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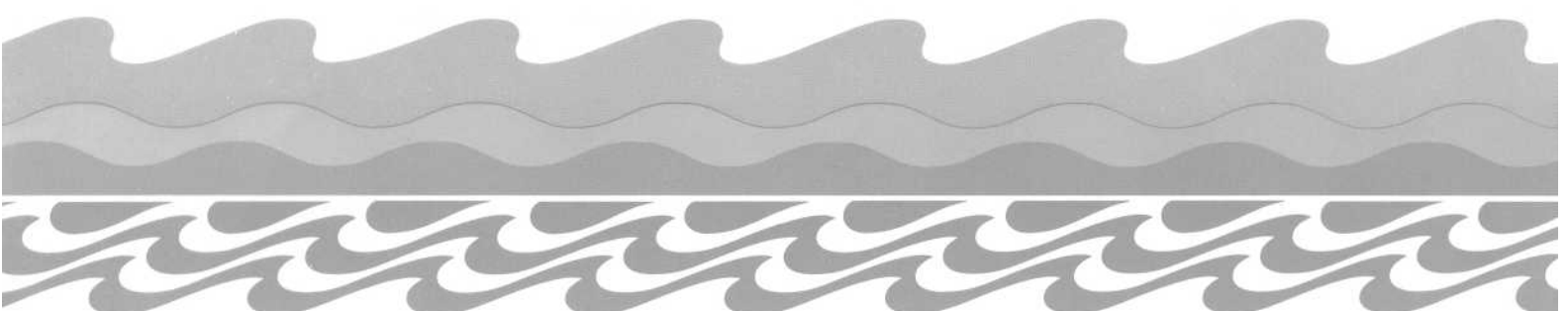
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RUAPEKAPEKA PA MANAGEMENT

(Short Answers in Conservation Science)

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"RUAPEKAPEKA PA MANAGEMENT"

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1.0 Summary

Amenity areas at Ruapekapeka Pa are generally dominated by the indigenous grass *Microlaena stipoides*. Management factors which should enhance the dominance of this species are outlined. Initially only small experimental areas should be trialled, so that the full impact of such management practises can be ascertained prior to more widespread use.

Open lawn areas.

1. Spray broadleaves with 2,4-D at 4 mls/l water during spring, using knapsack.
2. Allow *Microlaena stipoides* to go to seed by not mowing from October to February. Natural reseeding and establishment should occur. If necessary, collect seed from selected areas or other sites to serve as a supplementary seed source.
3. The eastern and southern periphery require additional reseeding. Some *Microlaena stipoides* seed collection during summer for hand reseeding during autumn is required on these areas. Reseeding should occur before expected rainfall.
4. Indigenous grasses have failed to survive on heavily tramped pathways and in the central areas of the Pa. These areas should be resown during autumn using introduced turf type *Festuca* spp. and *Agrostis* spp.
5. Maintain relatively lax mowing regime already in place.
6. Spray kikuyu on northwest periphery with Roundup at 10 ml/l water plus Pulse at 1 ml/l water. These areas should also be reseeded during autumn. Reseeding can occur about 1 week after spraying.

Excavations

1. Knapsack spray invasive shrubs and ferns with Roundup at 10ml/l water plus Pulse at 1ml/l water during autumn. Those weeds not killed may need follow-up spraying with an alternative broadleaf weed killer such as Grazon at 4 ml/l water.
2. Collect seed from local populations of *Microlaena stipoides*, *Rytidosperma* spp. and *Oplismenus imbecillus*. Areas may need to be locked up during October for seed harvesting during the period from December to February.
3. During autumn reseed the area with indigenous grasses. *Microlaena stipoides* and *Rytidosperma* spp. on steep dry banks. *Microlaena stipoides* in semishaded areas. *Oplismenus imbecillus* on heavily shaded or damp spots in bottoms of formations. Sowing should occur immediately prior to rain.

2.0 Brief

Ruapekapeka Pa Management

- Advise on
- 1) Grass species that could be established on this sensitive site.
 - 2) Planting regimes and associated fertilising requirements.
 - 3) Means of controlling invasive plants including kikuyu and shrubs while minimising impacts to the site.

3.0 Background

During 1845 Ruapekapeka Pa near Kawakawa was the site of the last battle of the war in the North. The Pa was one of the earliest fortifications built and defended by Maoris against Pakeha troops. Although palisades and huts were destroyed by the troops, the massive earthworks are still very evident.

Concern has been expressed about the degradation and erosion of these earthworks occurring over time. Some formations at the site are seriously eroding. Several tunnels have collapsed. Some of the steeper excavation faces are eroding.

Management systems which reduce erosion are required. Consideration must also be given to cultural and aesthetic values associated with the site.

3.1 Soils

Given the historic nature of the site detailed soil analysis was not acceptable.

The site is located within a mapping unit including both the Waimate North clay loam and the Whatitiri clay loam. These are Red and Brown loams derived from basaltic parental material. Natural fertility is described as medium to high, but the iron and alumina compounds present at high levels fix soluble phosphates in a form relatively unavailable to plants. Though free draining under moderate weather conditions these soils tend to dry out rapidly during summer months. In steeper areas the soils are prone to slight earth slip, gully and sheet erosion.

The extremely friable nature, and good structure of the soils at the site are probably assisting erosion processes affecting archaeological features.

3.2 Current management

The site is managed with a minimum of input. Stock are excluded from the site. The main area of the Pa appears to be laxly mown. It is unlikely that any regular fertiliser application has occurred.

Weeds such as bracken and gorse occur in most of the excavations. No evidence of attempted control is present.

Unkept peripheral areas are in tall bracken and kikuyu.

Some native tree and shrub plantings have occurred near the entrance gate.

The area is open to visitors.

3.3 Species present

Dominant plant species present in main amenity areas include:

Monocotyledoneae

<i>Microlaena stipoides</i>	Meadow rice grass.
<i>Rytidosperma spp.</i>	Danthonia.
<i>Paspalum dilatatum</i>	Paspalum.
<i>Dactylis glomerata</i>	Cocksfoot.
<i>Holcus lanatus</i>	Yorkshire fog.
<i>Sporobolus africanus</i>	Ratstail.
<i>Pennisetum clandestinum</i>	Kikuyu.

Dicotyledoneae

<i>Plantago lanceolata</i>	Narrow leaf plantain.
<i>Daucus carota</i>	Wild carrot.
<i>Geranium molle</i>	Doves foot.
<i>Chrysanthemum eucanthemum</i>	Oxeye daisy.
<i>Verbena bonariensis</i>	Purple top.
<i>Hypochaeris radicata</i>	Catsear.
<i>Bellis perennis</i>	Daisy.
<i>Prunella vulgaris</i>	Selfheal.

Filicidae

<i>Pteridium esculentum</i>	Bracken.
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Microlaena stipoides is the main grass species present and management should focus on encouraging this species.

Broad leaf weeds listed occur over the whole site, but tend to dominate on the southern and eastern areas. These should be selectively removed to enhance the grass population.

Dominant species present in excavations (tending to be damp and shaded) include:

Monocotyledoneae

<i>Holcus lanatus</i>	Yorkshire fog.
<i>Dactylis glomerata</i>	Cocksfoot.
<i>Juncus</i> spp.	Rushes.
<i>Cyperus eragrostis</i>	Umbrella sedge.

Dicotyledoneae

<i>Convolvulus arvensis</i>	Field bindweed.
<i>Rubus fruticosus</i>	Blackberry.
<i>Coprosma lucida</i>	Karamu
<i>Ulex europaeus</i>	Gorse.

Filicidae

<i>Pteridium esculentum</i>	Bracken.
<i>Cyathea</i> spp.	Ponga.

Where possible larger species should be removed in favour of vigorous grasses and herbs.

The larger shrubs may be offering some protection from erosive forces. However, the extensive root systems of shrubs, though providing protection at present, may in the long term assist the erosion process through soil disturbance.

4.0 Potentially useful species

Amenity grass species are expected to have: good colour throughout the year; fine leaves without stiffness; a high tillering dense and spreading growth habit; low productivity to reduce mowing frequency; wide environmental tolerance but minimal weed potential; simplicity of establishment; tolerance of shade; and treading or wear tolerance.

A range of grass species satisfying some, if not all of these characteristics exists and can be utilised at the site.

4.1 Species

The opportunity exists to use both indigenous and exotic grasses to aid preservation of archaeological features at Ruapekapeka Pa. Commercial seed supplies of indigenous species do not exist so hand harvesting and cleaning will be necessary. Indigenous grasses which may be appropriate include *Microlaena stipoides*, *Rytidosperma* spp. and *Oplismenus imbecillus*. Introduced species of the genera *Festuca* spp. and *Agrostis* spp. would also be useful. Each has specific environmental requirements briefly:

<i>Microlaena stipoides</i>	Dry sites, full sun or semishade. Drought tolerant.
<i>Rytidosperma</i> spp.	Excessively dry sites.
<i>Oplismenus imbecillus</i>	Full shade.
<i>Festuca</i> spp.	Drought and treading tolerant.
<i>Agrostis</i> spp.	Treading tolerant.

Additional detailed information on species is provided as an Appendix.

Prior to introduction of these species the control of existing vegetation will be required. Options for this are discussed separately.

4.2 Seed collection

Where possible seed of indigenous species should be collected locally so as to preserve genetic integrity.

Seed of indigenous species is not available commercially. To supply sowing requirements seed would need to be collected from wild populations.

As a very general guide for seed crops:

1. Apply 100 kg/ha urea during early winter and again in late winter to promote tiller formation.
2. Apply 250 kg/ha 15% potassic superphosphate in early spring.
3. Close seed crop during September/October i.e. cease mowing or grazing. No nitrogen applications after closing. Phosphate and potash could be applied if thought necessary.
4. Monitor seed development and harvest readiness from December to February.
5. Hand harvest as appropriate.
6. Naturally air dry collected seed in sunny ventilated position.
7. Hand thresh and clean and appropriate. Simple hand threshing equipment is easily constructed.
8. Store in cloth or paper bags under refrigerated conditions till sowing.

Seed of the introduced *Festuca* spp. and *Agrostis* spp. should be available from any seed merchant of stock and station company.

5.0 Recommendations

5.1 Open amenity areas.

5.1.1 Weed control

Spray during spring to selectively remove broadleaf weeds. Removal of broadleaves should reduce competition and allow *Microlaena stipoides* to dominate. Non residual chemicals are required as resowing and self seeding are planned. Such areas should be sprayed when weeds are actively growing i.e. during spring or autumn. Broadleaf herbicides such as 2,4-D or Grazon should be used. Knapsack application of either product using 4 mls/l water should provide adequate control. Current label recommendations should always be adhered to. Some slight burning of foliage on non target species can be expected.

Given the archaeological values of the site physical control methods such as grubbing or burning are neither viable or appropriate.

5.1.2 Reseeding

Natural reseeding of *Microlaena stipoides* should be encouraged by not mowing the site from October to February. Selected areas could be set aside on an annual basis so as not to interfere with visitor use of the site.

Natural reseeding should be supplemented by collecting and broadcasting additional seed from other sites onto selected areas. The eastern and southern peripheries require most attention. Sowing should occur in autumn when reliable soil moisture levels can be expected ie before rainfall. This usually occurs sometime during April. Seed should be broadcast at approximately 30 g/m² of dehulled seed. Under correct weather conditions covering the seed with soil is not necessary.

Seed of *Festuca* spp. and *Agrostis* spp. should be broadcast onto heavily treaded areas at 17 g/m² and 5 g/m² respectively. These occur on the pathway and in the central area of the pa. It would assist establishment if foot traffic was excluded until seedlings reached the first true leaf stage. A simple string should be sufficient to deter visitors from walking on seedlings.

5.1.3 Fertilisers

Indigenous grasses should not require much fertiliser.

If thought necessary supplementary nitrogen fertilisers (100 kg/ha urea) could be applied 6-8 weeks from sowing. Lime, potassium and phosphate may also be needed but application rates would depend on a soil test. Cores taken from adjacent roadside areas or the periphery of the Pa site would be the most appropriate, as sampling of the actual site would cause some damage.

5.1.4 Pests

Slugs and crickets could be controlled using Mesurol slug baits broadcast over sown areas. These are available from garden shops and stock and station agents.

Birds may be a problem with sowing in late autumn. If small areas are sown it may be feasible to temporarily cover these with material such as shade cloth.

5.1.5 Management

Once established the regular lax mowing regime already in place should be sufficient to maintain an acceptable turf. To achieve adequate population and plant density the whole procedure may require repeating in subsequent years.

Only small areas should be developed at any one time.

5.2 Excavations

5.2.1 Weed control

Chemical control of shrubby broadleaves and ferns is required. Selective knapsack application during summer and autumn is needed. Roundup with Pulse at 10 mls/l water and 1 ml/l water respectively should control bracken and other ferns. Woody weeds such as gorse could also be controlled using the same mixture, however, should problems be encountered then Grazon could be used at 5-6 mls/l water. Roundup should provide an almost complete non selective kill. Current label recommendations should always be adhered to.

Physical removal of trash will also be needed before sowing. A weedeater or scrubcutter type of machine should be sufficient to achieve knock down. Material may need to be removed by hand.

Physical control methods could also be used. These are unlikely to control gorse but may kill bracken and shrubs. All above ground plant parts would need to be repeatedly cut and removed, eventually starving the plant to death. With bracken all fronds would need to be removed by either cutting or pulling. This would need to be done during December - January and again in late autumn. It would take several years to achieve a complete kill.

Burning is not recommended.

5.2.2 Reseeding

Disturbance of site by raking or cultivation is not an acceptable option.

Surface broadcasting and indigenous species should occur during autumn.

Higher rates of seed application should be used as surface broadcasting does result in high seedling losses, especially in the harsh conditions which occur on the steep faces.

Seed of *Microlaena stipoides* and *Rytidosperma* spp. should be applied to drier faces and vertical areas. Getting seed to adhere to these sites may be difficult. An experimental hydroseeding application on steeper faces of some excavations may be warranted.

Oplismenus imbecillus should be spread in the bottom of excavations and in shaded zones.

5.2.3 Fertilisers

Though all species are adapted to low fertility supplementary nitrogen fertilisers (100 kg/ha urea) could be applied 6 - 8 weeks from sowing.

As before, lime, potassium and phosphate may also be necessary, but soil test information is really required.

5.2.4 Management

These species should provide adequate ground cover. Mowing or maintenance should not be required. Follow up selective control of broadleaf weeds and shrubs using Grazon at 5-6 mls/1 water may be required.

6.0 Other comments

6.1 British camp

Cattle should be excluded from this area. If grazing is necessary sheep should be used, as they are less damaging to soil formations.

Appendix: Species Information

Common name: Meadow rice grass.

Species name: *Microlaena stipoides*

Photosynthetic pathway: C₃

Seed harvesting: Close seed crops during October. Harvest seed by hand from mid-December to early - February. Dry naturally and store under refrigerated conditions in paper or cloth bags. Threshing of seed is not necessary. Seed dormancy has not been noted.

Establishment: From seed or rhizomes. Seedlings are aggressive in cultivated soil. Seed is not commercially available. Sow 30 g/m² dehulled seed during autumn or spring when adequate soil moisture can be expected.

Growth habit: Erect bunched creeping grass with a very short and compact rhizome system producing numerous slender stems. Tends to form small patches or clumps.

Fineness: Moderately coarse texture but has reasonably narrow leaves. Stiff.

Leaf colour: Light green-yellow during the warmer seasons. Dark green during winter.

Shade tolerance: Good. Tolerates shading too severe for most lawn species. Also grows well in full sun.

Productivity: Low. Most growth occurs in the warmer summer months.

Habitats: Present in a very wide range of dry habitats including poorly managed pastures, summer dry country, orchards, parks, lawns, coastal areas and bush margins. Tolerant of poor fertility. Often present on dry hillsides.

Origin: Indigenous.

Cultivars: None. Initial germplasm collection has been done in Australia and New Zealand. These are aimed at developing amenity and pasture cultivars.

Potential use: Rural or suburban sports fields, fairways, domestic lawns and conservation areas.

Comments: Forms a very attractive turf under close mowing. Tolerates mowing well. Close mowing can cause scalping. Best temperate species for summer greenness when mown. Yellow green in summer under lax management.

Common name: None

Species name: *Oplismenus imbecillus*

Photosynthetic pathway: C₃

Seed harvesting: Generally a sparse seeder. Close seed crops during October, and harvest February by clipping inflorescences from plant. Dry naturally, store under refrigerated conditions in cloth or paper bags. Thresh or sort to remove trash.

Establishment: Establishes from seed or stolons. Seed is not commercially available. No information on seed sowing rates available.

Growth habit: Low growing grass with short broad leaves and trailing stems. Tends to form monocultures. Intolerant of heavy treading.

Fineness: Slightly coarse, but has fine small leaves under mowing.

Leaf colour: Dark green throughout the year. Some yellowing and browning in full sunlight and if frosted.

Shade tolerance: Excellent, more tolerant of shade than *Microlaena*. Intolerant of full sun.

Productivity: Low. Main growth occurs during spring and early summer.

Habitats: Commonly in shaded places. Never in full sun. Tolerates wide range of soil types. Intolerant of heavy frosting.

Origin: Indigenous.

Cultivars: None. Initial germplasm collection has been done in New Zealand. Aimed at developing and amenity type for suburban use. Plants selected for tolerance of full sun and frosting.

Potential use: Excessively shaded areas under trees or beside buildings, suburban lawns and landscaped environments.

Comments: Under mowing in shaded conditions it forms a dense close mat.

Common name: Danthonia

Species name: *Rytidosperma biannulare*, *R. tenuius*, *R. pilosum*, *R. racemosum*, *R. pencilatum*, *R. gracile*, *R. unarede*.

Photosynthetic pathway: Not established, probably C₃.

Seed: Not commercially available. Mature flower heads usually present during December and January.

Establishment: Seed. No other information available.

Growth habit: Short bunched grass. Tends to form individual clumps rather than a continuous sward.

Fineness: Extremely fine.

Leaf colour: Blue or grey green.

Shade tolerance: Poor, prefers open areas in full sunlight.

Productivity: Extremely low. Summer grower. Would only require very occasional mowing.

Habitats: Low fertility, dry habitats. Often on very steep sites with extremely low soil moisture.

Origin: Indigenous.

Cultivars: None. No known germplasm collections in New Zealand.

Potential use: Low maintenance amenity areas prone to excessive summer moisture stress.

Comments: *Rytidosperma biannulare* is one of the most common species of this genera in Northland. Very little information available. Has been reported as having an allelopathic effect on other species.

Common name: Chewings fescue, creeping red fescue.

Species name: *Festuca rubra*

Photosynthetic pathway: C₃.

Seed: Commercially available.

Establishment: Establishes from seed. Sow at 17 g/m² in a pure sward. Sow during autumn.

Growth habit: Low growing grass forming very dense clumps. Weakly rhizomatous.

Fineness: Very fine leaves under mowing.

Leaf colour: Dark green throughout the year. Colour varies slightly with cultivar.

Shade tolerance: Tolerates shade but not as shade tolerant as *Microlaena* or *Oplismenus*. Best in full sun.

Productivity: Low but depends on soil fertility. Main growth occurs during spring and summer.

Habitats: Found in lawns and pastures on a wide range of environments. Common on low maintenance dry sites. Tolerant of frosting.

Origin: Europe.

Cultivars: Many. Widely used turf grass internationally. New Zealand cultivars include Cook and Tasman. Overseas cultivars commonly used in New Zealand include Barfalla, Amboise Dawson and Frida.

Use: Already widely used in sportsfields, domestic lawns and low maintenance areas. Usually as part of a mix with browntop.

Comments: Forms an attractive turf. Remains attractive dark green colour during droughts.

Common name: Browntop, Bent grass.

Species name: *Agrostis capillaris*, *A. castellana*.

Photosynthetic pathway: C₃.

Seed: Commercially available.

Establishment: Readily establishes from seed. Sow at 5 g/m² in a pure sward. Sow during autumn.

Growth habit: Stoloniferous grass forming dense mats.

Fineness: Fine leaves under mowing.

Leaf colour: Light or blue-grey green in colour. Colour varies slightly with cultivar.

Shade tolerance: Intolerant of shading. Best in full sun.

Productivity: Main growth occurs in spring and autumn. Summer growth constrained by droughts.

Habitats: Extremely common grass in pasture and lawns. Common in low fertility situations under sheep grazing or mowing.

Origin: Europe.

Cultivars: Many. Widely used turf grass internationally. New Zealand cultivars include Egmont, Sefton and Milford. Other cultivars include Bardot, Tracenta, Contrast and Astoria.

Use: Used in both pastures and lawns. Usually as part of a mix.

Comments: Good turf grass but is drought prone.