

Horton's Road Wetland Management Plan

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Background

The property was purchased by Doug and Marita Hattersley as one of three sections created by subdivision. Because a wetland was present, conditions of subdivision included the production of a Management Plan for the wetland, no wetland drainage, and no clearance of native vegetation except the minimum required for the crossing. These conditions were not met (at least in part) by the subdividers, but subdivision proceeded nonetheless. The Hattersleys now wish to subdivide their section, but some concerns have been expressed by the Department of Conservation (DOC), especially that the conditions of the previous subdivision were not met by the original subdividers. DOC would like to see some certainty that any conditions placed on the Resource Consents are actually complied with. To address these concerns this plan sets performance targets to be met before new titles can be issued.



Introduction

The purpose of this Management Plan is twofold; first to guide the landowner (and future owners) in the restoration and management of the wetland and second, to provide a mechanism whereby concerns relating to the subdivision of the existing section can be addressed through the setting of performance targets for restoration which will act as triggers for the final signing off process for subdivision.

An initial report has already been prepared for the wetland on this property as part of the Tasman District Council's Biodiversity Advice Service. This report forms Appendix 3, and serves as the background to this plan. Some inaccuracies in the original report have been corrected in this version. The original report provided an overview of the wetland; including wetland classification, a description of the communities, wetland functions and values, and management issues and recommendations. This plan provides details in relation to specific management issues. The Management Objectives are discussed first, then the Management Actions, before a brief discussion of Performance Targets.

Management Objectives

The current state of this wetland is that it has been very highly modified to the extent where less than 5% of the canopy cover consists of native species. This situation is neither good for the wetland nor desirable in terms of attractiveness to potential purchasers.

The management objectives for the property are:

Objective 1 - To restore the wetland and surrounds to a natural condition in both appearance and function

This is the primary objective and will require by far the most effort. The major components of restoration will be weed control and revegetation.

Objective 2 - To make the sections more attractive to potential purchasers

The current appearance of the wetland and surrounding area is unattractive and needs considerable improvement to attract buyers. Weed control and revegetation are the main tools to be used to tidy the appearance.

Objective 3 - To minimise any damage to the wetland resulting from subdivision activities

The main issue here is sensitive design and construction of the wetland crossing. It is critical to avoid major changes to the hydrology of the wetland, as well as minimising damage to wetland vegetation. Sediment from construction activities also needs to be kept out of the wetland.

Objective 4 - To provide long term protection for the wetland and surrounds

There will be a substantial commitment of resources and expenditure to complete the restoration of the wetland. In order to ensure that the wetland continues to be well managed it is intended to covenant the wetland.

Objective 5 - To satisfy the concerns of interested parties that subdivision will adversely affect the wetland

The current state of the wetland coupled with the amount of work to be done and the lack of action from the previous subdivision have combined to give rise to concerns on the part of DOC that the proposed work may not be carried out and that there will be adverse effects on the wetland. In order to satisfy these concerns performance targets for key management actions are provided.

Management Actions

Implementation is outlined under headings derived from each of the objectives of restoration; aesthetics, minimising subdivision impacts, long term protection, and performance guidelines. In the next section performance targets are established, and a work plan provides details of how much work will be required, at what times of the year. Detailed costings are provided in Appendix 2.

Restoration

By far the majority of management effort for the property will be required for restoration. The key components of restoration are weed control and revegetation.

Weed control

| Species | Area |
|-------------------------|---------------|
| Large crack willow | 0.20ha |
| Mixed grey/crack willow | 0.20ha |
| Small grey willow | 0.67ha |
| Large grey willow | 0.11ha |
| Total Willows | 1.19ha |
| Gorse | 0.50ha |

The main weed species present are Grey willow, Crack willow, gorse, broom, blackberry, and Himalayan honeysuckle. The distribution of the main weed species is mapped on the opposite page. The table on the left gives the approximate area for the weed areas shown on the map. Willows occupy about 1.2ha, while the total area of weeds present is about 1.7ha. For the purposes of this exercise weeds can be considered in three groups; [willows](#), [woody weeds](#), and [vines](#).

Willows

The environmental impacts of willows are very significant in this wetland. They are shading out and displacing the native wetland species. Left unchecked willows will dominate even more completely than the current situation. They also transpire large quantities of water, drying out the wetland and making it more vulnerable to invasion by other weeds. Because they are deciduous, they drop very large quantities of leaf litter into the wetland, which reduces water quality. Grey willow are considered to be the weed which presents the biggest problem to New Zealand wetlands. It is not so widespread in Nelson compared with areas such as Waikato and Canterbury, and this is the largest known infestation in Nelson.

The large crack willows (bottom right) are not considered a serious problem and they contribute some aesthetic value to the existing access road. In the short term some thinning of those trees which front on to Horton's Road is recommended to allow the regenerating natives below the opportunity to expand as they receive more sunlight. This will create a more natural appearance from the road. Any large crack willow which are to be removed will be poisoned and allowed to die before they are removed. Small crack willow will be treated as for small grey willow, but the cut trunks will be removed.



Weed control (Cont.)



Weed control (Cont.)

The objective for grey willow is total extermination from the wetland. All will be treated with Glyphosate, either painted on the stump for small trees or inserted in frills in the trunk for larger trees. The use of Metsulfuron (Escort) and Picloram (Vigilant) was investigated but Glyphosate is preferable in wetlands because it has lower toxicity and half life in the soil. The small trees will be cut with a hand saw (many are 10 - 25mm diameter) and painted with straight Glyphosate in autumn. The grey willows near the southern boundary are on the route for the proposed road crossing. The road crossing is scheduled to be put in place in the summer/autumn of 2005 (subject to consent), so these willows will be treated in the early summer of 2004 so that they have time to die off before the road crossing goes in. This will serve the purpose of limiting the opportunities for the willow to spread and to allow increased light into the wetland to encourage growth of the natives which are currently being suppressed by heavy shade. This will avoid a sudden change of light intensity, which tends to favour introduced weeds.

Woody weeds

These include gorse, broom, pine, and Himalayan honeysuckle. They are in three locations; on the west side there is a large area of gorse with patches of broom, scattered through the wetland are isolated gorse, pine, and Himalayan honeysuckle, while adjacent to the road is an area where there is gorse in significant numbers mixed in with grey willow.



The west side has large stumps amongst the large area of gorse (left) which have prevented any mowing of the area, which is the management regime for the hills on this side. The intention is to use a digger to bury the stumps and mulch the gorse, creating a clear planting area. Particular care will be taken to ensure that the topsoil is left at the surface. The mechanical

clearance of weeds will take place down to the edge of the wetland, marked with an arrow on the photo above. Immediately after this mechanical work is completed, the strip adjacent to the wetland will be planted up, and the remainder will be contoured to allow mowing. Planting will maximise the chances of suppressing the regrowth of gorse.

Weeds in the body of the wetland will be controlled during the grey willow control operations. As they are encountered they will be cut at the base with the cut pieces placed over the stump to prevent regrowth. If they are unlikely to be shaded out in the short term (as in the photo to the right) the stumps will be painted with Escort. Woody weed control adjacent to the road is covered under the section on aesthetic improvements.



Vines

The vine weeds include blackberry and *Muehlenbeckia australis*. While *Muehlenbeckia* is a native, in this situation it can be regarded as a weed. It is a light loving climber, which has the potential to cause problems in this situation. When grey willow is removed it will cause an increase in light intensity which will result in a rapid expansion of *Muehlenbeckia*. Blackberry is a similar weed, but does not have the ability to grow as high as *Muehlenbeckia*. Both will be controlled by cutting and painting the stumps with Escort.

Revegetation

The key areas for revegetation are a strip on the western side, the body of the wetland, and the area between the road and wetland. In addition, some planting is proposed between the two sections which border the wetland - this is covered in the aesthetics section. The eastern and western strips are shown below.



Revegetation (Cont.)

The western strip is the area between the wetland and a natural change in slope about 10 - 15m upslope. A typical view of this strip is shown below. Currently it is mostly in young dense gorse. This strip will be planted up as a buffer zone on the edge of the wetland after it has been cleared of gorse. Very few native plants are currently growing in this area, and it all will need planting.



The roadside strip is a mixture of gorse, willow, and regenerating native species. It will require a combination of weed control, releasing the existing natives, and planting to create a buffer on the road side of the wetland. The buffers on each side of the wetland will provide habitat for birds, improve the appearance, and prevent sediment reaching the wetland.

The main body of the wetland is also a mixture of willows, other weeds and native species. The photo below right shows the understory beneath tall crack willow. This understory requires releasing from heavy shade then it will rapidly expand. The main tool for re-establishing native vegetation in the wetland will be weed control. It already has most of the plants necessary, but in areas of very dense willows (below left) there may need to be some replanting.



Spacing

The area occupied by each of these potential revegetation sites is shown in the table below. It also indicates approximately how many plants would be required to plant the sites at varying spacings. Recommended spacing for wet sites is about 2m between plants, for dry sites about 1m, and for most sites 1–1.5m. The estimates of plant numbers incorporate the spacing above and make allowance for existing plants. In general, the drier the site the closer the spacing. If all the sites were planted up at the recommended spacing, a total of about 5,200 plants would be required. The western strip will be fully planted up, while the roadside strip will be planted much less densely because there are reasonable numbers of natives present. The wetland will not require large numbers of plants, but some will be necessary where weed density is high. An allowance of 600 plants has been spread across the sites for failures in the first year; these will be planted in 2006.

| Site | Area (ha) | # Plants –1m | # Plants–1.5m | # Plants 2m | Estimate |
|----------------|---------------|---------------|---------------|--------------|--------------|
| Western strip | 0.24 | 2400 | 1600 | 1200 | 2400 |
| Roadside strip | 0.30 | 3000 | 2000 | 1500 | 1150 |
| Wetland | 0.67 | 6700 | 4500 | 3350 | 600 |
| Gully | 0.21 | 2100 | 1400 | 1050 | 1650 |
| Total | 1.42ha | 14,200 | 9,500 | 7,100 | 5,800 |

Timing

Once planted, the key stresses on plants are lack of available water, shelter, and frost. Timing of planting can help alleviate some of these stresses, and may also assist in spreading the workload. Autumn plantings allow the establishment of a good root system while there is still some growth, which helps the plant get through the dry summer typical of the Moutere area. However there is full exposure to the winter frosts, which can be severe in places. Spring plantings avoid the frost but allow little time for root development before the summer. They can be useful where there is plenty of moisture available. Plants in damp conditions tend not to thrive over the cold of winter. Plantings in any wet areas are probably best in spring (September). Any plantings on drier sites would benefit from the extra root development which comes from early plantings (after the rains have come in late April/May). Every site is different and it is worthwhile to trial different planting times. The

western (shown right) and roadside strips are probably best planted in autumn, while spring planting may be best for the wetland.



Appropriate species

Each of the planting sites has a group of species best suited to the site. The table below provides suggestions for planting in each of the sites, both for initial plantings and for later when more shelter and shade has been established. This is not an exhaustive list, but will be sufficient to establish a framework of vegetation in each of the sites. Although this is not a full representation of the original communities, these species have a proven revegetation record and will create a functioning ecosystem which will allow the development of more natural communities over time. Full revegetation lists produced by DOC are appended to the report.

| | Western edge | Roadside edge | Wetland |
|-------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------|
| Initial plantings | Karamu Kohuhu Lemonwood Mapou Manuka Tree lucerne Flax Toetoe | Karamu Kohuhu Lemonwood Mapou Manuka Tree lucerne Flax Toetoe | Flax Cabbage tree Manuka <i>Carex secta</i> Toetoe |
| Later plantings | Wineberry Pigeonwood Mahoe Marbleleaf Black beech Kahikatea Cabbage tree | Wineberry Pigeonwood Mahoe Marbleleaf Black beech | |

Preparation and maintenance

The key issue with many new plantings is to minimise moisture competition from grass and woody weeds. Spraying, scarfing, and mulching are some of the techniques used to address this issue. In the case of the western and roadside strips preparation will be mulching by machinery. Within the wetland many plants will be interplanted so preparation will be less of an issue than many sites. New plantings can be mulched using cut willows and gorse to assist their early survival. The most common mistake is to plant more plants than can be maintained. Normally plants need to be weeded for two growing seasons, and experience has shown that it is more productive to look after a smaller number of plants well rather than a larger number of plants poorly. Details of planting and maintenance schedules are included in the Work Programme. The photo below shows two year old plantings in a damp Moutere Gully.



Planting strategy

The key consideration for any planting on this property is that the preferred deadline for completing planting is May 2006. In order to get the maximum time for maintenance the vast majority of plants will be planted in 2005. This takes advantage of the clearing of the weeds on the western and roadside strips, and also the clearance of willows from the wetland. Planting as soon as possible after weed clearance maximises the chances of the new plantings shading out weeds. One of the key considerations for restoration on this property is the contribution that the plantings could make to landscape values. From the house sites virtually all of the plantings will be visible. This is further discussed in the aesthetics section. In the long term, when shrubland is established, plantings could provide a corridor for birds to travel to and from the house sites. Research has shown that a number of bird species (bellbird especially) do not like travelling across open areas and establishing a corridor will allow the full range of birds to be seen around the houses.

Plant sourcing

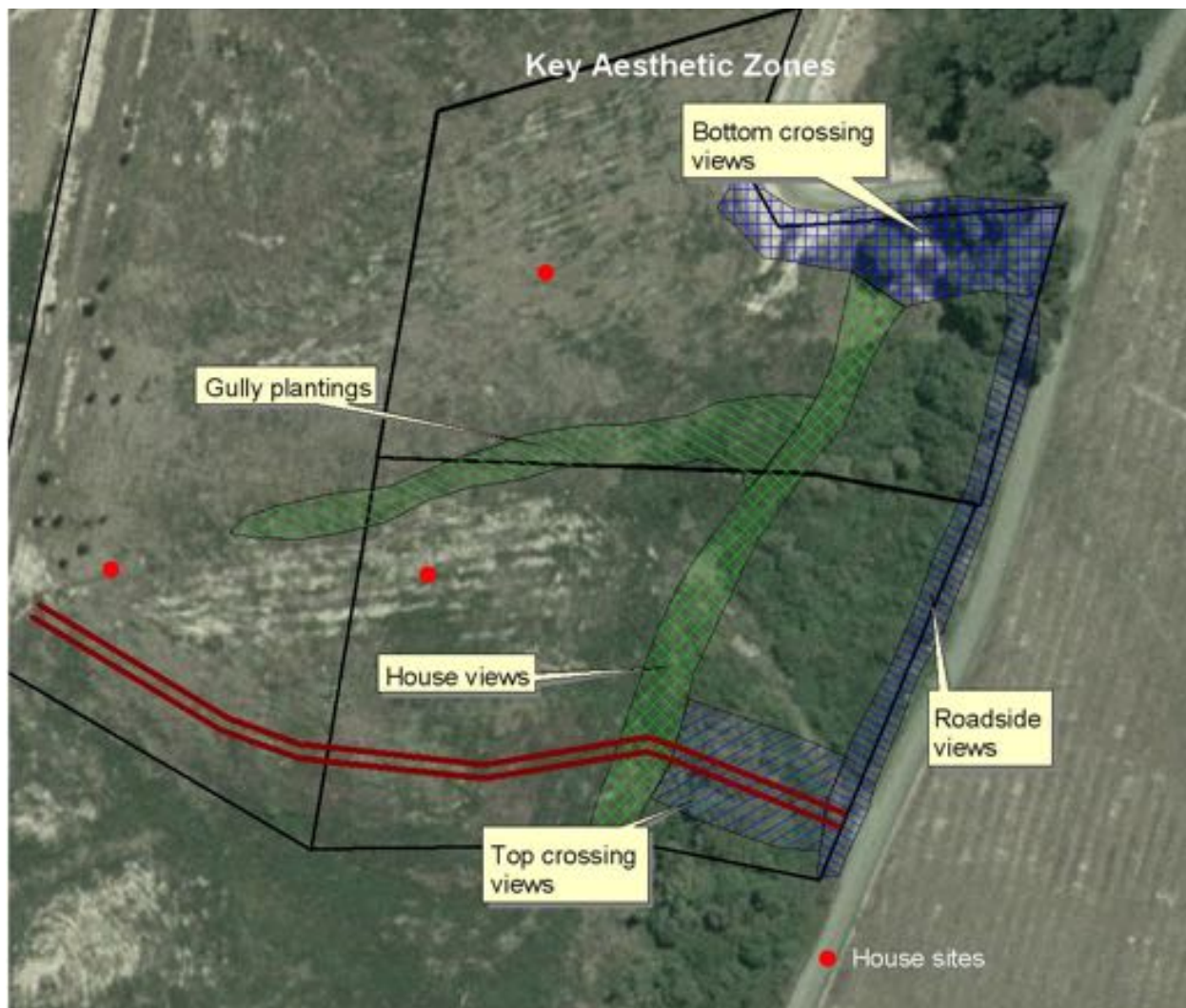
There are a number of potential sources for plants. They can be purchased from a nursery for about \$1.80 each (bulk price) grown in Rootainers. This is the best way to purchase most plants, with the exception of some of the larger, forest trees (e.g. kahikatea, beech) which are better grown in planter bags to a larger size before planting. Rootainers (shown below) produce plants with well formed roots, they are convenient to handle, take up less space, and have a proven record in revegetation in the Moutere. It is recommended that plants are eco-sourced, and one of the local nurseries which will do this is Titoki Nursery.



Aesthetics

An important part of the restoration process is to improve the appearance of the property so that it is more attractive both to the current owners and to potential purchasers. To achieve this the most commonly used tools will be weed control and revegetation. There are several key views which are instrumental in creating a more favourable impression. These are shown on the photograph below. Included in this are all the edges of the wetland and the edges of the road accesses. The main body of the wetland is also important, but has been covered in the Restoration section. The edges are the areas which are most seen, but are often the most modified and unattractive in appearance. Weeds thrive in the high light environment which is the key ecological characteristic of edges. In most cases the objective is to replace the weeds with native species using a combination of weed control, releasing, and planting.

The key view from the house sites is the western edge which is to be totally planted up after cleaning up of the gorse by machinery. This will be a major improvement. Care in siting larger trees will be needed to avoid impinging on the views from house sites. On the roadside edge there is a mixture of gorse and willows with some native species (mostly karamu and mahoe) competing for the available light. In some cases the most effective technique will be to release the native plants in winter to allow more light in. The weeds can be used as mulch. Encouraging existing plants can be more effective than planting new ones.



Aesthetics (Cont.)

The weeds along the roadside will be progressively removed and replaced with native species, so the views from the road should be considerably improved. One of the least attractive areas is the strip under the power lines. This was heavily modified when the lines were put in place. The edges of this strip will be densely planted to restrict the views down the line. Any species planted along the line need to be chosen carefully so they do not grow too tall and interfere with the power lines. Entrances are also key areas to focus on. The proposed new wetland crossing will be installed in the first half of 2005, giving maximum time for the plantings to establish before the sections are put on the market. This new crossing provides access for two sections and it will be from here that the best close views of the wetland are obtained. Weed control will therefore be intensive in area around the crossing, and plantings will be carried out to ensure that the natives are able to out-compete the weeds. The existing crossing provides access to one section, and at the moment the views are dominated by very tall crack willow. It is proposed to leave some of the tall trees around the entrance but to thin out those along the roadside to allow natives to dominate. Ultimately the tall crack willows could be replaced by other tall species such as black beech. On the western side of the crossing is an area with very little vegetation. This will become an important view for the owners of this section and it is proposed to plant up around this entrance. Between the two sections adjacent to the wetland is a gully which has a natural seep. It also extends to the upper section. Planting up a strip based on this gully will provide a natural extension to the wetland and a link between the sections. In a landscape sense it would provide a unifying feature to the sections, while ecologically it provides more habitat for birds and an access to draw them towards the houses. It will also act as a sediment trap for any runoff which enters this watercourse. Plants will be a mix of the species used for the western strip and the wetland.

Minimise subdivision impacts

The major potential impacts of subdivision on the wetland are increased sedimentation of the wetland, changes in hydrology and vegetation from the proposed crossing, and changes made by future landowners.

Sedimentation

Construction activities for roading and housing inevitably mobilise sediment. Large amounts of sediment added to the wetland could have adverse effects on hydrology and nutrient status, as well as potentially smothering vegetation. This will be minimised by early establishment of a strip of native vegetation along the western edge and up the gully between the two lower sections. Especial care will need to be taken with design of water management for the access road for Lots 2 & 3 to avoid run off from the water tables building up high velocity and discharging directly into the wetland. Water tables from this road will not discharge directly into the wetland. Instead they will be discharge to the side of the wetland where the water will filter through dense vegetation before entering the wetland.

Future changes

Some landowners are not aware of the values of wetlands and do not manage their wetlands sympathetically. Others believe that creation of open water improves the wetland. To avoid these situations arising it is proposed to place a covenant over the wetland. This is further discussed in the section on long term protection.

Wetland crossing

The key issues with the wetland crossing are the design of the crossing itself, management of the vegetation, and timing of the construction.

Vegetation management

Currently the area where the road is to be placed is under tall grey willows. Beneath these is an understorey of native and weed species. The native species are sparse because light is currently limited by the tall willows. In order to slow flows both before and after the crossing vegetation needs to be established. Culverts often have scouring associated with them and this can be reduced by slowing down flow. This can be achieved either by encouraging existing plants or by planting. Initial encouragement to existing natives will be given by removing the tall grey willows before they come into full leaf, allowing a gradual increase in light intensity. Blackberry, gorse, Muehlenbeckia, and Himalayan honeysuckle will also be removed from the immediate area to limit competition. Plants which are located on the line of the road crossing will be salvaged and replanted above or below the crossing.

Timing

The most favourable conditions for installing the wetland crossing are when conditions are the driest. This is most likely to be about February, but is not predictable. The work will be carried out between February and May. The most important issue is to complete the work in as short a period as possible to minimise the risk of a flood event moving material from the crossing before it has been fully installed. Tall grey willows will be removed just before construction.

Wetland crossing

A key balance in the functioning of the crossing is to allow passage of low water flows as per normal without changing wetland hydrology, while still catering for the very high flows which follow flood events. Normal flows are very low (at most a few litres/sec), but during flood events discharge is high. The catchments in this part of the Moutere are exposed to storm events especially from the north.

It is beyond the scope of this report (and the expertise of the author) to produce engineering plans for the crossing. However, it is possible to come up with some design guidelines which can be incorporated into the plan:

- Design the crossing to be the minimum width for safety to minimise damage to the wetland
- Use the minimum possible construction area
- Use multiple culverts across the full width of the wetland
- Set the culverts into the wetland at the same slope as the bed, and embedded so that approximately 20 - 30% of the pipe is covered at normal flows
- Place culverts at low points where natural channels occur
- Give consideration to leaving some organic soils to help retain natural wetland hydrology
- Remove any excavated sediment from the flood zone
- Consider using geotextile cloth and a geo grid between fill and organic soils to help retain natural hydrology
- Give consideration to the use of a row of bedded in straw bales at the downstream end of the culvert to minimise sediment movement

Long term protection

Long term protection is desirable both because lowland wetlands are under-represented in the Reserves system and much reduced from their former extent, and to protect the investment of resources by the current landowner from possible future mismanagement. Approximately 93% of wetlands have been lost from the Moutere Ecological District. Therefore virtually anything which remains is of representative significance. The better known Moutere wetlands are typically dominated by flax and raupo, which are only minor components of this wetland. Instead of being flaxland or reedland, the natural areas are dominated by sedges such as *Carex secta* and *Baumea tenax*, with a scattering of karamu throughout. While currently a willow forest, it is likely that, in a few years time, tussockland and rushland communities dominated by sedges will be prevalent, along with shrubland communities of karamu and manuka. This type of community is not typical of most Moutere wetlands and is not protected within any DOC reserves.

To restore this wetland to these communities will require a substantial input of resources and expenditure. The existing owners wish to sell the sections around the wetland but retain ownership of the top section, which looks down on the wetland. In order to protect the view, their commitment to restoration of the wetland, and their investment of resources the owners wish to covenant the wetland. In order to present the wetland in good enough condition to warrant a covenant, the bulk of the management actions will need to be completed before covenanting.

Monitoring

There are two key reasons for monitoring; first to see if the management objectives have been met, and second to provide confirmation to DOC and TDC that the promised management actions have taken place and are benefiting the wetland. The monitoring programme will comprise several components:

- Assessment of the overall condition of the wetland
- Assessment of the impact of individual management actions
- Assessment of the extent to which performance targets have been met

Wetland Condition Monitoring

Because the condition of the wetland is the driver for most management actions this will be monitored using the methodology set out in the Handbook for Monitoring Wetland Condition. The first assessment (prior to any management) is attached as Appendix 4. The assessment reveals a highly modified wetland subject to a high degree of pressure. The assessment will be repeated annually to provide comparisons of condition.

HANDBOOK FOR MONITORING WETLAND CONDITION

Coordinated Monitoring of New Zealand Wetlands

*A Ministry for the Environment Sustainable
Management Fund Project*

Beverley R. Clarkson, Brian K. Sorrell, Paula N.
Reeves, Paul D. Champion,
Trevor R. Partridge, Bruce D. Clarkson

AUGUST 2002



Management Action Monitoring

In order to determine whether the individual management objectives have been met monitoring is required. In most cases this will involve using photopoints to monitor any changes. The table below indicates which specific management actions will be monitored. The monitoring will be carried out by analysis of photographs and notes taken from photopoints. The location of photopoints is shown in Appendix 5.

| Objective | Management Action | Measure |
|----------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------|
| Restoration | Overall weed control | % reduction in weed canopy area |
| | Large grey willow control | % reduction in canopy area, # of regrowth saplings, % canopy replacement by natives |
| | Sapling grey willow control | % reduction in canopy area, # of regrowth saplings, % canopy replacement by natives |
| | Crack willow control | % reduction in canopy area, # of regrowth saplings, % canopy replacement by natives |
| | Gorse control in wetland | % reduction in numbers visible |
| | Gorse control on edges | % reduction in area |
| | Roadside revegetation | numbers planted, % survival |
| | Western strip plantings | numbers planted, % survival |
| | Gully plantings | numbers planted, % survival |
| | Aesthetics | Roadside plantings & weed control |
| Western strip plantings & weed control | | % increase in visible natives |
| Top crossing views | | % increase in visible natives |
| House views | | % increase in visible natives |
| Bottom crossing views | | % increase in visible natives |
| Subdivision Impacts | Wetland crossing vegetation impacts | in numbers of native plants within 5m of crossing |
| | Wetland crossing hydrological impacts | in sediment amount and distribution within 5m of crossing |
| | Gully sedimentation | in sediment amount within 5m of wetland |

Performance Target Monitoring

Before the final signing off procedures which will result in issuing of the titles for the subdivision, a written report will be provided to DOC and TDC which will provide an assessment of to what extent the performance targets have been reached. The actual performance targets are discussed in the following section.

Performance Targets

The purpose of this section is to provide performance targets for the satisfactory implementation of the proposed management actions and the road crossing. Not all of the activities require performance targets; this section looks to identify the key components of the subdivision and management about which DOC has expressed concern. The current intention is to have the vast majority of the restoration work completed by the end of May 2006. All the performance targets below are to be reached by the end of May 2006. The key management actions are directed towards restoration of natural wetland communities, creation of a buffer zone alongside both edges of the wetland, and minimisation of damage to the wetland from the road crossing. The key actions to achieve these objectives are weed control, revegetation, and careful design and construction of the road crossing. The performance targets listed will be reported on in June 2006 using data from the monitoring programme begun in 2004.

| Objective | Action | Performance Target |
|--------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Restoration of natural wetland communities | Overall weed control | 1. 95% reduction in weed canopy area |
| | Grey willow control | 2. No grey willows visible from road or from overview above western side 3. Native wetland species to have achieved 70% canopy closure |
| | Crack willow control | 4. No crack willow visible from road or from overview above western side (except in the lower NE corner) |
| | Woody and vine weed control | 5. Removal of 80% of woody and vine weeds from the wetland |
| | Planting | 6. Planting of approximately 600 plants within the wetland with 75% survival rate |
| Overall improvement in wetland condition | Wetland condition monitoring | 7. An improvement in wetland condition of 25% (as measured by the Wetland Condition Index) |
| Creation of buffer zone | Weed control | 8. Removal of 80% of woody and vine weeds from a strip 10 -15m wide from the edge of the wetland 9. No willows visible from road or from overview above western side |
| | Planting | 10. Planting of approximately 3000 plants within the buffer strips with a 75% survival rate |
| Minimise road crossing impacts on wetland | Road crossing | 11. An increase in the number and density of native wetland plants within 5m of the road crossing 12. Less than 10% increase in visible sediment within 5m of the road crossing 13. No change in bed level > 5m from road crossing |

Appendix I - Work programme

Timeline for management

The table below gives an indication of the timing of the main management actions.

| Action | Winter 2004 | Spring 2004 | Summer 2004/05 | Autumn 2005 | Winter 2005 | Spring 2005 | Summer 2005/06 | Autumn 2006 |
|----------------------------------------------|-------------|-------------|----------------|-------------|-------------|-------------|----------------|-------------|
| Release native plants along roadside | | | | | | | | |
| Mulch gorse along roadside | | | | | | | | |
| Poison willows near crossing | | | | | | | | |
| Construct road crossing | | | | | | | | |
| Salvage & replant natives from road crossing | | | | | | | | |
| Woody & vine weed control in wetland | | | | | | | | |
| Spray roadside gorse regrowth | | | | | | | | |
| Willow control | | | | | | | | |
| Release native plants on western side | | | | | | | | |
| Mulch gorse on western side, bury stumps | | | | | | | | |
| Plant buffer strips | | | | | | | | |
| Plant gully | | | | | | | | |
| Wetland planting | | | | | | | | |
| Blanking plantings | | | | | | | | |
| Release plantings | | | | | | | | |

Appendix 2 - Costings

The table below gives indicative costs for those management actions related to restoration of the wetland and surrounding areas. These are preliminary only but can serve as a guideline to indicate the resources required to implement the restoration.

| Action | Winter 2004 | Spring 2004 | Summer 2004/05 | Autumn 2005 | Winter 2005 | Spring 2005 | Summer 2005/06 | Autumn 2006 |
|---------------------------------------------------------------|-------------|-------------|----------------|-------------|-------------|-------------|-----------------|-------------|
| Meet QEII on site | \$90 | | | | | | | |
| Release native plants along roadside | \$315 | | | | | | | |
| Set up photopoints | \$196 | | | | | | | |
| Order plants | \$56 | | | | | | | |
| Mulch gorse along roadside | | \$806 | | | | | | |
| Poison willows near crossing | | \$806 | | | | | | |
| Construct road crossing | | | \$90 | | | | | |
| Salvage & replant natives from road crossing | | | \$259 | | | | | |
| Woody & vine weed control in wetland | | | \$691 | | | | | |
| Spray roadside gorse regrowth | | | \$522 | | | | | |
| Willow control | | | | \$4,283 | | | \$535 | \$535 |
| Release native plants on western side | | | | \$112 | | | | |
| Mulch gorse on western side, bury stumps | | | | \$1,140 | | | | |
| Plant buffer strips | | | | \$11,154 | | | | |
| Plant gully | | | | \$5577 | | | | |
| Wetland planting | | | | | | \$2,197 | | |
| Blanking plantings | | | | | | | | \$2,197 |
| Release plantings | | | | | | \$1,013 | \$1,013 | |
| Total Cost for restoration planning and implementation | | | | | | | \$33,222 | |