure 12. Proposed improvement project, western lagoon, Matata 1993 (APR Consultants, 1993).

There was some pressure from the home owners to prevent a recurrence of the devastation around their properties. On the other hand, Whakatane District Council had obligations pursuant to the Building Act 2004 to curtail any further construction in the immediate locality where there was a history of flooding.

To solve future flooding problem there needed to be extensive remodeling and contouring of the land form around the stream outlet, either to produce a new basin for sediment accumulation in the future or to produce an overland flow path to the sea for flood emergency. The Department could not plan any work in the Reserve until these issues were resolved.

The eastern lagoon outlet needed to be upgraded, for the long term, by provision of a permanent spillway and fish passage just above maximum tide level at the Tarawera River end.

4.7 IMMEDIATE FLOOD RECOVERY WORK

To stabilise the situation in the Reserve in the short term the following work was proposed:

Reinstate Tarawera River Embankment

Fill the breech in the Tarawera River embankment at the eastern end of the Reserve and make good. Check the flap gate and remove debris as necessary to ensure the gate is free to operate as designed and that fish passage was available. Remove exotic aquatic plants that arrived as a result of the embankment breech.

The fact that the eastern lagoon may have operated for some time without a movable tide flap gate was possibly due to evaporation from the lagoon or that seepage was sufficient to keep the water levels to a constant level. It was also isolated from tidal influence. In the flood, however, the flow was too high and the level rose. No doubt the townspeople were alarmed that flood levels built up back towards the town (less than 2 metre drop to Moturiki datum).

The breech was subsequently filled and a new structure placed there. Unfortunately it does not appear to be any provision for fish passage into the Reserve from the Tarawera River.

Domain Grassed Area

The silt deposited on the seaward side of the western lagoon near the domain (see Figure 8) needed to be graded and re-grassing. This was subsequently done in 2010.

Causeway to Domain

The Whakatane District Council repaired the surface of the causeway and re-metalled it after the other repairs have been completed.

Plant Pest Control and Planting
In association with the above cleanup, a programme for plant pest control and revegetation was implemented as previously planned.

Redirection of Waitepuru Stream
There was discussion during preparation of this report on the diversion of the Waitepuru stream away from the eastern lagoon. A decision to have the stream discharge back into the lagoon during restoration was formally considered. However, without this water input salinity in the eastern lagoon may increase, with potential effects on the existing ecology. Anecdotally, land owners affected by the new stream location and the community also support redirection. In fact there was no opposition to redirection of the Waitepuru Stream.

A resource consent would be needed to redirect the stream as there would need to be a barrier to stop the stream altering course as this has happened before.

The action recommended, in association with other agencies, was to consider redirecting the Waitepuru Stream back to its old course and for construction of a barrier to prevent the stream redirecting again in the future.

4.8 COMMUNITY INVOLVEMENT

In October 2003 the Department organised a Weed busters field day at the Matata Domain. At this event community members were asked if and how they wanted to be involved with the Reserve's management. Several members were interested in being more actively involved and having workdays to tidy up the flax around the margin of the lagoon and two further working bees were held. Members of the Matata Community Centre secured funding for a community worker to co-ordinate a more integrated restoration project.

In addition to this the Matata community worker and Department staff received funding from Bay of Plenty Regional Council's Environmental Enhancement Fund to create a walkway around part of the eastern lagoon. This included building a bird hide and interpretation panels. This work was subsequently done.

Based on this activity the reporting group felt that the Department should continue to work with the Matata community worker to establish a community care group for restoration of the Reserve.

4.9 STATUTORY PROCESSES

The Department is required to comply with the Conservation Act 1987, and Bay of Plenty Conservation Management Strategy (Anon 1997). This includes a strategy to maintain water levels in selected wetland reserves by obtaining or renewing consents under the Resource Management Act 1991.

The Bay of Plenty Regional Council advised the Department by letter on 13th June 2005 (Bay of Plenty Regional Council 2005) of the statutory processes required under the Resource Management Act 1991 that were needed to be met with respect to a Matata Lagoon Management Plan.

They said "*Emergency works can be extremely useful, flexible and there is no limit on time to undertake them. Rather than go into a whole dialogue on what the Matata Lagoon Management Plan might or might not try to achieve we suggest that your flood recovery group put together a proposal on what they would like to do and bring that in for discussion. What is finally decided may then change through that discussion. We would then be able to say what activities might be construed as emergency works and what else may need consent(s) and what form these take"*

They went on to say *"The consent process is really no reason to get concerned as you will want to involve the community in any proposal. It is likely that once you are at the application stage you will have already done all the consultation necessary and even obtained the support of all the parties required. That's not to say that there wouldn't be someone objecting at the end of the track but that possibility should be minimal."*

5 Postscript 2010

A series of comparison photographs taken between 2005, 2006 and 2010 of the western lagoon are listed in Appendix 7. One page of these photographs shows three different photos taken over 3 different dates, indicating the dynamic natural re-vegetation from 2005 to 2006 and a post completion photograph of the rehabilitation works taken in July 2010.

Within a year of the flooding (June 2006) the whole of the in-filled western lagoon had naturally regenerated and was largely covered by a *Juncus* sp. dominated rush lands with pockets of raupo reed lands and very limited open shallow water areas present (see Appendix 7). No rehabilitation earthworks had taken place yet.

By July 2010, 4 years later, the bulk of the post-flood mitigation for the western lagoon involving considerable earthworks, embankments and ponding wetland areas had been completed by the contractors (J Swaps Contractors Limited) with interagency co-operation under the management and oversight of Whakatane District Council (see Appendices 6 and 7). Although looking very different to the pre-flood lagoon landscape, the restoration programme has provided for a smaller open water western lagoon, several raupo reed land ponds, numerous embankments and planted surrounds. The last task of the project before its completion was the landscape planting of close to 44,000 native coastal and wetland plants on the embankments and spoil dump areas. The last plantings by Whakatane District Council were in September 2010. The responsibility for the day to day management of the restoration programme has now been handed back to the Department of Conservation.

Of the five restoration options tabled in this report the Reserve now has components of several of them and probably has most components of option's C and D. Today it comprises of a smaller western lagoon of c7 ha of open water, and the creation of four floodway bays, on the seaward side of the lagoon. Two of these are small bays (c0.8 ha and c0.9 ha respectively) with shallow water. The other two bays are larger (c3.6 ha and c3 ha respectively) and are dominated by dense raupo reed lands.

These bays are linked by a series of large embankments and drainage channels that direct the water flow from the Awatarariki Stream into the western lagoon via one of the smaller bays. The two larger raupo bays have been bypassed with no water entering into them except from precipitation. The smaller Waimea Stream also flows directly into the western lagoon.

There were large scale deposits of excessive sediments at the western end near Richmond Street and these areas have since been contoured and this area and the embankments around the lagoon are now planted with native coastal and wetland plants (see Appendix 6 for a plan showing indicative works and details of the plantings, as prepared for the Resource Consent). The planted areas are separated by a series of large embankments and are connected by drainage channels that direct water flow into the Reserve from the Awatarariki Stream (and to a minor

extent from Waimea Stream). The flow passes through the western lagoon and into the eastern lagoon and out into the Tarawera River nearby.

The western lagoon wetland restoration has now been completed but it will be sometime before the final results can be fully determined from an ecological perspective. The completed restoration work reflects the preferred option that the local authorities and community were seeking, within the resources that were available, and taking into account the desired community aspirations for the lagoon. The western lagoon will over time provide adequate habitats for native and introduced water bird species, some of which are already well established but in low numbers. To improve this attractiveness, the margins will need some aquatic emergent vegetation to make them more suitable to water birds by providing shelter, cover and breeding sites. In its current raw state this is unlikely to be fully achieved.

There is concern that there is no water flow physically entering the two large dense raupo reed land areas and the current in flow bypasses them and flows directly into the lagoon. These areas will dry out rapidly during summers, reducing the value of these areas to wetland birds and plants, and will increasingly become a haven for plant pests. We are already seeing an immediate proliferation of grey willow (*Salix cinerea*) in these two bays. This impact will require subsequent high levels of maintenance and control costs to the DOC. The loss of water flow into these areas needs rectifying otherwise this is going to be an ongoing issue.

The planted areas, containing 44,000 plants, will also initially require high maintenance levels over the summer and ongoing pest plant control.

There appears to be no proper freshwater fish passage for migratory fish access from the Tarawera River into the Reserve, at the eastern end of the eastern lagoon. This is of concern and needs rectifying immediately.

The Reserve is providing suitable habitats for a range of species of native flora and fauna (especially water birds) seeking refuge in the Reserve. However whether the restoration ultimately reflects the wetlands former glory, as a regionally important wildlife habitat, has yet to be fully determined.

6 Recommendations

- Provide sufficient all year round water flow in and out of the two large dense raupo reed lands areas (c3.6 ha and c3 ha respectively).
- Restoration areas require a high level of initial maintenance around plantings along with further planting as well as ongoing pest plant control.
- Provide improved access for freshwater fish from the Tarawera River into the Reserve at the eastern end.

7 Acknowledgements

Whakatane District Council provided Appendix 6, the Boffa Miskell drawing showing the extent of the proposed restoration works and plantings as prepared for the Resource Consent. Climate data in Appendix One was supplied by Stuart Burgess of NIWA.

8 References[1]

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[1] An Asterisk represents where two Bay of Plenty Conservancy Department of Conservation reports have a duplicate number.

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