Enhancement of Floral Diversity for Mana Island

Stage One - Collation and review of records and data for Friends of Mana Island

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April 2015

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Executive summary

This report outlines the collation and review of physical and electronic information and data relating to the revegetation and floral diversity of Mana Island. In 2010, Friends of Mana Island (FOMI) identified the need for a project to improve the floral diversity on the island, following 27 years of planting and threatened plant management. The initial project stage required the organisation and review of existing information to inform further project stages, along with recommendations for interim volunteer opportunities until the full project is complete.

The material was mainly sourced from the Department of Conservation (DOC), Friends of Mana Island and direct contact with previous staff and volunteers. The material was variable and, in general, had been produced by many people over three decades. To structure the collation, the information has been collated into three themes – *revegetation and floral diversity; threatened plants;* and *Waikoko wetland.* These align with relevant recommended tasks of the Mana Island Ecological Restoration Plan review (2010)[1] and pragmatic fieldwork requirements.

Copies of collated material are now held by FOMI in the form of an A4 folder, an A3 portfolio and a flash drive containing electronic files, with the potential for selected material to be available via the FOMI website.

Mana Island was an extremely modified environment at the commencement of restoration work and the records indicate extensive work undertaken by DOC and volunteers since 1987. Over 500,000 eco-sourced plants have been grown and planted, several threatened species introduced and a wetland created from drained paddocks. Most of the records pertain to planning and work on the ground, with some isolated monitoring undertaken at points in time only. It is recommended that an achievable form of monitoring be agreed on by DOC and FOMI for use over a longer period of time. Photo points have been useful for revegetation but may not monitor the success of future floral diversity actions.

Following the review of Waikoko wetland information, it is clear the wetland lends itself to a separate project brief. It is a small but complex hydrological system with siltation and weed challenges and will require specialist advice and potential monitoring before any further investment in floral diversity work.

Threatened plant work can continue using the information that is currently available. There are clear and relatively recent actions in the collated material (outlined in Appendix 5) and only require further discussion between appropriate DOC staff and FOMI before actions can be undertaken.

Utilising the plant lists and plans from the records, an initial list of potential new species has been drafted (Appendix 4) for assessment by botanical specialists in the following stages of this project. There is very little information in the collated material on the current state of existing floral communities and this report suggests they are re-surveyed by botanical specialists before any new floral diversity priorities are decided in the short term. There is much scope for DOC and FOMI led work to maintain the flora work already undertaken and therefore a re-survey will not inhibit opportunities for either organisation to continue floral diversity efforts on Mana Island in the interim.

[1] Mana Island Ecological Restoration Plan Review 2010. C Miskelly, Dept of Conservation

Project Background

Friends of Mana Island have been working with the Department of Conservation (DOC) on various restoration projects on Mana Island since 1998. The largest of these projects by volume and scope would be the revegetation work started in the late 1980's, involving several other community groups such as Forest and Bird, Wellington Botanical Society, Ngati Toa and local schools.

FOMI has an active interest in the long term development of these projects and following the 2010 review of the Mana Island Restoration Plan (1999)[2], one of the recommended actions to progress was the floral diversity of the island following several decades of propagation, primary and secondary planting and seed dispersal (see Appendix 1 for Floral Diversity Project Outline – stages 1-3).

Friends of Mana Island is funding this work, which has been made possible through a Wellington Community Trust – Heritage and Environment grant. The project is proposed in three stages. This initial stage has been primarily desktop, to:

- collate and review existing records
- assess the progress of revegetation using the documentation available
- provide pragmatic recommendations for volunteer involvement (refer Appendix 3) until the following stages of the project are undertaken.

Proposed stages two and three will cover ground-truthing, botanical surveys and a longer term implementation plan. This first stage will be used to inform the following two stages.

The information used for this stage has been sourced from Department of Conservation files (mainly Mana Island, District and Conservancy records), FOMI files, online websites and catalogues, personal files and short interviews with previous rangers, scientists and volunteers. The authors, Lisa Clapcott and Richard Gill have been previous rangers and programme managers for DOC offices administering work on Mana Island and are familiar with management approaches for the island and other Kapiti Coast and Porirua coastal reserves. They have worked with reserve management plans, implementing revegetation, weed control and freshwater protection. During Stage One, Lisa worked with the files, collation and report writing while working collegially with Richard on images, photo points, some technical aspects and reviewing.

This report has sought to identify gaps in the records and pursue those where practicable. Some monitoring and reporting records have been elusive and further work with Mana Island hard copies is recommended.

Re- survey existing communities and threatened species before setting floral diversity priorities

The Mana Island Restoration Plan and the 2010 review state that '*the primary restoration objective is to maintain those threatened species and communities that have survived on Mana Island within self sustaining eco-systems similar to those likely to have existed on the island before human contact'*. Therefore, a general survey of these communities is recommended along with site assessment of floral diversity for these and revegetated areas. There may be examples of decline, where the priority will be to protect and enhance one or more existing species before introducing any new species in the same community.

[2] Mana Island Ecological Restoration Plan 1999. C Miskelly, Dept of Conservation

Collation of Material

Initially, files and images had been organised by FOMI committee members, Linda Kerkmeester and Jason Christensen. These were mainly sourced from the DOC Waikanae Field Centre, Mana Island files and the DOC database. These have been supplemented with additional information sourced during this study by Mana Island hard drive files and discussions with past managers, island rangers, ecologists and volunteers (refer Appendix 2 for full list of people contacted in preparing this report).

At the completion of this stage, the information has been collated as follows:

Scan selected records with no digital counterpart

Hard copy — A4 folder for copies of the material sourced in hard copy during Stage One. These are mainly historic (and often unpublished) records, which may not have a digital counterpart. Scanning a selection of these is recommended.

A3 folder for copies of aerial maps and wetland designs

Digital — Flash drive containing an excel spreadsheet as a database of documents and weblinks, along with photo point files and various pdf documents saved during the work on this stage. The excel spreadsheet has several tabs separating the inventory into the three themes, along with tabs for relevant fauna documents and current gaps in the material. This spreadsheet has been set up as a living document, with scope to add entries over time. The intention is that this be superseded by another form of database or web repository in future, but an excel spreadsheet provides an accessible, simple database initially.

Explore a FOMI web database of floral diversity information

It has been discussed during Stage One meetings that the FOMI website could offer links to some of the files above. It is recommended that this be explored further as a FOMI task during the following stages.

Rationale for themes

There is a reasonably large body of information pertaining to this project and the collation could have been managed in several ways. As this review commenced, the material began to fall naturally into three main themes - Revegetation/floral diversity; Threatened Plants; and Waikoko Wetland.

As with all ecological information, there are inherent links between these themes but the collation of material into categories offers a structure to organise scattered material. Staff, volunteers and scientists have often run work in specific areas of interest and expertise so it is considered thematic collation will assist in ordering tasks, with the acknowledgement that occasionally this will not be the case.

Weeds could be an additional theme not covered in this brief. As weeds are an important factor influencing any revegetation project, it will be pertinent to consider specialist advice during the interim actions and following stages of this project. Temporary DOC weed rangers are employed for three months on the island to control priority weeds, with some assistance from mainland rangers. The focus of this work is to control the main environmental weeds[3]. Weed advice relating to any

[3] Mana Island weed reports can be sourced from DOC Wellington District staff.

floral diversity actions should be sought during ground-truthing and specialist input. Specific mention is made in this review of the weed threat in Waikoko Wetland as it does limit recommendations and potential progress at this stage of the project.

Review of Material

Restoration History

Following 150 years of modification for agriculture, the island was a challenging restoration project when gazetted as a scientific reserve in 1987. All farm stock were removed from Mana Island in 1986, leaving depleted soils and a few compromised bush remnants on cliffs and steep coastal gullies. There have been various levels of documentation during the restoration work over 28 years with a relatively large amount of material generated for the planning of revegetation and wetland design in the first decade.

The hard copy planning documents are fairly well represented from this time and, as digital records became the norm, hard copy records were not so prevalent. It is possible that once the initial planning was done, vast effort was put into implementation and it can be more challenging to record progress, as the demands of the work itself may have left less time for this.

Ecological Restoration Records

Although many of the documents and maps are enlightening and useful, they are often disconnected by time and circumstance. Ecological improvement is a long term undertaking and single projects have seen generations of specialists, managers, field workers and record takers. Organisational change, new priorities and unexpected opportunities often leave their mark on the records. This is somewhat evident in the variable records gathered on flora work for Mana Island. For example, many documents are not dated and it has taken time to analyse how they mesh chronologically.

The records show short summary reports on the revegetation programme were written from 1992 through to 2009 but formal design and specialist records seem to tail off during an intensive phase of physical work on the island. Although the written records hold a certain amount of useful information, experience lies dormant in the grey matter of those actively involved in the implementation of planned work over time and this is often lost to the records. DOC staff, scientists, and volunteers were contacted for additional knowledge during this stage (refer Appendix 2).

Vegetation Monitoring Methods

Search for full sets of vegetation monitoring data in Mana Is. physical archives

Various approaches can be taken to vegetation monitoring, assessing survival rates of particular species, prevalence and health at specific measured plots or transects over time. Monitoring protocols specify the methods to be replicated at each monitoring interval. There are some documents relating to vegetation monitoring in the late 1980's and from 2003/2004, but it is not clear that these sets of monitoring used the same plot or transect locations. Monitoring of transects from 1988 and (and secondly in approx. 2007) has yet to be undertaken as it is known that this monitoring was qualitative (how well the plants grew, rather than purely survival). The 2003/4 monitoring recorded species presence only so it is likely the protocols were different. The staff who undertook the early monitoring were unable to source the data from this work at DOC National Office and we suggest a search of the hard copy archives on Mana Island.

Revegetation and floral diversity

Comparisons with the relevant mainland site plant checklists and planting plans/records that are available suggest that many of the primary and secondary species suggested in early planning phases of revegetation[4] have been propagated and planted on the island already. Following discussions with past and present rangers responsible for implementing the planting, it is likely there has been some variation between planned species and quantities in specified areas due to:

- Managing plant placement with large plant volumes and many workers
- Success of seed collection and germination year to year
- Experience with repeated failure of certain species at certain sites or aspects, leading to adjustments in plant species and numbers planted
- Grass and weed species dictating labour and plant selection (planting preparation and weed competition was underestimated in planning phase)

In our experience, this is quite common as the realities of undertaking fieldwork do not always follow ecological ideals or plans to the letter. However, we know that, in general, many of the planned species have successfully been planted in the areas designated by the early plans. As detailed information on species success and mortality is sparse, ground-truthing will reveal if any particular species have struggled and are not well represented at this point. In the interim, releasing (and GPS recording) some species to increase light wells and growing space may be useful, if undertaken cautiously so as not to stress plants.

Release species requiring more light and space

The revegetation focus to date has been on shrub and tree species. There are fewer records for planted lianes, ferns or understory species. As the work on appropriate species for soil types has already been done, a logical next stage of the floral diversity project would be to consider appropriate lianes, ferns and sedges not yet seen on the planting records. Site visits by botanists/ecologists will be required to analyse whether planting these is appropriate and/or necessary, considering site conditions and current abundance. Some species may already be spreading from older remnants on the island now that there is more cover and young forest. It was noted in the comparisons with mainland sites that many of the lianes were occurring in openings in existing forest.

Botanical specialists to assess appropriate species in Stage 2

Appendix 4 lists some of the species applicable to Mana Island soil types[5] which have not featured on plant inventories during revegetation and/or were in low numbers on the original Botanical Society survey in 1984. This is not an exhaustive list but aims to provide FOMI and Stage 2 specialists with an initial list to assess. As part of the second stage of this project, it is recommended botanical specialists assess which species should be included, similar to that undertaken for Matiu-Somes Island in 2008 [6].

[4] Mainly designed by Robin Gay, DOC landscape architect, and Isobel Gabites, contract ecologist.

[5] Specifically two documents written for DOC by Isobel Gabites, 'Generalised Site Descriptions' and Notes for Mana Plantings', assumed late 1990's and based on assessments of mainland sites with similar soil types to Mana Island.

[6] 'Recommendations for secondary planting under forest and shrubland canopies on Matiu-Somes Island' by Peter Russell, 2008 (DOCDM 315270)

Threatened Plants

There are sufficient records outlining recommendations for threatened plant work to continue threatened plant efforts. The documents over time seem to reflect similar species recommendations, although early on there were some disagreements amongst specialists as to the appropriateness of one or two species. Several species listed for consideration in the original restoration plan have since been listed as inappropriate due to lack of suitable habitat, propagation technique or availability of propagation material.

Locate, GPS record and photograph threatened species

Records for the exact location and planting of threatened species are less apparent. Most of the threatened species identification or planting took place before GPS was commonplace in fieldwork. Mana Island hard copy files did hold some basic map information and only one GPS record has been found (for *Lepidium oleraceum*). Some sites are known as the information has been passed on between rangers and the sites are near the Lockwood, ranger houses and landing bay. Others have been discovered due to information from Mana Island hard copy files at the close of this stage of the project.

Release and monitor threatened plants where necessary

Grant Timlin, previous DOC ranger, worked with a group focused on threatened plants from the Wellington Botanical Society for a time (approximately 2006-2008), including Alan and Glenis Shepherd, Jill and Ian Goodwin, Barbara Mitcalfe, Chris Horne and Julia White.

Continue threatened plant actions listed in Appendix 5

John Sawyer, Conservancy (DOC, Wellington) technical Support Officer, re-visited the threatened species listed in the 1999 Restoration Plan and outlined whether these had been actioned, needed further work or were not appropriate considering current knowledge and site restrictions. This list, excluding the discounted species, is attached as Appendix 5. A new column has been added for comments following this stage and a site visit in November 2014. It is recommended that these actions are included in tasks to be followed up as subsequent actions arising from this review.

The records indicate that two other species, *Trisetum antarcticum* and *Lophomyrtus obcordata*[7], have been introduced to Mana Island.

Another threatened species which may be assessed for appropriateness on Mana Island is *Dactylanthus taylorii*. It is the only fully parasitic flowering plant in New Zealand's indigenous flora. DOC specialists are wary that there is no evidence of it's presence in the ecological district but there have been pollen grains found in coal deposits near Porirua dated between 180 and 50 000 years ago[8]

Further discussion with DOC specialists on *D. taylorii*

Recent work on *D. taylorii* suggests it may be a keystone species (with a variety of fauna visiting it) and it is found on many primary and secondary tree species. Due to this and Mana Island's lack of possum, its main threat, Mana Island could provide a predator free environment for the recovery of the species. Nga Manu Nature Reserve in Waikanae is considering introducing *D. taylorii* and there is potential for a FOMI / Nga Manu / DOC partnership in this case. We recommend further discussion with DOC specialists regarding this potential.

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[7] Refer DOC internal memo from Colin Ogle, Wanganui Conservancy to Wellington Conservancy, dated 9 October 1989. Copy located in Floral Diversity A4 folder.

[8] Refer 'The ecology of *Dactylanthes Taylorii* and threats to it's survival', NZ Journal of Ecology (1996)

Waikoko Wetland

Since it was created in 1998, the records for Waikoko Wetland were more numerous in the planning and development phase than in subsequent years. Several maps, aerial photos and landscape designs were produced in the late 1990's, mainly by DoC landscape architect, Robin Gay. The documents following this phase seem sparse and it is recommended that further investigation of the DOC database (DOCDM) and the Mana Island hard drive is undertaken. There was only time for a cursory look at closed files on Mana Island but there is certainly more material there that would be valuable. Files noted:

NHE-05-02 WNMI – 1 (1990-2003)
NHS-03-12-05 WNMI – 1 (2001 – current)

Review the current relevance of Waikoko wetland design with DOC staff

The wetland was designed to potentially create habitat for many species, including some threatened plant species. A series of ponds creating open water is unlikely to replicate the original wetland at the site but Mana island's potential may have driven the design for as broad a habitat as possible.

Wetland hydrology

The hydrology (how water moves through the system) of the wetland has been an issue since earthworks were first undertaken to create the wetland in 1998. The system was designed with some manual controls but it is not known how well that is working currently. In the past, efforts have been made to clear silt from culverts and ponds with machinery, which could conflict with any aspiration for flora to self sustain and regenerate naturally in the long term.

Undertake seasonal monitoring of Waikoko Wetland - water levels and quality. Search through Mana Is. hard copy archives.

Wetland plants can be particularly sensitive to water chemistry and seasonal variations in each part of the system are not well understood. A study of the water quality was undertaken by Catherine Chague-Doff of GeoEnvironmental Consultants in 2000, which recommended more seasonal studies before threatened plant work commenced in the wetland. There have been some attempts to monitor water levels but no records or data have been found at this stage. We recommend further searching of the hard copy archived files on Mana Island.

Some of the wetland ponds dry out completely at times and others are covered in floating vegetation (*Azolla rubra*) and these factors alone may limit further introductions of some flora and fauna species.

Google Earth footage may reveal some of the seasonal changes and a series of these have been included in the files. The atmospheric and light conditions affect the images somewhat but they also indicate the need for further monitoring.

Wetland weeds

Waikoko Wetland weed assessment required prior to new flora introductions

The wetland also creates prime conditions for vigorous weed growth and there is anecdotal evidence the exotic bindweed threat (either *Calystegia* or *Convolvulus* spp.) is increasing. Thus it may be counter-productive to consider investing in floral diversity work there, let alone threatened species until these weeds are controlled. As there are other areas of work which do not involve quite the same level of complexity, we recommend flora actions for the wetland are avoided until the hydrology, water chemistry, and weed threats are better understood.

Fauna requirements

Mana is an important site for many threatened fauna and it is imperative that the flora of the island is considered as part of a larger ecological context.

Takahe

Takahe habitat has always been a consideration in revegetation planning for the island. The records show a list and map of non-planting areas, to ensure enough grassland persists for at least 25 pairs of takahe. Some pairs of takahe favour the wetland area and this should also be considered as part of wetland planning.

Giant Weta

Cook Strait giant weta require a mix of grassland and tauhinu shrubland. There is sufficient habitat at present but the natural regeneration of planted tree species may need to be monitored to ensure this habitat persists. It is recommended that DOC advice be requested to gauge the need for this monitoring.

Goldstripe Gecko

Goldstripe gecko require corridors of flax in the wetland area and lower valleys. These have been established but should also be monitored for *phytopthora*, and any excessive damage incurred by flax weevil populations now that they are becoming established in the area. It was noted during a recent site visit that some flax in this zone are being shaded by increasing tree canopies and we suggest advice be gained from DOC as to whether there is enough flax thriving to sustain the goldstripe gecko population.

Fernbird

The records also suggest more wetland planting for habitat for North Island Fernbird (not yet introduced). This could be in conflict with takahe management as the grassed areas in the wetland seem to be favoured by them at times. The wetland could be improved by the addition of more *Plagianthus divaricatus* (saltmarsh ribbonwood) and *Olearia solandri* (Coastal tree daisy) but this would have to be weighed against any disadvantages for fauna species already established on the island, as would continued establishment of large wetland tree species such as Pukatea and Kahikatea.

Monitoring and mapping

Develop monitoring regime

Assess feasibility for a simple ongoing monitoring regime

In reviewing available material, the main gap identified is an easily achieved monitoring regime with robust records. Within the scope of this brief, more information has been sourced on the monitoring of the revegetation project. It has become evident that the project would benefit from further clarification of previous monitoring, as there are still missing data and records. A quantitative survey of grid plots was undertaken by international volunteers in 2003/4, where numbers of plants were counted in specific plots on a grid system. This was an opportunity to utilise labour offered at the time and did provide some training for participants. However, it used approximately eight new people each trip with an unknown variation in their plant ID skills, the information needs to be viewed with that in mind. It is possible the baseline data from DOC scientists, S Timmins, C Ogle and I Atkinson, in 1988 and follow up survey approximately 10 years later could provide simple transect lines to re-visit in future. Susan Timmins was unable to source the

Search Mana Island hard files for transect line data.

data from National Office archives but it is possible it is still amongst the Mana Island hard copy archives.

Photo point records

Label photopoints to match lists and continue recording photopoints at practical intervals

The photo point records collated at this point consist of four lists from 1986 through to 2013. These have reasonably consistent details for each point, with extra points added twice during this period as the revegetation progressed. There are some scanned and digital images which need to be assessed and labelled by people familiar with the photopoints to ensure the record is easily accessed in future. As the vegetation in some areas is well established, if the task to include all known photopoints is too onerous, a selected number of points could be agreed upon to ensure a record is kept over the long term.

Although Mana Island revegetation had begun in the late 1980's, the programme does not appear in 'Guidelines to the Development and Monitoring of Ecological Restoration programmes' written by Ian Atkinson in 1994 (DOC technical series No. 7), even though Ian had been involved in vegetation trials and monitoring transects there in 1988. It is noted that all conservancies responded to the survey for this report but no Wellington Conservancy projects appear in the document. It is possible the project was considered 'enhancement' or 'revegetation' at the time, rather than restoration, and was not included.

Alignment of map grid with NZTM grid

With the assistance of DOC District staff, we have ascertained that aligning the main grid system shown on hard copy maps in the records with the current NZTM system should be possible. DOC staff have requested assistance from National Office GIS staff. We will continue to communicate with DOC staff on the progress of this task.

Consistent terminology

There are several terminologies for sites used over time and this can be confusing assessing the planting documents and organisation of planting. Some relate to soil types, others to grid plots, others to larger zones on the island. Although further work could be done on this, it may not be necessary for the progress of this project. The complexity and scope of the planning documents versus the lack of qualitative data on actual planting and success of particular species could undermine any gains made by further desktop analysis of these records. Once current site surveys have been undertaken, an intimate understanding of how older planting records mesh may not be required for current floral diversity work to be planned.

Recommendations for Interim Volunteer Opportunities

Working through the records and discussing Mana Island's revegetation with various rangers and specialists, it has become clear that a precautionary approach to new flora projects will be necessary. There are still many options for volunteers for floral diversity work on the island, without necessarily creating too many new programmes in the next 1 – 2 years. However, vegetation monitoring is an area of work which FOMI could possibly improve the revegetation programme significantly, if ongoing, and inform floral diversity work in future.

Due to the lack of boat transport over recent years, the volunteer involvement on the island has decreased which has fortuitously coincided with the completion of

planned revegetation of 500,000 plants, along with infill planting taking place. It would be advisable to move ahead with easily achievable volunteer opportunities initially, to gauge support and allow for incremental growth. It is often trip co-ordinators who shoulder much of the work and a slow approach will allow FOMI and DOC to ease back into island trips without overloading either organisation.

However, it is acknowledged that a certain number of trips should be offered for existing and new volunteers to remain engaged. If island trips can be co-ordinated with mainland opportunities, bad weather contingency options are created while also increasing public knowledge of the island's connections to the mainland; for example, visiting mainland sites of relevance to the work such as Karehana Bay and Whitireia Peninsula (to undertake seed collection and threatened plant identification). It is possible that demand for the mainland activities would not equal that of island trips but it could be worth trialling the concept for a year.

Appendix 3 outlines the volunteer opportunities which may be meaningful in the short term, based on the information gathered in this stage.

[*Note that these options have yet to be reviewed with DOC staff and the full FOMI committee and are subject to the inputs and priorities of both organisations*].

APPENDIX 1

PROJECT BRIEF
For FOMI: Enhancement of Floral Diversity for Mana Island

Overview

This proposal outlines an approach to progress three related projects that were identified in the Mana Island Ecological Restoration Plan review by Colin Miskelly (DoC) in 2010. These include the enhancement of floral diversity, threatened plants and wetland enhancement projects. This proposal has been informed by documents, maps and data held on file by DoC, including material recently relocated (May 2013) from the island and held in the Wellington conservancy. A brief review of this material has provided an understanding of historical surveys, data and recommendations that will need to be reviewed and updated as part of this project.

In reviewing the existing documents, although still in an uncollated and fragmented state, it was useful to note that there is much relevant information and data already recorded that will provide a sound basis for undertaking these projects. This avoids the need to 'reinvent the wheel' to a large degree. Collating and reviewing this information will be a necessary first step in the process. The two stages that follow will need to refine this data to update the records, 'ground truthing' as relevant, thus enabling a clear implementation strategy to be developed for future actions as required.

The first stage (collation & review) is the subject of this proposal. The outputs from this stage will deliver a strategy for the subsequent two stages to follow. It is anticipated that subsequent stages would be undertaken with specialist input (in terrestrial and aquatic ecology) to refine the required tasks and develop a clear implementation plan, based on sound empirical evidence to enhance the island's floral diversity into the future.

Background

The following is an extract from a project brief initially developed by Colin Ryder (past FOMI President) in 2010 for the enhancement of the floral diversity and threatened plants for Mana Island. It outlines some of the background and objectives of the island's restoration. At that stage the brief did not include the wetland enhancement as part of this project, but it appears logical to include any planting to enhance the habitat value for the wetland flora and fauna within this project. It is expected that a wetland hydrology review will be undertaken as a future action arising from this strategy.

Colin's extract as follows:

> "Currently, the island's restoration is guided by the *Mana Island Ecological Restoration Plan.* In accordance with this Plan, the primary objective of the restoration is to:

"... maintain those threatened species and communities that have survived on Mana Island within self-sustaining ecosystems similar to those likely to have existed on the island before human contact".

In order to achieve this outcome, the restoration programme has included projects and activities to:

- recreate coastal forest, shoreline, cliff and wetland plant communities typical of the Wellington coast and similar to those expected to have occurred on the soils and landforms present on Mana Island; and
- establish self-maintaining populations of threatened plants of the Wellington coast of Cook Strait appropriate to the habitats present on Mana Island.

The restored forests and shrublands on Mana Island were designed to replicate the structure and composition of forest remnants growing on similar soils on the nearby mainland. So far, over 500,000 seedlings have been planted during the last two decades or so over approximately 85.5 ha at a density of approximately 6,000 plants per hectare. Most of these have been pioneer species although about 32.6 ha have been under-planted with species that require shelter or shade to establish. It is not proposed to substantially increase the area to receive initial plantings.

The restored forests and shrublands are understandably immature and lack the floristic and faunal diversity found on e.g., Kapiti Island. Some plant species that could provide habitats or food for several fauna that could otherwise be considered for reintroduction to the island are missing. Some species of plants, birds and insects may colonise naturally as the forest matures, but many species will have to be re-introduced. In the absence of ongoing planting, faunal introductions and some weed control, Mana Island forest may never achieve the structure and complexity of a sustainable ecosystem. It is envisaged that several decades of growth and management will be needed to achieve this objective."

Proposed project stages

A three stage process is proposed which becomes more specialised and detailed as each stage is developed and information is verified. These are broadly outlined as:

Stage One: Collate & Review Existing Data;

Stage Two: 'Ground-truthing' and recommendations based on updated surveys;

Stage Three: Implementation Plan – provides detailed action plans on how to apply the recommendations over time

The outputs for each stage are elaborated further as follows:

Stage One: Collate & Review Existing Data

This stage will enable a database to be created which will be used to inform the following stages. It will involve:

- Using the latest map grid for the island (based on NZMS grid – on which GPS is based)
    - Note that a 2004 Global Volunteers survey was based on a different grid, so will need to be reconciled with the NZMS grid to enable newly obtained GPS units to be effectively utilised – it is clear these will prove invaluable for accurate monitoring and recording.
- Comparison of the existing island vegetation with comparable ecological sites (including wetland) on the mainland to what is actually growing on the island. This will provide an initial assessment of what is under-represented or missing on the island.
    - These mainland sites have been previously identified and surveyed (Ogle 1985, Gabites 1994) but will need to be reviewed/updated since the island was last surveyed in 2004. This may include the need to locate additional sites on the mainland as some time has passed since last surveyed and composition of species may have altered due to degradation.
- Discussions with relevant people (rangers, DoC managers and volunteers) who have undertaken any planting, seed dispersal, significant maintenance; to ascertain changes in method or species planted, that may have occurred since last surveyed

This data will be collated (hard copies held by FOMI, originals returned to DoC) into a file format that can be directly translated into a brief for the next stage. Good record keeping will be critical to avoid the need to replicate this process in the future.

Stage Two: 'Ground-truthing' and Recommendations

It is currently envisaged that this stage will consist of on-ground botanical surveys on both Mana and selected comparable ecological sites on the mainland as identified in stage one. It may require some verification that current sites are still relevant, as noted above. Surveys will be undertaken to ensure any proposed strategy relates to what is actually on the ground, considering that nearly 10 years have passed since the last comprehensive survey was undertaken on which current planting recommendations are based.

This will enable a clear strategy and reasoning, based on empirical evidence, to be developed for new species introduction. It may include recommendations for removing some existing predominant vegetation to create new sites for plant communities that are currently rare or missing on the island. These recommendations will need to consider the enhancement of habitat to support current and possible future fauna communities.

It is proposed that this stage will be undertaken by a specialist botanist with assistance from experienced volunteers, with anticipated opportunities for training new volunteers.

Stage Three: Implementation Plan

This final stage will provide a forward-looking plan (20 years +) that details what to plant where and how to manage this. It will include actions such as:

- Indicative planting schedules (with maps, based on GPS grid layout)
- Recommended eco-sources + plant propagation advice
- Site preparation + maintenance requirements
- Specific advice on threatened or keystone species

- Monitoring & recording – to maintain good records to allow refinement of methods to maximise plant survival and establish healthy plant communities

Estimated Costs

The above outlines the proposed sequence of work, with each stage informing the next. Having viewed the current material, it is expected that selective collation will minimise any doubling up of data collection in stage two so that any updated surveys are directly relevant and focussed on the questions arising from stage one. For example, are there any gaps in the grid survey undertaken in 2004 and is there a clear explanation for this?

Stage One: Collate & Review Existing Data

A draft for costs of the first stage is estimated at 20 days

As this would essentially be a desktop study, no boat trips are anticipated, however this may be considered necessary.
Photocopying costs and travel to meetings would be itemised as disbursements along with any other reasonable costs considered necessary to undertake this work.

Stages Two and Three

Budgets for these stages are yet to be determined and will depend on the outputs of Stage One

Conclusions

An initial review of the existing documents held by Doc was undertaken and shows that much relevant data exists to inform and enhance this project to enhance the floral diversity of Mana Island. Three stages of work are proposed to review this existing data, the first being to collate and review that data to inform subsequent stages, as outlined.

Stages two and three will develop a clear strategy with tasks to define action lists for specific areas from year to year. One significant outcome of this work is to enable planning of specific volunteer input on which to base boat trips and volunteer numbers within specified dates. Accurate recording and monitoring will be important to allow refinement of methods to maximise plant survival and ensure efficient use of time, energy and costs.

END

APPENDIX 2

Staff, specialists and volunteers contacted during stage one

Contact name	Role	Period of involvement
Colin Miskelly	Former DOC Technical Support Officer – Wellington Conservancy (still involved in translocation work)	1992 – current
Jeff Hall	Current DOC Mana Island Ranger	2012 – current
Jason Christensen	Former DOC Mana Island Ranger and current FOMI committee member (still involved in translocation work)	1994 – current
Grant Timlin	Former DOC Mana Island Ranger	Various ranger contracts (1996 – 2009)
Sue Caldwell	Former DOC Mana Island Ranger	2006 - 2012
Di Batchelor	Current DOC temporary employee - weed control and cover ranger	Various temporary ranger contracts (1999 – current)
Trevor Hook	Former Mana Island Ranger	1986 – 1993
Ian Cooksley	Former Kapiti Area Manager	1996 – 2010
Jeremy Rolfe	Former DOC Technical Support Officer – Wellington Conservancy. Currently Technical Adviser Flora, technical DOC roles also)	1987 - current
Graeme Lacock	DOC botanist/ecologist	1987 – current (occasional)
Colin Ogle	Former DOC ecologist	1988 - 2000
Darlene Adams	Former FOMI committee member and volunteer weed team leader (still co-ordinating membership database)	2005 - current
Alan Corry	Volunteer with knowledge of seed collection	1990 - 2000
Sue Chesterfield	Volunteer with knowledge of seed collection	1990's

APPENDIX 3

Interim recommendations for volunteer opportunities

Revegetation/ Floral Diversity
Explore a FOMI web database of floral diversity information
Digital scanning of selected historic documents that are currently only in hard copy
Re- survey existing communities before setting floral diversity priorities
Bi-annual photopoints (using baseline points, GPS and bearings). These could be taken less often given the age of plantings. However, tasking these every two years will keep volunteers in tune with point locations and GPS software etc. Annual photopoints could be required for any new experimental floral diversity work in future.
Further searching in Mana island files and possibly older DOC archives for full sets of vegetation monitoring records
Assess feasibility for FOMI to monitor a selected number of plots per year or bi-annually (either existing plots or new ones set up for floral diversity plantings/leaf litter areas)
Transferring small volumes of leaf litter from the original forest gully to a small number of planted sites to introduce microbiology that may be absent from the planted sites and monitoring to see if there is a difference in seedling numbers over time.
Identifying and GPS recording light wells in plantings for appropriate secondary species (Mid 2013 storm created many new ones).
Release tree species that may require more light to thrive (Eg, Kohekohe). May require some training (refer Matiu Somes guideline)
If there is interest, foster a FOMI team with an enthusiasm for plants to take on some tasks but also gain an intuitive understanding of the plant progression on the island. This team could potentially run a number of plot monitors a year.
Investigate acquiring new aerial photo as per A3 photo in files looking north from SE corner (member contacts?). This would create a powerful 30 year aerial photopoint.

APPENDIX 3 (continued)

Interim recommendations for volunteer opportunities

Threatened Plants
Approach Alan Shepherd and Colin Ogle regarding a site visit with floral diversity project leads (and possibly 2nd stage specialist or Botanical Society) to assist with threatened plant check (photograph and GPS sites)
Threatened plant releasing and monitoring
Search lighthouse site and track edges for Leptinella Nana (clifftops - H&S?). Create GPS records
Increase the existing threatened plant areas to create points of interest. Ideally this would also be in conjunction with controlling pressures where they could sustain a more natural occurrence and range.
Site visits to mainland sites of relevant threatened species, (with botanists or managers of conservation programmes, if possible) to gain knowledge of species needs and availability before considering new or increased threatened species sites on Mana Is. Mainland workshops - Allan Corry, Alan Shepherd, Brent Tandy, Jeremy Rolfe, Graeme Lacock, Robyn Smith?
Actions listed in threatened plant list above (Brent Tandy and Jeremy Rolfe to advise)

Waikoko Wetland
Review the current relevance of Waikoko wetland design with DOC
Further work searching Mana Island archive files on Waikoko Wetland monitoring data
Water monitoring – chemical/ph (training required)
Water monitoring – water levels (training required?)
Photopoints during seasons
Brown Teal monitoring

APPENDIX 4

Potential Mana Island floral diversity species (requires ground truthing by botanical specialists)

Species name	Common/maori name	Common on mainland Soil type (if recorded)*	Propagation note	General comment
Lianes				
Metrosideros perforata	White rata, akatea	Pm/PmH/Pf/TwS/TiH	Ideally seed sown when fresh or dry store 3 months	Should cope with dry Mana conditions well once established
Metrosideros diffusa	White rata	Pm/PmH	As above	
Ripogonum scandens	Supplejack	Pm/PmH/TwS	Cool moist stratify 2-3 mths before sowing	
Parsonsia heterophylla	NZ jasmine	TwS/TiH/Pi/Pf	Cool moist stratify 1-2 mths before sowing	Not on lists but has been planted on Mana at some stage
Clematis forsteri	Forster's clematis		Clematis germination can be erratic	Possibly increased since BotSoc survey
Freycinetia bauriana spp. Banksiii	Kiekie	Pm/PmH	Sow when ripe	Rats target flowers/fruit
Ferns				
Asplenium gracillimum	Hen and chicken fern	TwS/TiH	Collect ripe sori in growing season	
Asplenium hookerianum	Hookers spleenwort	Pm/PmH/TwS/TiH	Collect ripe sori in growing season	
Asplenium flaccidum	Hanging spleenwort	TiH/TwS	Collect ripe sori in growing season	
Asplenium bulbiferum	Pikopiko	Pm/PmH/TiH	Collect ripe sori in growing season	
Arthropteris tenella	Jointed fern	TwS	Collect ripe sori in growing season	
Blechnum filiform	Thread fern	Pm/PmH/TwS/TiH	Collect ripe sori in growing season	
Cheilanthes sieberi	Rock fern		Collect ripe sori in growing season	Dry rocky habitats (low veg)
Cyathea dealbata	Tree fern, ponga	Pm/PmH/Pf/Pi	Collect ripe sori in growing season	
Cyathea medullaris	Mamaku	Pf/Pi	Collect ripe sori in growing season	
Lastreopsis velutina	Velvet fern		Collect ripe sori in growing season	
Microsorum pustulatum	Hounds tongue fern		Collect ripe sori in growing season	
Microsorum scandens	Fragrant fern	Pm/PmH/TwS	Collect ripe sori in growing season	
Pellaea rotundifolia	Round leaved fern	TwS/TiH	Collect ripe sori in growing season	
Pteris macilenta	Sweet fern		Collect ripe sori in growing season	Young plants transplant readily
Pyrrosia eleagnifolia	Leather-leaf fern	Pm/PmH/TwS	Collect ripe sori in growing season	Grows well in dry situations

* Refer two documents written for DOC by Isobel Gabites, 'Generalised Site Descriptions' and Notes for Mana Plantings', assumed late 1990's and based on assessments of mainland sites with similar soil types to Mana Island.

APPENDIX 4 (continued)

Potential Mana Island floral diversity species (ground-truthing by botanical specialists required)

Species name	Common/maori name	Common on mainland Soil type (if recorded)*	Propogation note	General comment
Grasses/Sedges				
Carex raoulii	Coastal forest sedge		Ideally sow when ripe or stratify 1 month	
Lachnagrostis filiformis	NZ wind grass		Easy germination from fresh seed	Can be prolific
Uncinia uncinata	Hook sedge	Pm/PmH/TiH	Ideally sow when ripe or stratify 1-2 months	
Herbs/Orchids				
Acaena anserinifolia	Bidibid, Piripiri		Ideally sow when ripe or stratify 1-2 months	Red/ pink, white flowers
Astelia fragrans	Bush flax		Clean and sow fresh or cool moist stratify 1-2 months	
Earina mucronata	Bamboo orchid			Orange yellow flowers
Helichrysum filicaule	Creeping everlasting daisy		Can be difficult from seed. Cool moist stratify 2 months	
Libertia grandiflora	NZ Iris		Germination takes 5-6 months	
Microtis uniflora	Onion leaved orchid		Easy germination	Can be prolific/invasive
Peperomia urvilleana	Peperomia		Sow when fresh. Seed can potentially be collected much of year	
Schleranthes biflorus	Canberra grass		Dry store seed 1-2 months	
Dicot trees and shrubs				
Coprosma areolata	Thin leaved coprosma	Pm/PmH/TwS/TiH	Coprosma seed does not keep well in dry storage	Purple/black fruit
Coprosma crassifolia			Coprosma seed does not keep well in dry storage	Green flowers
Lophomyrtus bullata	Ramarama		Easily grown from fresh seed	White flowers

* Refer two documents written for DOC by Isobel Gabites, 'Generalised Site Descriptions' and Notes for Mana Plantings', assumed late 1990's and based on assessments of mainland sites with similar soil types to Mana Island.

APPENDIX 5

Threatened plant action list (with additional 2014 comments)

Species/action advocated	Current situation (2006)	Comment (2006)	2014 comment (based on files and November 2014 site visit)
FOREST / FOREST EDGE			
Trees, shrubs, lianes			
Dodonaea viscosa	Actioned.	Part of general planting programme	Many sighted
Entelea arborescens	Actioned.	Part of general planting programme	Several sighted
Ileostylus micranthus	Not actioned	**Attempt establishment if host plants available.**	**Still to action**
Rhabdothamnus solandri	Not actioned	**Action:** Source Battle Hill.	**Still to action**
Sophora microphylla	Actioned	Part of general planting programme	Sighted? Query re. S. molloyi
Streblus banksii	Actioned	Part of general planting programme	Many sighted on site visit
Tupeia antarctica	Actioned	Trial placement on Pittisporum tenufolium and Pittsporum eugenioides. **Continue attempts.**	Need to identify and record site/s.
Ferns			
Anogramma leptophylla	Not actioned	Plants found on Mana Island. **Resurvey September 2007.**	Searched briefly but more specific location detail required. Re-survey.
Doodia squarrosa	Actioned	Planted in threatened species garden and forest gully.	Re-survey (one fern in lockwood garden a possibility)
CLIFF / SHORELINE			
Trees, shrubs, lianes			
Clematis afoliata	Not actioned	**Action**	**Still to action**
Discaria toumatou	Under action	Plants received 2006. **Continue efforts.**	Searched briefly but none found. More location info and search required. Possible confusion with boxthorn and destroyed.

APPENDIX 5 (continued)

Threatened plant action list (with additional 2014 comments)

Fuchsia perscandens	Actioned	House valley, Plants ex Taupo Nursery. Between office and rear house.	Grant Timlin gave a location of between the office and top house.
Hebe elliptica var. crassifolia	Actioned	Several sites, plant material ex Titahi Bay.	A few plants sighted – at lockwood and southern Tirohanga track.
Melicytus obovatus	Actioned	Several sites, plant material ex Titahi Bay.	A few plants sighted – at lockwood and top house.
Muehlenbeckia astonii	Not actioned	Not actioned	Actioned. Several plants sighted at landing bay but only one plant at each of other group plantings known.
Pimelea aridula	Actioned	Planted in stock garden and on coastal faces.	Pimelea seen on southern Tirohanga track edge – awaiting confirmation from Jeremy Rolfe.
Rubus squarrosus	Not Actioned	**Action**	Actioned since. Searched briefly but none found. More detailed location needed and further search required.
Scandia geniculata	Not actioned.	**Action**	**Still to action**
Sophora microphylla	Actioned	Hole in the rock area, (Colin Ogle 1984)	Several plants sighted. S molloyi query with Jeremy Rolfe.
Tetragonia tetragonioides	Not actioned.	**Action.** Source Petone.	**Still to action (T. implexicoma already common)**
Herbs			
Atriplex cinerea	Not actioned	**Action.** Source Nelson/Marlborough.	**Still to action**
Euphorbia glauca	Actioned	Landing beach. (Ex Kapiti Island.) **Continue efforts.**	Several plants sighted in landing bay area but not as numerous as previous visits 2011/12
Lepidium oleraceum	Actioned	Rock stack and stock garden. (**Awaiting seabird colony establishment to provide necessary soil conditions.)**	Rock stack plant still present. Tree fallen over landing bay plantings. Other sites still require searching

APPENDIX 5 (continued)

Threatened plant action list (with additional 2014 comments)

Leptinella nana	Actioned	In stock garden and various sites. **Continue efforts.**	Sighted at lockwood garden and entrance to office (bottom door). Latter in better health.
Rumex neglectus	Not actioned	**Action**	**Still to action**
WETLAND			
Brackish			
Carex litorosa	Actioned	In stock garden and in wetland south of potting shed.	Search required
Freshwater			
Gahnia rigida	Actioned	Planted in Waikoko Wetland	Search required. Possibly destroyed by pukekos