

MANAWATU ESTUARY WEED IMPLEMENTATION PLAN

2015 – 2020



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BACKGROUND

This plan is designed to complement the Manawatu Estuary Management Plan 2015 – 2025 and provide a pragmatic guideline for operational staff involved in the control and monitoring of weed threats in the Manawatu estuary.

The estuary covers a total of 558 Ha, 386 Ha of land and 172 Ha of river channel. 200 Ha has been granted Ramsar status, reflecting the high biodiversity values and international importance for migratory bird species of the estuary.

Many weed species present in the estuary pose significant risk to the natural values there and the Department of Conservation (DOC) has focused control work on species which pose the greatest risk such as spartina, sharp rush and boneseed or species which are only just becoming established in areas with relatively healthy native vegetation. Appendix 1 lists and prioritises species by zone (including rationale). Appendix 2 outlines potential annual allocation of staff hours for prioritised weeds. Appendix 3 lists volunteer opportunities. Appendix 4 covers scientific names, control methods and reproduction information for the main weed species found at the estuary. As operational staff, contractors and volunteers generally refer to many weed and native species by their common name, these have been used in the text of this plan (acknowledging that occasionally the same common name can be used for different species).

There are a number of herbaceous and grass weed species (such as plantains) not covered by this plan and it may be possible to address some of these following the control of larger weeds over the next five years. This may be particularly applicable for areas where rare plants are found.

The control of spartina will continue in the greater estuary, utilising larger scale methods such as helicopter spraying and boat surveys. This plan will focus on more accessible terrestrial zones adjacent to and west of the Manawatu Marine Boating Club through to the dunes south of Foxton Beach. These areas are also higher profile and offer more potential for community and business involvement. The weeds listed within the plan and appendices are not exhaustive but aim to address priority weeds.

Given that many weed species are well established, immediate broad scale control of all species is not possible with the resources available. Also, such an approach may affect native fauna habitat, create opportunity for new weed encroachment or cause unpredictable erosion near the built area of Foxton Beach. This plan proposes a staged approach over time, while attempting to address the greatest weed threats and limitations of particular zones in the estuary.

COMPLEXITY

Manawatu estuary presents land managers with a complex set of considerations when planning for weed control:

- Considerable size compared with other lowland reserves
- Tidal movement limiting access and control options
- Mobile dunes and river course can vary weed distribution over time
- Water is a substantial weed vector compared with terrestrial sites
- Difficult accessibility for saltmarsh and some estuary edges
- Regular and strong winds limit spraying opportunities and hours
- Sensitive zones such as saltmarsh and estuarine edges
- Herbicide selection is limited in or adjacent to aquatic environments
- Salt laden foliage is less receptive to herbicide
- Weed species hardened to difficult conditions can be more resilient following control
- Community concern regarding erosion effects of removing vegetation
- Regular dumping of green waste, perpetuating garden escapes
- Lack of flexible contractors familiar working with indigenous vegetation
- Convoluted agency boundaries requiring staff resource on interagency co-ordination
- Notification requirements may limit flexibility of control options in zones adjacent to the residential areas.

It is important that weed control expectations are in line with the challenges of the site. Consistent monitoring (GPS records of all control) will indicate if the pace of control is effective for each species.

Land and river tenure is particularly complicated across the ecological scope of the estuary. Management boundaries are convoluted, with the Ramsar site overlaying a patchwork of oddly shaped management units, some of these still unallocated crown land. As agencies run by prescriptive operating procedures, difficult boundaries cause extra work and potential issues for operational staff. These can also be problematic when working with community groups, iwi, landowners and commercial interests as policies and relationships can differ with each agency. Although there is a management team in place, it would be ideal if a lead agency were agreed to co-ordinate at an operational level.

[*Small map of management units/boundaries here?*](#)

CURRENT WEED CONTROL

Control of priority weeds such as spartina and sharp rush is underway and the resourcing seems to be adequate to decrease densities of spartina each year, with the aim of eventual eradication over time. The large, mobile 'rafts' of river detritus deposited during floods can obscure spartina remnants but annual control will continue to address these.



Small patch of spartina exposed after flooding



Pampas control on small spit near Pinewood Rd

DOC has also focused on achievable control in areas with relatively good and/or diverse native vegetation cover. Species such as boneseed, lupin, gorse, pampas and yucca have been treated on the small spit to the east of Pinewood Road. It is a logical approach to protect the best areas of native vegetation first before attempting control in larger, more modified areas. This plan supports this approach, while assessing priority weed species in other areas, which may slowly become unmanageable without intervention in future.

There are some weeds acting as natural inhibitors or barriers to other weeds and should be kept for the benefits they offer in the short term. The macrocarpa on either side of the beach access road are shading out many of the weeds adjacent. If the younger of these is allowed to grow, this effect will increase and provide temporary control in that area until work is carried out in other zones. In areas where this is not ideal, the small number of macrocarpa seedlings could be pulled manually or stump treated. These areas would still require monitoring for shade tolerant weed species (eg. Periwinkle).

EXTENSIVE WEED SPECIES

There are extensive infestations of sharp rush in the marsh zones of the estuary and it is possible sharp rush is increasing in some zones, even though some control is undertaken each year. It is recommended that control and monitoring of sharp rush is increased in future, as it seeds prolifically, can reproduce in several ways and is readily distributed by floods and tidal action. There are opportunities to learn more about sharp rush habitat and distribution here, which could inform future control of this species in certain zones (see zone descriptions for M1 and M2).



Distinctive clusters of sharp rush seedheads

Silver poplar at the western end of the spit

Large areas of silver poplar have established in the rear dunes. Although mature trees produce thousands of wind-dispersed seeds that may be carried long distances, it seems that most of the spread here is through root suckers as the population is mainly contiguous. The eastwards progression of the silver poplar seems to be contained by the marsh edge just to the east of Pinewood Road but this cannot be confirmed without monitoring. Priority control of this species is at this eastern edge, where it harbours Japanese honeysuckle. Control trials could also be undertaken on the outside edge of the main silver poplar population to assess response and future control options.

Tall fescue is so well established in much of the estuary, control is only viable in areas of high indigenous value. While it is unfortunate tall fescue is so widespread, it does suppress other weed species and provides whitebait spawning habitat. It is likely tall fescue would increase following control of larger species in some zones.

The marram distribution is substantial from the top of the foredune and very mobile across the sand bar near the mouth of the river. Ideal marram control should progress west to east to minimise seed source from the direction of predominant westerly winds. Marram control can be problematic due to the need to time spray work in very low winds, after rain and while there are still signs of growth.

As successful marram control can lower a dune profile, it may be necessary to inform the community of the positive ecological benefits, as it may be perceived as causing dune erosion. Traditionally, marram control is followed with planting of spinifex and pingao to maintain a more natural foredune profile. Some dune restoration programmes rely on existing spinifex to repopulate areas where marram and other dune weeds have been controlled and, superficially, there seems to be potential for this at Manawatu Estuary as the front face of the foredune is predominantly spinifex. However, the viability of the spinifex seed appears to be limited. Research carried out for Horizons by the Seed Technology Centre at Massey University has shown that germination conditions along the coast would have to be absolutely ideal to achieve even a minimal amount of successful germination and conditions at the estuary are far from ideal. Although it can be assumed some natural regeneration will occur following weed control, dune restoration at this site is more likely to succeed with planting of nursery raised seedlings along with the application of fertiliser to existing plants to accelerate

the spread by stolons. This approach will also mitigate the risk of dune blow outs once weeds have been removed. If planting were achievable from 2017 onwards, a staged approach would allow narrow bands of control and planting east from the foredune over several years.

If an experienced contractor is available, they may be more flexible to respond to ideal weather, particularly in spring, where active growth persists longer. However, contractors can be influenced by the same pressures as staff and may still find it difficult to achieve ideal results for marram control.

WEED MAINTENANCE AND REVEGETATION

If weeds are controlled with no thought of follow up or replacement revegetation, the control may only provide an opportunity for new weed species to establish. The control of a priority weed may increase the distribution and/or density of a lower priority species. However, investment in planting of natives should only go ahead when full control is assured and all repeat control is complete. There may be situations where some weeds will be shaded out but these are uncommon in an estuarine environment.

Controlling weeds amongst native plantings is problematic and expensive so it is worth the extra patience and maintenance required prior to planting. It can be very difficult balancing these tensions during control over several years. The use of selective herbicides which do not kill grass (Eg. Grazon) in dry areas can be a useful tool in retaining some cover following control of broadleaf weeds. Long grass cover can also deter rabbits colonising dry sites following control work.

Considering all the challenges involved in estuarine restoration and experience from planting work carried out in other estuaries, a 'less is more' approach could be applicable at Manawatu Estuary before any planting programme is undertaken in earnest. High quality, small scale programmes are more likely to succeed and in turn, gain ongoing public support.

ZONES (Draft only - requiring staff input)

The zones used in this plan are a communication tool for staff and volunteers. Various micro-environments and areas with a high level of recreation require different weed control approaches. The use of labels for certain zones allows for efficient communication between planning or supervising staff and field staff, contractors and/or volunteers. Ideally site visits are undertaken with new staff, contractors and volunteers but once workers are relatively familiar with a site, reference labels (formal or informal) tend to be used for off site planning.

There is no perfect design for the zone demarcations as they could be lead by various factors such as species distribution, native vegetation, natural and manmade barriers, hydrology, pragmatic use of equipment and herbicide, control access, land tenure, public recreation, public perception and awareness potential. These have been taken into account where possible but it is difficult to treat them equally in every instance and there will always be a level of compromise in assigning zones and labels. The zones are approximate and not prescriptive. It is anticipated staff and contractors will employ their own field

knowledge to address any issues presented by this design and subsequent planning.

ZONE MAPS AND DESCRIPTIONS



D – Dune
E – Estuarine edge
M - Marsh

D1 – Extensive mobile area of dunes at the northern mouth of the Manawatu River. This area is mainly vegetated by Marram grass and would require an increase in current resources and public consultation on natural dune processes to initiate broadscale control of Marram. High and regular wind will also decrease the efficiency of control work. *Pimelea arenaria* has been noted on the eastern inland tip of the bar here during a site visit. There is evidence of previous spinifex and Pingao planting at the northern end of this zone. The area is commonly used for 4WD recreation, dog walking and green waste dumping.



D1 – looking southwest across mobile sand bar



D1 – High occurrence of vehicle use

D2 – Large area of relatively stable dunes to the north of D1. This area is bounded by exotic pines and Foxton Beach community to the north, a steep dune to the east, a dune edge drop off to the south and the beach to the west. This area is still very exposed to the predominant north west and south west winds and there are several weed issues here, including marram, silver poplar, boxthorn, acacia, tamarix, wilding pines, yucca, lupin, periwinkle, japanese honeysuckle, cape ivy, buffalo grass and iceplant. Although this zone is mainly out of the Ramsar site, the weed species present are a seed source for it due to predominant north westerly winds. Natural values are limited here as this area has been significantly modified by exotic vegetation and will require decades of control with the resources currently available.



D2 – Looking east over highly modified dunes



D2 – Area common for green waste dumping

D3 – Small dell bounded by pines and beach motor camp to the north, a steep dune-lee to the west and south and Pinewood Road to the east. There are macrocarpa in the dell at different levels of maturity which seem to be suppressing some weed growth in this area. If these trees are left to continue shading other weeds species until the control programme has resources available, that may prove advantageous. Some weed species such as Japanese honeysuckle, ivy, everlasting pea and periwinkle will require ongoing control however. Volunteers could assist here to dig out various lily species and agapanthas at the northern end. Native flora such as wiwi, hounds tongue, cabbage tree, taupata and Korokio are relatively sparse.



D4 – Dunes on the southern side of Manawatu River Mouth below plantation pines. Mainly acacia. Due to the relatively inconvenient access and ongoing seed source from large dune populations of acacia on this coast, it is recommended that weed control at D4 is deferred until control at other sites in the estuary are in hand. When the plantation is logged, this may need to be reviewed.



D4 – Southern river mouth



D4 – Marram to sand acacia to pines

S1 – A small area directly adjacent and east of Pinewood Road and south of the beach access carpark. This area is distinguished by an almost concentrated blanket of weed species at its' centre. This is very likely the result of historical green waste dumping due to the numerous and concentrated species at this site. The combination of shelter and water table proximity has encouraged weed growth here but has been somewhat contained by drier or more brackish environments surrounding it. At the eastern end of this zone the silver poplar

obscures the Japanese honeysuckle woven throughout. Ideally, the issues regarding Council endorsed dumping of fill and re-aligned bollards would be addressed before control is undertaken adjacent to Pinewood Road. Notable weeds in this zone are german ivy, ivy (*hedera helix*), periwinkle, Japanese honeysuckle, lily of the valley vine and several bulb species.



S1 – Multiple weed species adjacent to road



S1- Eastern edge of silver poplar near marsh

S2 – Low lying spit running west to east with good natural values due to a long estuarine edge and relatively low weed densities. *Yucca* has become established here and is bouncing back from initial control due to extremely large and deep roots. Marram, lupin, gorse, fennel, acacia and poplar are found in small numbers across dry areas, with *Atriplex prostrata* common in the glasswort beds. Some native flora found here are wiwi, sea rush, oioi, saltmarsh ribbonwood, shore bindweed, flax, coastal tree daisy, taupata, tauhinu, sand piripiri, remuremu and glasswort.



E1 – A combination of terrestrial and estuarine edge from the carpark at the base of the spit and east to Darwick Street (by the small lookout platform). Sharp rush is peppered throughout this zone, with higher density near the Pinewood Road carpark. Other weed species present but in relatively low numbers are pampas, lupin, tamarix, acacia, marram, iceplant, everlasting pea, karo and agapanthas.



E2 – An extremely narrow modified edge running from Dawick Street to the Manawatu Marine Boating Club. Although this zone is predominantly narrow, it still hosts a range of weed species, fostering a seed source and a perception that garden edge planting is acceptable directly adjacent to the estuary. This area offers the greatest awareness potential for weed control followed by appropriate native planting. The costs would be achievable due to the small square area, offering a high level of public exposure due to the well used scenic walkway directly abutting the zone. Weed species include gazania, arctosis stoechadifolia, tree aloe, agapanthas, canna lily, tree mallow, boxthorn, yucca, geranium, African daisy, karo, kikuyu, and iceplant.



E3 – A combination of saltmarsh and mown lawn edge east of the boating club. This zone harbours high densities of sharp rush along and east of the small drain joining the main river here. This is also a spartina control site. *Bolboscoenus caldwellii* (Purua grass) is a regionally rare native here and should be avoided during control. Weed species such as Yucca, tamarix and acacia on the edge of the mown area west of the drain could be worth controlling in the short term as they are in low numbers. This would require consultation with the boat club.



E3 - Drain running into river near boat club



E3 – large Tamarix on highly modified river edge

M1 – Tidal mudflats nearest the river mouth on the southern bank of the river. This area, in conjunction with M3, has sometimes been referred to as 'Estuary South' in plant lists. It is highly influenced by tides and floods and some weeds such as spartina can be covered by debris one month and exposed the next. Spartina has been surveyed and controlled here annually and is now at very low density. Sharp rush is mainly established on the slightly elevated parts of the zone and seems to be contained by the very wet conditions here. It could be useful to monitor an area where only a few sharp rush are amongst predominantly native vegetation to assess whether this is the case. A slightly raised 'island' in the flats hosts a few acacia, boxthorn, pine and gorse. Sea rush, oioi, remuremu, glasswort and sea primrose are common native plants seen in this zone, with some saltmarsh ribbonwood, purua grass and wiwi.



M1 – Glasswort/sea primrose beds



M1 – Exotic sharp rush amongst native sea rush

M2 – an extensive point bar in the river, mainly salt marsh, minor river channels and tidal flats bounded by pasture to the north and a large drain to the east. The area is known as 'Fernbird flats' or 'Spiers block'. It hosts the largest extent of saltmarsh ribbonwood in the estuary, with improving habitat for bachelors button following many years of spartina control. Access is difficult and helicopters and

kayaks have been used for weed control here. Willow is found near the river course and is worth targeting before it becomes too established. Mulching of willow upstream of the estuary will necessitate ongoing monitoring of the river edges and flood extents. There are large areas of sharp rush which are too extensive to consider controlling at this stage. However, there is a distinct sharp rush boundary approximately 200 metres along the east to west section of 'fernbird track' and this could be the ideal site to monitor plots on either side of the boundary to assess whether the sharp rush is increasing it's range or naturally contained by the hydrological regime here. Purua grass and *Ruppia polycarpa* are rare plants found in this zone.



M3 – A long point bar on the southern river bank bounded by pine plantation and the river. Large areas of tall fescue and other exotic grasses dominate this zone. Reed canary grass and willow have a low distribution and should be prioritised in the next two years. *Glyceria maxima* can be seen in drains and gorse is spotted in drier areas. Anecdotal observation by DOC staff suggests saltmarsh ribbonwood and flax may be slowly increasing in some parts of this zone.



M3 – Looking east from southern river bank

M3 – Willows in M3 seen from northern saltmarsh

[Unable to access Manawatu S drive from Waikanae for better pics of this zone....to follow](#)

SENSITIVE AREAS AND RARE PLANTS

Some specialised habitats such as tidal flats and saltmarsh have excluded many invasive plant species due to saltwater inundation and therefore sustained more diverse native plant communities than most of the terrestrial environments in the estuary. Historic *Spartina* control has also ensured areas of tidal flats are recovering their cover of indigenous vegetation. Ideally, weed work in these areas should be undertaken by staff, contractors and/or volunteers familiar with these values, rather than new contractors or large groups of volunteers. Modified spraying equipment, hand control methods and using only few operators can minimise damage to sensitive areas.

It is recommended that regionally rare or threatened plants be mapped by experienced staff or contractors with appropriate botanical skill and ID resources for staff and contractors made available. Ideally threatened plant sites and visual identification should be highlighted to workers on site initially.



Spinifex and pingao are well adapted to extreme dune conditions but not to repeated trampling. Although there is relatively good vehicle and pedestrian access to the edges of these areas, it is wise to educate large numbers working in the dunes of this intolerance.

If herbicide spraying is required, there may be some collateral loss of common native species such as *wiwi* and small leaved *pohuehue* as it is very difficult to exclude these species in some areas where weed species dominate or are intertwined with such natives. Where appropriate, selective herbicides should be utilised to minimise loss of native vegetation. This will generally be on dry sites only or sites dry at the height of summer.

All temporary staff, new contractors and volunteers should be briefed on site regarding rare plants and sensitive areas before undertaking work in areas where these can be found.

Locally rare and threatened species of Manawatu Estuary

Species	Common name	Status	Zone/s
<i>Selliera rotundifolia</i>	Selliera	At risk - declining	M1
<i>Carex litorosa</i>	Sea sedge	At risk - declining	?
<i>Thyridia repens</i>	Native musk	At risk – Naturally uncommon	?
<i>Bulboschoenus caldwellii</i>	Purua grass	Regionally rare	E3, M2, M3
<i>Ruppia polycarpa</i>	Horses mane weed	Regionally rare	M2
<i>Leptinella dioica monoica</i>	Shore cotula	Regionally rare	M2

PROMOTING AWARENESS

It can be extremely difficult for agencies and concerned residents to address local behaviour in ecologically sensitive areas historically used for recreation and refuse dumping. Small numbers of the community can be uninformed or blinkered regarding the effects of green waste dumping and 4WD activity in dune environments and wetlands. Changing existing beliefs and undesirable behaviours can often be the most challenging aspect of restoration planning.

Awareness work regarding dumping of green waste and rubbish should only commence if contractors cease the dumping of fill at the beach entrance on Pinewood Road behind the motor camp. This activity only re-enforces that dumping is acceptable and will send mixed messages if awareness and/or enforcement work is undertaken. Iceplant and kikuyu are two weeds noted in the transported fill, which is commonly made up of sand, soil, concrete and bitumen. The dumping at the southern end of the fill bank is also causing vehicles to cut further east into the vegetated reserve.



Contractor dumping soil, kikuyu and iceplant on Pinewood Road

Department of Corrections could be approached to investigate the potential for a fortnightly or monthly sweep of the sand pans in the D1 & D2 area to clear dumped green waste as part of other work programmes for community service workers. This would be a relatively simple task as the dumping seems to be focused around the firm pans of sand at the base of the dunes. This may minimise new weed incursions until awareness work can improve the situation.

The current location of existing signs and bollards could be adjusted to increase protection and communicate clearly regarding travelling in the estuary (vehicle travel in particular). The content of the large information signs is clear but should be used in conjunction with physical barriers which encourage desired behaviours without sign engagement (or a proliferation of signs). The estuarine edge may have changed over time since bollards were first installed in the Pinewood Road carpark. Vehicles now drive over sensitive areas, while directly adjacent, a 'keep out' sign protects a large hump of exotic kikuyu. This would not always have been the case and illustrates that infrastructure should be reviewed periodically in line with the larger management plan.



Small sign failing to protect fragile area at the edge of Pinewood Road carpark



Road signage prioritising recreational values

Although the beach is legally a road and the sign at the end of Pinewood Road is designed to encourage safe road behaviour, it inadvertently suggests that recreational values are more important than ecological ones. The beach and dune area is far more than just a road and a clever design could address ecological threats and road safety issues simultaneously.

Any opportunities to connect the estuary with local schools and youth groups would help with the future care of the estuary. Current adult attitudes to the estuary may be difficult to change but investing in time spent with Foxton and Manawatu youth may filter through to their families and peers. Schools and wananga often find it difficult to facilitate extra curricular activity so effort should focus on education activities aligned to the curriculum. Field trips are also unrealistic much of the time so any digital initiative such as LEARNZ or the

improvement of existing web information may prove to be the best investment initially.

The Manawatu Estuary Trust has invested time and energy into various awareness initiatives over time and it would be worthwhile approaching the trust for assistance with the potential weed control and planting for zone E2.

ALLOCATION OF RESOURCES

DOC currently has staff hours allocated to undertake weed work at the estuary. This ensures that knowledge and familiarity is kept in house and DOC staff can be eyes and ears for other work programmes on site. Staff are often more familiar with the natural values for a particular site than can be expected of contractors, who may be spreading their work across a variety of environments and requirements. DOC staff may also be more recognisable and able to increase public awareness through their presence.

Coastal reserves are notoriously fickle sites to deal with and where spraying of herbicide is required, wind behaviour plays a significant role in this. The disadvantage of only utilising staff, is that spray work can only go ahead if there is access to a vehicle and equipment on a day where the wind strength stays below a certain level well after staff arrive on site following preparation and a 40 minute trip from base. This could also be a day where only certain species can be treated due to their life cycle or the time of year. Manual control and work at nearby sites can compliment spray work once wind halts spraying but other pragmatic issues such as spraying out mixed herbicide and notification have to be managed also.

A contractor may be closer to site and be better placed to time control work when it is required. Using a contractor may be appropriate for large infestations (Eg. silver poplar) and species requiring specific timing (Eg. periwinkle).

It can be ideal to use only one or two versatile contractors, who can become familiar with the site and the control results particular to site. This approach is not always favoured by publicly funded agencies as it can be perceived as nepotistic. However, it may be the most ecologically sound way to utilise weed contractors for challenging weed control in areas with significant indigenous vegetation.

Appendices 1 and 2 are designed as working documents which can be reviewed annually to reflect the adaptive work style required for estuarine weed control and any potential extra funding sourced and/or changing staff levels over the next five years. The level of prescription in these appendices is also deliberate as this document is intended to be succinct for operational staff and volunteers with time constraints. It is anticipated that staff and contractors will bring their own experience of weed control and the estuary to the field and 'tune' the finer details.

VOLUNTEER OPPORTUNITIES

The zones which lend themselves to community involvement for weed control are the dune zones D2, D3, S1 and E2. Some dry edge zones between the beach carpark and the boat club could also be improved by planting once any weed control is complete. There have been attempts at dune planting in the past and some have been moderately successful. However, while marram is still such an extensive threat in the dunes, it would be advisable to leave any dune planting efforts until the marram can be controlled effectively, taking a rollback approach from the foredune.

Volunteers could undertake some weed control requiring manual techniques, especially if agency policies allow for volunteers to undertake stump treatment using herbicide gel application. Appendix 4 lists weed species in particular zones of Manawatu Estuary which could potentially be targeted by volunteers.

Previous experience at Waikanae Estuary has seen worthwhile use of corporate groups where large areas of weeds can be controlled and damage to natural values easily avoided (Eg. large areas of lupin, senecio, celery weed). They can also manually remove climbing weeds from native vegetation until longer term control can be undertaken. Seed heads can be cut and removed (Eg pampas). Fleabane and senecio species can be pulled before flowering.

Weed work may not seem particularly marketable as a volunteer activity but corporate groups can be surprisingly fit and keen. Also, many corporate groups such as ANZ, BNZ, NZ Post and Contact Energy, have days allocated throughout the year and some teams can only get out to do a work day at certain times and are often happy to do any activity that fits with their availability.

However, this opportunity requires resourcing for the co-ordination of groups and equipment to cater for numbers. Established care groups can facilitate these days but they do add an extra burden to those already volunteering many hours to sites. It is not advisable to use 'one-off' volunteer groups in sensitive areas as positive gains can be outweighed by damage to existing natural values.

ADDITIONAL FUNDING

As the resources currently available are a limiting factor for weed control and other improvement work within the estuary, it has been identified in the Management Plan to seek additional support, resources and funding. Although this would be a positive action, it is acknowledged that extra funds and labour are often managed by staff already at capacity in their roles.

It is recommended that some facilitation component be included in funding applications or sponsorship relationships, otherwise those funds can draw some staff away from planned work or result in diluted staff time across the weed control programme.

Additional funding can also lead to inappropriate volumes of work within funding timeframes, where the funding drives the programme without enough flexibility to respond to the ecological needs of the site. This can even occur in very well planned operations, as weed control is unpredictable. Rain, wind, temperature,

seasonal fluctuations, operator availability and the unknown level of resilience for well established weeds are all factors which create some uncertainties for weed control work. If funding is designed to adapt with the work, this is ideal for effective long term treatment programmes.

Funding can be difficult to source for generic weed control, so it may be that externally funded or sponsored work may be better suited to specific and priority weed species such as spartina or sharp rush where the immediate threat can be easily perceived by the funders. This may allow existing budgets to increase work on the wider host of weed threats.

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APPENDIX 1 (a) – Dune priorities in line with existing resources

Zone	High priority	Rationale	Medium priority	Rationale	Low priority	Rationale
D1					Marram	So extensive and mobile, control will detract from achievable work in other zones
D2	Boxthorn	Large seed source	Silver poplar	Large infestation.Wait until feasible or resource found	Periwinkle+	
	Sharp rush	Low numbers achievable	Acacia & wattle	Slower spread	Iceplant	Relatively Isolated from natural values
	Boneseed	Previous investment Low numbers achievable	Yucca	Wait for regrowth. Drill & fill a few?	Lupin	Dies back during winter
	Senecio	Low numbers achievable	Tree lucerne	Low seedling numbers	Fleabane	Lesser threat
	Evening primrose	Low numbers achievable	Everlasting pea+	Relatively Isolated from natural values		
	Formosan lily	Dense in similar environments in the region – assume high risk Low numbers at present	Japanese honey+	Relatively Isolated from natural values	Buffalo grass, kikuyu	Large distribution.Wait until feasible or resource found Limited natural values here
	Pampas	Prolific seed source	Gazania	Relatively Isolated from natural values	Tall fescue	Extensive and also suppressing other weed species in interim
			Tamarix	Low numbers but slower spread than high priority	Conifer spp.	Extensive. Natural barrier. Low natural values at present.
		Marram	Behind good spinifex			
D3	Boneseed	Low numbers achievable	Agapanthas	Ideally use volunteer labour – time to organise	Macrocarpa	Natural suppressant of other weeds
	Periwinkle	Containment before spread throughout pines here	Silver poplar	Extensive. Wait until feasible.	Lupin	Lesser threat
	Karo	Low numbers achievable	African daisy	Slowly gains ground		
	Pampas	Previous control/investment	Various lily species	Ideally use volunteer labour – time to organise		
	Japanese honeysuckle	Spreads rapidly	English ivy, German Ivy	S1 first, then D3 (road is a natural barrier)		
	Boneseed	Low numbers achievable	Everlasting pea	Annual. Intertwined with native		
D4					Acacia	Extensive with access – leave until other zones controlled
					Marram?	As for Acacia

APPENDIX 1(b) – Spit priorities in line with existing resources

Zone	High priority	Rationale	Medium priority	Rationale	Low priority	Rationale
S1	Periwinkle	Near area with high values	Agapanthas	Ideally use volunteer labour – time to organise	Marram	So extensive and mobile, control will detract from achievable work in other zones.
	Japanese honeysuckle	Spreads rapidly	Montbretia	Ideally use volunteer labour – time to organise	Euphorbia	Not as invasive relative to others
	Silver poplar	Hosting 22Formosan honeysuckle	Yucca	Wait for regrowth Drill and fill a few?	Solanum	Less impact on natives in this zone
	Ivy species	Form dense cover. Suppress all regeneration	Vetch	Intertwined amongst native in places	Bindweed	Problematic as intertwined. Dies off in winter.
	Boxthorn	Low numbers achievable	Everlasting pea	Annual. Intertwined with native	Fleabane	Less impact on natives. Annual only
	Willow	Low numbers achievable	Macrocarpa seedlings	Keep new macrocarpa in check	Buffalo grass, kikuyu	Large distribution. Wait until feasible or resource found Limited natural values here
	Lily of the valley vine	Not seen elsewhere. Eradicate before spread	Tree mallow	Possibly be hit at same time as high priority		
	Thistle	Not seen elsewhere. Eradicate before spread	Arctosis	Low numbers		
S2	Sharp rush	High value edge Suspect increasing	Lupin	Less competition here than west sites	Atriplex prostrata	Tidal zone, salt laden. Static numbers?
	Japanese honeysuckle	Spreads rapidly	Vetch	Contain west	Bindweed	Amongst native. Dies off in winter
	Silver poplar	Control small number to contain west	Everlasting pea	Annual. Intertwined with native	Tall fescue	Extensive and also suppressing other weed species in interim
	Pampas	Previous control/investment Thrives in this area	Tree lucerne	Low seedling numbers	fleabane	Lesser threat
	Karo	Low numbers achievable	Fennel	Average distribution Dies down in winter	22Formosan lily	Monitor spread
	Acacia	Low numbers achievable	Yucca	Wait for regrowth. Drill & fill a few?	Marram	Western seed source persists but monitor if containment west considered achievable
	Queensland poplar	Low numbers achievable				
	Gorse	Low numbers. Keep seed source down in this zone				
	Climbing dock	Difficult to control and spreads rapidly following clearance of other weeds				

APPENDIX 1© – Estuarine edge priorities in line with existing resources

Zone	High priority	Rationale	Medium priority	Rationale	Low priority	Rationale
E1	Sharp rush	Largest risk in high value estuarine edge	Acacia	Slower to colonise	Lupin	Only likely to thrive on drier banks
	Pampas	Spreads quickly each year. Prolific wind borne seed	Karo	Slower to colonise	Pohutukawa	Single tree. PR risk.
	Periwinkle	One area found in this zone – contain before spread	Tamarix	Invasive but numbers still achievable in next five years	Buffalo grass, kikuyu	Large distribution. Wait until feasible or resource found Limited natural values here
					Tall fescue	Extensive and also suppressing other weed species in interim
E2	Sharp rush	Largest risk in high value estuarine edge	Arctosis stoechadifolia	Public consultation required as this edge will be considered a garden extension of the houses along this strip. However, good awareness potential so worth progressing control in this area. Possibly control it in sections.	Lupin	Dies back during winter
	Boxthorn	Low numbers achievable	Tree aloe (Aloe arborescens)		fleabane	Lesser threat. Annual.
	Periwinkle	Requires repeat control so if planting possible in this zone in later years, high priority now	Agapanthas		Tall fescue	Control in line with sectional control and planting
			Canna lily			
			Formosan lily			
			Tree mallow			
			Yucca			
			Geranium			
			Dimorphothecca			
			Karo			
			Kikuyu			
			Buffalo grass			
			Iceplant			
		Gazania				
E3	Spartina	Extremely invasive Previous investment	Tamarix	May take time to consult with boat club	Macrocarpa	Natural suppressant of other weeds
	Sharp rush	Large site- seed source Containment boundary?	Wattle	May take time to consult with boat club	Lupin	Lesser threat
	Periwinkle	Low numbers achievable				

APPENDIX 1(d) – Marsh priorities in line with existing resources

Zone	High priority	Rationale	Medium priority	Rationale	Low priority	Rationale
M1	Spartina	Extremely invasive Previous investment	Gorse	Much of zone not ideal habitat for gorse	Sharp rush	Too extensive in parts of zone. Possibly monitor areas of low numbers in native vegetation to ensure hydrology is containing current levels of sharp rush
			Acacia	Isolated by wet but low numbers		
			Pine (island)	Isolated by wet but low numbers		
			Boxthorn	Isolated by wet but low numbers		
M2	Spartina	Extremely invasive Previous investment	Sharp rush	Too large? Monitor boundary first?	Tall fescue	Too extensive Supressing other weeds Whitebait habitat
	Red canary grass	Low numbers High risk	Acacia	Difficult access		
	Willow	Low numbers. Achievable				
M3	Spartina	Extremely invasive Previous investment	Sharp rush	Too large?	Tall fescue	Too extensive Supressing other weeds Whitebait habitat
	Red canary grass	Low numbers High risk	Gorse	Confined to drier areas		
	Willow	Low numbers	Floating sweetgrass	?? medium term due to access and other work here?? Possibly 'high'		

Note: Due to time and access constraints, a more thorough survey of weeds is recommended in zones M1 – M3 following the implementation of high priority work above.

APPENDIX 2 (a) – Recommended 2015/2016 hours for species or zone per year (based on existing business planning hours)

Feedback from team re. this approach....maybe needs more work re. efficiencies once methods fully agreed. Designed as working document. Set each year to one page.

Approx. hours	2015 / 2016	Zones	Potential gain for 2016/17	Comments
16	Staff visit for threatened, regionally rare and unknown native plant ID (if required for current staff)	All?		Contract or invite botanical specialist
100	Spartina	M1, M2, M3, E3	30	Hours likely to level out to approx. 70 per year
16	Reed canary grass	M3		More hours required to include M2 next year
80	Sharp rush	D2, S2, E1, E2, E3		
40	Mapping sharp rush distribution when in seed	All		Recorded as GPS clusters/polygons where numerous
40	Boxthorn, pampas, boneseed	D2, D3, S2		
32	HDC consultation re. dumping, bollards and signage, ideally prior to spring control	S1, D3, E1		Office/consult only
24	Ivy species, periwinkle, lily of the valley, thistle species	D3, S1, E1, E2, E3		Possibly include lower priority if efficient (eg. tree mallow)
16	Climbing dock, karo, acacia, iceplant, queensland poplar (low #'s)	S2, D3		Some possibly by volunteer (see appendix 3)
24	Japanese honeysuckle	S1, S2, D3		
16	Gorse, Willow	S1		Possibly include lower priority if efficient
8	Planning and initial contact for potential E2 control and eventual planting.	E2		Office/consult only
12	Staff set up volunteer senecio, 25formosan lily and evening primrose manual removal	D2		Possibly include lower priority weeds which make sense to do at the same time. No staff required year 2
Any extra resource	Next priority weeds in D3 and S1 as per Appendix 1 Monitoring of sharp rush boundary in M2	D3, S1, M2		Possibly also monitor low numbers of sharp rush in native vegetation in M1

APPENDIX 2 (b) – Recommended 2016/2017 hours for species or zone per year (based on existing business planning hours)

Approx. hours	2016 / 2017	Zones	Potential gain for 2017/18	Comments
72	Spartina	M1, M2, M3, E3	Nil	Expected baseline hours for survey each year
96	Sharp rush	D2, S1, E1, E2, E3		Very approximate. Will depend year 1 & 2 control results
32	Reed canary grass, floating sweetgrass	M2, M3		
40	Boxthorn, pampas, boneseed follow up. Acacia, wattle and tree lucerne	D2, D3, S1, S2, E1, E2		
16	Japanese honeysuckle, german ivy, English ivy, lily of valley vine, climbing dock follow up	S1, D3		
16	Periwinkle	D3, S1, E1, E2, E3		
16	Yucca, fennel, lupin	S1, S2		
32	Silver poplar	S1, S2, D3		
24	Everlasting pea, vetch	S1, S2, D2, D3		
32	Willow	M2, M3		
32	E2 control/planting consultation. Planting planning. Boat club consult re. species along mown part of E3	E2		Partnership support – both DOC partnership team. HDC, Horizons, Manawatu Estuary Trust?
16	Volunteer day digging tuber and bulb spp (inc. comms and prep). Also pampas seed head removal if useful before control work	D3, S1		Next year's follow up could possibly be done without staff assistance if same volunteers on board
Any extra resource	Further weed surveying of M1 & M3 Extend silver poplar control Kikuyu and buffalo grass in high value zones such as S1			

APPENDIX 2 (c) – Recommended 2017/2018 hours for species or zone per year (based on existing business planning hours)

Approx. hours	2017 / 2018	Zones	Potential gain for 2018/19	Comments
72	Spartina	M1, M2, M3, E3	Nil	Expected baseline hours for survey each year
64	Sharp rush	D2, S1, E1, E2, E3, M1?		Introduce M1 control?
32	Reed canary grass, floating sweetgrass	M2, M3		
24	Boxthorn, pampas, boneseed follow up. Acacia, wattle, tamarix and tree lucerne	D2, D3, S1, S2, E1, E2		
8	Japanese honeysuckle, german ivy, English ivy, lily of valley vine	D3, S1		
16	Periwinkle	D3, S1, E1, E2, E3		
16	Yucca, fennel, lupin	S1, S2		If yucca has enough foliage. Possibly biannual control
40	Silver poplar	S1, S2, D3		
8	African daisy, follow up bulb/tuber species	D3, S1		
16	Everlasting pea, vetch follow up	S1, S2, D2, D3		
32	Willow follow up plus surveying for new outcrops	M2, M3		
16	Gorse, pine, acacia, boxthorn	M1, M2, M3		
40	Notification and control of first section of E2 if consultation is successful (see appendix 3 re. manual volunteer help)	E2		Partnership support – both DOC partnership team. HDC, Horizons, Manawatu Estuary Trust?
8	Volunteer day digging tuber and bulb spp (inc. comms and prep)	D3, S1		DOC partnership team assistance?
16	Tamarix, wattle, gazania, yucca	D2		
16	Start marram control at top of D2 foredunes (narrow band). Planting planning (seed collection, volunteers etc)	D2		Only if planting feasible following successful control (2 years?)
Any extra resource	Increase sharp rush control Extend silver poplar control	As above		

APPENDIX 2 (d) – Recommended 2018/2019 hours for species or zone per year (based on existing business planning hours)

Approx. hours	2018 / 2019	Zones	Potential gain for 2019/20	Comments
72	Spartina	M1, M2, M3, E3	Nil	Expected baseline hours for survey each year
64	Sharp rush	D2, S1, E1, E2, E3, M1?		Continue M1 control?
16	Reed canary grass, floating sweetgrass	M2, M3		
16	Boxthorn, pampas, boneseed, acacia, wattle, tamarix and tree lucerne follow up	D2, D3, S1, S2, E1, E2		
8	Japanese honeysuckle, german ivy, English ivy, lily of valley vine	D3, S1		
16	Periwinkle	D3, S1, E1, E2, E3		Possibly less hours
8	Yucca, fennel, lupin	S1, S2		If yucca has enough foliage. Possibly biannual control
48	Silver poplar	S1, S2, D3		
8	African daisy, bulb species follow up	D3		
8	Everlasting pea, vetch follow up	S1, S2, D2, D3		
24	Willow follow up plus surveying for new outcrops	M2, M3		
16	Gorse, pine, acacia, boxthorn follow up	M1, M2, M3		
40	Follow up control of first section of E2 if consultation is successful. Initial control of second section.	E2		Partnership support – both DOC partnership team. HDC, Horizons, Manawatu Estuary Trust?
16	Volunteer day digging tuber and bulb spp (inc. comms and prep)	D3, S1		DOC partnership team assistance?
4	Tamarix, wattle			
20	Marram follow up at top of D2 foredunes	D2		
Any extra resource	Lodgepole pine D2 Periwinkle and iceplant control D2	D2		

APPENDIX 2 (e) – Recommended 2019/2020 hours for species or zone per year (based on existing business planning hours)

Approx. hours	2019 / 2020	Zones	Potential gain for 2020/21	Comments
72	Spartina	M1, M2, M3, E3	Nil	Expected baseline hours for survey each year
64	Sharp rush	D2, S1, E1, E2, E3, M1?		Continue M1 control?
8	Reed canary grass, floating sweetgrass	M2, M3		
16	Boxthorn, pampas, boneseed, acacia, wattle, tamarix and tree lucerne follow up	D2, D3, S1, S2, E1, E2		
8	Japanese honeysuckle, german ivy, English ivy, lily of valley vine	D3, S1		
16	Periwinkle	D3, S1, E1, E2, E3		Possibly less hours.
8	Yucca, fennel, lupin	S1, S2		If yucca has enough foliage. Possibly biannual control
48	Silver poplar	S1, S2, D3		
8	African daisy, bulb species follow up	D3		
16	Everlasting pea, vetch follow up	S1, S2, D2, D3		
24	Willow plus surveying for new outcrops	M2, M3		
16	Gorse, pine, acacia, boxthorn follow up	M1, M2, M3		
40	Planting of first section of E2 (if consultation successful). Second control of second section.	E2		Partnership support – both DOC partnership team. HDC, Horizons, Manawatu Estuary Trust?
32	Spinifex/pingao planting top of D2 foredune Another narrow band of marram control east of first section	D2		Partnership support – both DOC partnership team. HDC, Horizons, Manawatu Estuary Trust?
48	Lodgepole pine, periwinkle and iceplant, lupin control	D2		
Any extra resource	Consider macrocarpa removal in D3 if silver poplar control going well	D3		

APPENDIX 3 – VOLUNTEER OPPORTUNITIES

ACTIVITY	ZONE/S	NUMBERS OF VOLUNTEERS	COMMENTS
Digging out bulb species	D2, D3, S1, E2	4 - 12	Bulbs difficult to control with herbicides
Digging out agapanthas	D2, D3, S1, E2	4 - 12	As above
Digging out climbing dock tubers	S2	4 - 12	
Cut n paste lupin, gorse, queensland poplar, karo, acacia, wattle, tamarix, tree lucerne	S1, S2, D2, E1, E2, E3	4 - 12	Some may be too large for volunteers and should be assessed by staff first (Eg, tamarix in E3)
Cut n paste wilding pines	D2	4 - 12	As above. Can rot down in situ. Potential for Xmas tree event?
Manually remove arctosis, fleabane, solanum and senecio species before seeding	S1	1 - 2	Small amount only in S1
Manually remove evening primrose	D2, D3	2	Low numbers
Cut and remove pampas heads before seed released	D2, D3, S2, E1 – 3	6	
Manually remove the physical bulk of some weeds adjacent to houses in E2 to minimise herbicide volumes required	E2	10 -20+	Staff to select appropriate species
Co-ordinating awareness and replanting of E2 in achievable sections	E2	?	Possibly undertaken from west to east but could be driven by other factors such as buy in from neighbours
Writing media releases in conjunction with agencies re. weed awareness and estuary values		1 - 3	Must be well informed and engaging. Estuary Trust?
Giving school/wananga presentations on the estuary, including weed issues (garden dumping, vehicles etc)		1 - 3	Must be well informed and engaging. Estuary Trust?