Draft Revised Recovery Plan for *Lachnagrostis limitanea* (synonym *Agrostis limitanea*) (Spalding Blown Grass) 2007-2012

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A recovery plan prepared under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999.

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Abbreviations

SA DEH	South Australian Department for Environment and Heritage
AG DEH	Australian Government, Department of the Environment and Heritage
IUCN	International Union for the Conservation of Nature
TPAG	Threatened Plant Action Group
EPBC	Environment Protection and Biodiversity Conservation Act 1999
BEST	Biodiversity and Endangered Species Team

PART 1: SPECIES INFORMATION AND GENERAL REQUIREMENTS

1.1 Species

This recovery plan concerns *Lachnagrostis limitanea* (Spalding Blown Grass) (J.M.Black) S.W.L.Jacobs. Listed under the synonym *Agrostis limitanea* (Spalding Blown-grass) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as Endangered.

1.2 Conservation Status/Taxonomy

Agrostis limitanea has recently been included in the genus *Lachnagrostis* (Jacobs, 2001), a member of the Poaceae (Gramineae in Jessop & Toelken 1986). *L. limitanea* (J.M.Black) S.W.L.Jacobs (Spalding Blown Grass) is a short-lived tufted perennial grass, growing 30-45 cm tall. The stems and leaves grow erect. Leaf blades are bright green to blue-green with in-rolled edges, slightly rough to touch with a 4-6 mm long colourless membrane (ligule) at the base of the leaf blade. Fertile heads are produced in the spring to autumn season when conditions are favourable. The flowering head is much branched, 8-20 cm long; becoming open and loose soon after emerging from the leaf sheath, branches whorled, slender; flowers tiny (approx. 3 mm long) and borne singly on fine branches. A distinctive feature of this species is its lack of awns.

Lachnagrostis billardieri, an annual, occurs in the same habitat and the two species may occur together. The most obvious difference is the presence of a bent awn, which is easily visible protruding from the seed in *A. billardieri*. *Lachnagrostis limitanea* seeds lack an awn. While the original description of the species (Black 1931) was based on a single specimen, its taxonomic status as a distinct species has been supported by recent work (Jacobs 2001).

The status of *L. limitanea*, both under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 and under the South Australian *National Parks and Wildlife Act* 1972 is Endangered. The status according to the IUCN (1994) criteria is Critically Endangered under criterion CRB1 because its population is severely fragmented and CRB2(c) the area and quality of the species' habitat is projected to continue to decline. The species is endemic to the Northern Lofty Ranges Region of South Australia. Only four extant subpopulations are known, of which the two main subpopulations comprise an estimated 4000±500 plants at Yakkalo and 117 adult plants at Tarlee. The third subpopulation (Riverton) consists of only two individuals. A single plant has been found at a fourth location (Logan's Creek). This subpopulation has only recently been relocated and a thorough survey has not been undertaken, however it is thought to number less than 10 individuals. An additional subpopulation was discovered on a water reserve outside the town of Saddleworth in the early 1990's, however the site did not receive the appropriate management and the species is believed to have become extinct at this location (pers. comm. R. Bates 2005).

Under the previous recovery plan (Robertson & Steed 2000) a translocation site was established on private property at Gulnare, detailed in Steed (2002). Ten plants were planted at Gulnare and two areas of $1m^2$ were direct seeded. All propagules were obtained from the Yakkalo site. A fence to exclude stock from the translocation area was planned, however complications with the ownership of the land meant that this fence was never erected and translocated plants were grazed upon by stock. No *L. limitanea* individuals were recorded during visits to the site by members of the Spalding Blown Grass Recovery Team in October 2004 and May 2005.

The known extent of occurrence for the species is less than 1 000 square kilometres (obtained from the Arc GIS package using minimal convex polygons) and the area of occupancy is less than one hectare.

The species' status under the International Union for the Conservation of Nature (2001) criteria is Critically Endangered, under criteria CRB2 (area of occupancy $<10km^2$) because:

a. Its population is severely fragmented and
b. The area and quality of habitat is projected to continue to decline.

As assessment under the IUCN criteria deems *L. limitanea* to be at a greater extinction risk than is reflected in its listing under Commonwealth and State legislation, the recovery plan recommends that its status should be upgraded to Critically Endangered under the EPBC Act. At present, the South Australia threatened species legislation has no mechanism for listing species as critically endangered, with the highest extinction risk-rating category being endangered. If, in the future this changes, the recovery plan recommends that the status of *L. limitanea* be upgraded to Critically Endangered under State legislation.

1.3 Objectives of EPBC Act

Implementation of this recovery plan will directly further objectives a), b) and c) of the Act. Objectives d) to g) are addressed below:

d) To promote a co-operative approach to the protection and management of the environment involving governments, the community, landholders and indigenous peoples.

This plan promotes a co-operative approach to the protection and management of the environment through the role of the Recovery Team, involving the South Australian government (SA DEH, Department of Transport, Energy and Infrastructure), the Northern Areas Council, local community groups such as BEST, state-based community groups including TPAG and land holders.

e) To assist in the co-operative implementation of Australia's international environmental responsibilities.

This plan covers recovery of a species that is endemic to the Mid North of South Australia; therefore by implementing the plan, Australia is contributing to its international responsibility to conserve biodiversity.

f) To recognise the role of indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity.

g) To promote the use of indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

The indigenous community/ies in the area affected by this plan have not yet been identified; however the implementation of recovery actions will consider the role and interest of such communities. The involvement of any relevant indigenous communities will be sought throughout the recovery process, particularly during the consultation phase. This will be conducted in conjunction with the Aboriginal Partnerships Unit of SA DEH.

1.4 International Obligations

L. limitanea is not listed under any international agreement, therefore this plan will not impact on Australia's obligations made under the Convention on Migratory Species or the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975). However the implementation of this Recovery Plan is in keeping with the principles of the Rio Declaration on Environment and Development (Agenda 21) (1992). This plan is also consistent with Australia's obligations under the United Nations Convention on Biological Diversity (1992), ratified by Australia in 1993 and the subsequent National Strategy for the Conservation of Australia's Biological Diversity (1996).

1.5 Affected interests

The main subpopulation (Yakkalo) occurs on a small water reserve that is under the care and control of the Northern Areas Council. The council is involved in the Recovery Team and participates in decision-making that affects the reserve. A major pipeline along a pipeline easement is adjacent to the subpopulation and managers of the pipeline (SA Water) are consulted on any activities that may affect their interests. The subpopulation at Tarlee occurs on a railway reserve beside an operating railway line and the managers (Australian Rail Group), and owners (Department of Transport, Energy & Infrastructure, South Australia) are informed of all visits and consulted on any activities. *L. limitanea* individuals at Riverton occur along a public trail which is under the jurisdiction of the Office of Recreation and Sport, while the fourth subpopulation (Logan's Creek) is on a private pastoral property. Negotiations are currently underway with the landholders at both these sites to develop mutually satisfactory management agreements.

Local landholders adjoining the subpopulations are informed of all activities and a number are members of the Recovery Team. Spalding Primary School has also been involved in the establishment of a demonstration planting of the species on the school grounds.

Intensive on-ground work by members of the Threatened Plant Action Group (TPAG) and project management by the Northern & Yorke Region of the Department for Environment and Heritage are currently driving the recovery of *L. limitanea*. Land managers and neighbouring landowners have contributed substantially. The Recovery Team is providing guidance and broadening participation in the recovery process.

1.6 Indigenous people

The relevant indigenous communities in the region affected by this plan (Mid North of South Australia) are being contacted and consulted through the Aboriginal Partnerships Unit, Department for Environment and Heritage (DEH). The implementation of recovery actions under this plan will consider the role and interest of such communities.

The requirements of the *Native Title Act* 1993 only apply to land where Native Title rights and interests may exist. When implementing any recovery actions in this threatened species plan where there has been no Native Title determination, or where there has been no clear extinguishment of Native Title, there needs to be consideration of the possibility that Native Title may continue to exist.

Generally, the *Native Title Act* 1993 requires certain procedures to be followed prior to undertaking activities – known as future acts that may include certain recovery actions in this plan – which may affect Native Title rights and interests. This threatened species plan is released and will be adopted subject to any Native Title rights and interests that may continue in relation to the land and/or waters. There are no actions in this plan intended to affect Native Title. The relevant provisions of the *Native Title Act* 1993 should be considered before undertaking any future acts that might affect Native Title. Procedures under the *Native Title Act* 1993 are additional to those required to comply with the *Aboriginal Heritage Act* 1998.

1.7 Benefits to other species

The main subpopulation of the species occurs in a relatively diverse remnant grassy wetland, which is also a regionally threatened plant community (Graham *et al* 2001). Recovery actions for *L. limitanea* will also benefit this threatened habitat and other species of regional conservation significance. The other natural subpopulations occupy highly modified sites, which are undergoing restoration. This project contributes to the conservation of grasslands in the region through protection and restoration of the sites. It also contributes to knowledge of intensive management techniques that can potentially be applied to other sites and species. This project raises awareness of grassy wetland habitats in the region.

1.8 Social and economic impacts

The implementation of this recovery plan is unlikely to cause significant adverse social and economic impacts. The area of land on which actions will be undertaken is small and, with the exception of the Logan's Creek site, is not used for productive purposes. The implementation of the plan does not require major expenditure or losses by the authorities responsible.

PART 2: DISTRIBUTION AND LOCATION

2.1 Distribution

Lachnagrostis limitanea is endemic to the Northern Lofty Ranges Region of South Australia. Only four extant subpopulations are known. Figure 1 shows the current known national distribution, historical distribution, and geographic locations of subpopulations.

In 1931, J.M. Black reported the South Australian distribution of *Lachnagrostis limitanea* as: "Northern Lofty (known from only one collection from near Riverton)." Riverton is adjacent to the Gilbert River; however, the location details recorded with the specimen indicated only that the species occurred as tussocks inside the railway fence. No description of habitat was recorded and the location description was imprecise. Some searches were undertaken at Riverton during the 1990's, but failed to relocate the species (Davies 1995) and it was presumed to be extinct at the type location.

The species was not recorded again until 1989 when R. Bates collected it from a small water reserve on the upper Broughton River, near Spalding. This population (known as Yakkalo after the nearby waterhole) is still the main subpopulation known. A second subpopulation was discovered in 1994 on a rail reserve north of Tarlee. A third subpopulation was recently discovered along a disused rail reserve just outside Riverton, and this is thought to be the type location (R. Bates pers comm. 2005). A single individual has also been located along Logan's Creek, on private property, northwest of World's End.

Potential suitable habitats in the region were searched for the species in 1997/8, focusing on road, rail and other minor reserves intersected by watercourses. Figure 1 shows the sites that were searched unsuccessfully in 1997/8. A number of creek lines in the Spalding area were also unsuccessfully searched in 2005. This information is held in the SA DEH office in Clare.

2.2 Habitat that is critical to the survival of the species.

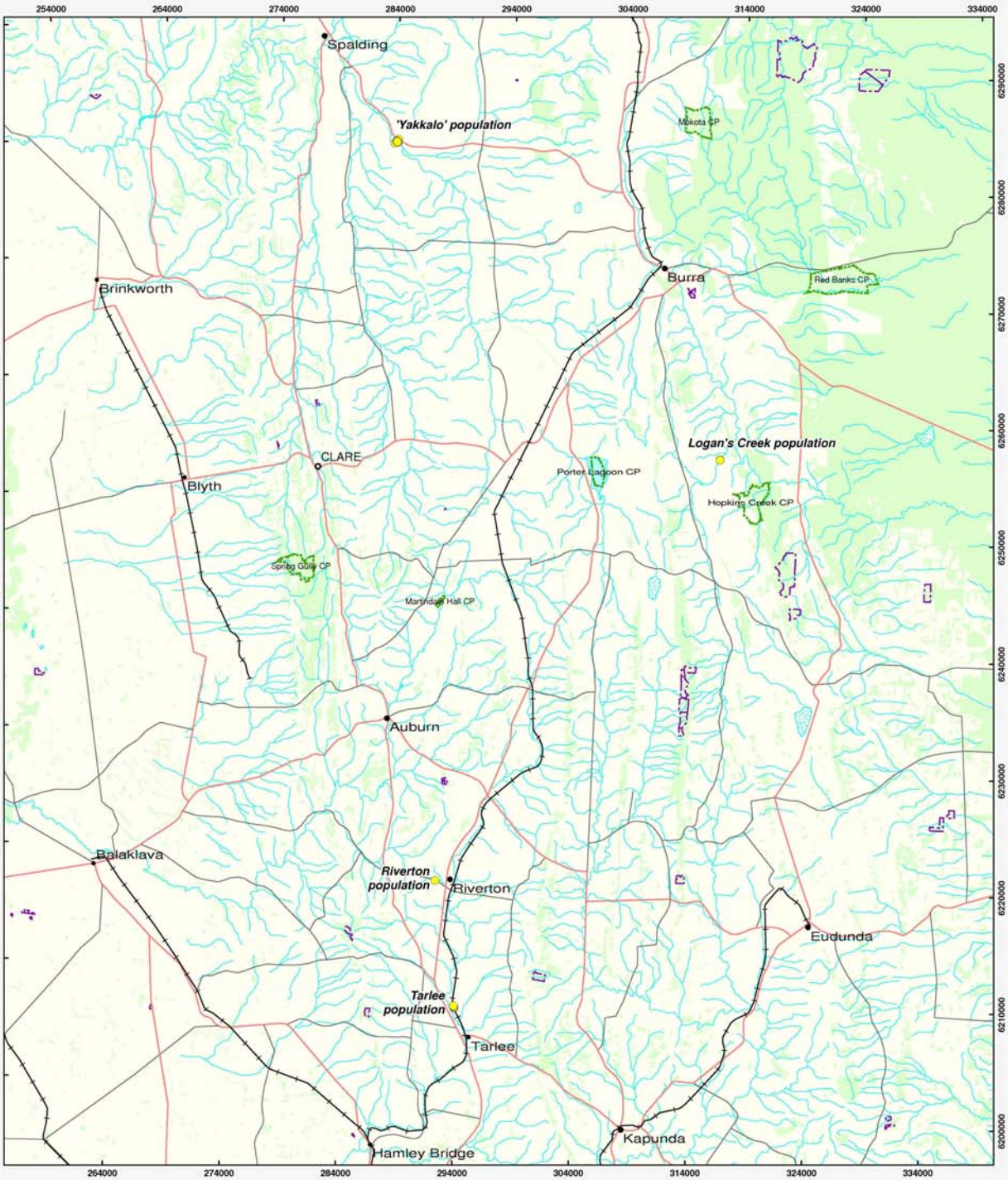
As the species is confined to only four extant subpopulations and the area covered is very small, habitat critical to the survival of the species is defined on an interim basis by its extent of occurrence and by the prevailing habitat types. Information on the habitat requirements of the species is limited to observations of the four known extant subpopulations. The known habitat consists of low-lying, flood-prone clay loam near watercourses in the Northern Lofty Flora Region of South Australia.

Habitat of the major extant subpopulation (Yakkalo) is a swampy flat, on the banks of a perennial watercourse. Most of the area where *L. limitanea* occurs has moist surface soil throughout the year. The associated native vegetation is open sedgeland with Sea Rush (*Juncus kraussii*) and sedges over low-growing native herbaceous species, including: Beaded Samphire (*Sarcocornia quinqueflora*), Emu-grass (*Distichlis distichophylla*) and Creeping Brookweed (*Samolus repens*). The subpopulation of *L. limitanea* extends towards the river among stands of Common Reeds (*Phragmites australis*), which dominate the riverbed. The associated soil is a clay loam of pH 9 ± 0.2, which is light yellow brown when dry, and dark reddish-brown when wet. Soil salinity is fairly uniform across the site, although surface moisture varies.

The Tarlee subpopulation occurs on a rail reserve north of Tarlee, in the valley of the Gilbert River and is prone to seasonal flooding. The plant association at the site is a mixture of introduced and native grassland species (see Department for Environment and Heritage 2005 for species list). The *L. limitanea* plants at the Riverton site are on the edge of creek line dominated by Common Reeds (*P. australis*), while the Logan's Creek site is a swamp dominated by Sea Rush (*J. kraussii*) and Common Reeds (*P. australis*).

As this species is critically endangered, with a limited distribution, all known habitat on which *L. limitanea* occurs should be considered to be habitat critical to the survival of this species.

Figure 1.
Distribution of extant natural populations of *Lachnagrostis limitanea*



Legend

Distribution of *Lachnagrostis limitanea*

- Extant natural population
- NPWSA Parks and Reserves
- Vegetation Heritage Agreements
- Native Vegetation Cover
- Perennial Waterbody
- Intermittent / Mainly dry Waterbody
- Major Road
- Minor Road
- Vehicular Tracks
- Drainage
- Localities

Produced by SIS Regional GIS - Northern and Yorke Region
Department for Environment and Heritage (DEH)
GPO Box 1047 Adelaide SA 5001
Web: www.environment.sa.gov.au

Data Source Flora records from Biological Databases of South Australia and State Herbarium of South Australia, DEH. All topographic data supplied by Environmental Information, DEH.

Projection Lambert Conformal Conic
Datum Geocentric Datum of Australia, 1994
Compiled October 2007

Government of South Australia
Department for Environment and Heritage

Additional areas in the Mid North meeting the environmental variables described above may also be considered to be potential habitat for *L. limitanea*. Whilst some searching for additional subpopulations has taken place unsuccessfully in the past, recent discoveries have shown that there is still the possibility that the species may remain extant at unknown locations. This is particularly the case for private property where, for logistical reasons, little searching has occurred. The long-term viability of *L. limitanea* may depend on translocation of the species, to increase the area of occupancy, extent of occurrence and reduce the extinction risk. Thus areas where the species may exist, but have not yet been identified, or where the *L. limitanea* could potentially be translocated to, may be considered to be sites potentially critical to the long-term survival of the species.

2.3 Mapping of habitat that is critical to the survival of the species.

Figure 1 shows the location of the habitats critical to the survival of the species. These locations are the only known extant occurrences of the species. As discussed above, each subpopulation covers only a small area and therefore the entire area of occupancy (and potentially the extent of occurrence) is critical to the survival of the species in the wild.

2.4 Important populations

As only four subpopulations are known and these are limited in size (see Table 1), all extant subpopulations are important for the recovery of *L. limitanea.* Their locations, land tenure and habitat type have been described above.

Table 1. Abundance of *Lachnagrostis limitanea* subpopulations.

Site	Abundance (Established plants only)
Yakkalo	4000 +/- 500 (estimate)
Tarlee	117
Riverton	2
Logan's Creek	1
Total	4120 +/- 500

The Riverton and Logan's Creek subpopulations were only located in late 2005 and thus no data is available on population trends. As a result of intensive management, the subpopulation at Tarlee has increased from 6 plants in 1994 to 117 adults in 2006. This increase appears to be largely the result of population enhancement techniques as only four adults plants at this site are natural germinants, although a large number of naturally occurring seedlings were observed in 2006.

A sub-set of the subpopulation at Yakkalo has been monitored since 1994. This has taken place in twenty contiguous 5m x 5m grids. This monitoring appears to show dramatic fluctuations in the number of plants located within the cells (see Table 2). It is unclear whether this is a reflection of the influence of seasonal conditions on population numbers or if observer error (reflecting the difficulty in distinguishing between individuals in close proximity) is the cause.

Table 2. Total number of *L. limitanea* plants counted in Yakkalo monitoring quadrat.

DATE	Total no. of plants	Cells	Area monitored within cells (m^2)	Plants/m^2 within cells
23-Jul-94	732	17	425	1.72
17-Jun-95	296	16	400	0.74
18-May-96	212	15	375	0.57
20-Sep-97	257	17	425	0.6
14-Oct-98	563	20	500	1.13
13-Oct-99	679	18	450	1.51
24-Jan-06	315	20	500	0.63

PART 3: THREATS

3.1 Biology and ecology relevant to threatening processes

This species occurs on flat to gently undulating land, along streams. This habitat has been almost entirely cleared for cereal cropping and pasture in the Northern Mount Lofty Ranges Region. These low-lying areas are generally dominated by alien plant species. The profile and hydrology of most streams in the region have been altered by the replacement of native perennial vegetation with annual crops over wide areas, and by stock watering.

L. limitanea is a short-lived, shallow-rooted perennial grass that is highly susceptible to grazing. It occurs in permanently moist drainage lines that are particularly prone to weed invasion and are generally accessible to stock. Little is known about its specific habitat requirements. A fire escaping from adjacent farmland in 1997 burnt the main Yakkalo site, but the subpopulation doubled in the following year. To germinate, seeds typically require bare ground and rain at the appropriate time, and can be readily cultivated from seed (T. Jury pers comm. 2005). In the wild, healthy green leaves are most evident in spring to summer and abundant fertile heads may be produced in the spring to autumn season when conditions are favourable. Seeds are small (less than 2 mm) and readily spread by wind and presumably water. The entire seed head also readily breaks off and can be dispersed as a unit.

While *L. limitanea* grows among dense reeds (*P. australis*) and other native wetland plants on the edge of the Broughton River, it does not survive invasion of its habitat by large alien perennial grasses such as Phalaris (*Phalaris aquatica)* and Tall Wheat Grass (*Lophopyrum elongatum*).

3.2 Identification of threats

The threats to the survival of *L. limitanea* are identified in Table 3 and addressed in more detail below.

Table 3: Identified Threats to the Recovery of *Lachnagrostis limitanea*

Threats	Threat to Short-term Survival	Threat to Long-term Survival
Competition from environmental weeds	High	High *
Grazing	High	High*
Lack of formal protection	Medium	High
Small isolated populations	Medium	High
Genetics	Medium	High
Lack of knowledge	Medium	Medium
Altered hydrology	Low	Unknown- potentially high
Climate change	Low	Unknown- potentially high

* Threats posed by these factors in the long term could be high; however the appropriate management actions in the short to medium-term may be able to reduce the threats of these factors in the longer term.

3.2.1 Competition from environmental weeds

All the subpopulations of *L. limitanea* occur in modified habitats that are dominated by alien plant species to varying degrees. The species occurs on remnant native grasslands existing as narrow strips adjacent to agricultural land and transport corridors. The survival of *L. limitanea* is dependent on continued intensive site management, including; slashing or brush cutting to control annual grasses and the selective treatment of other weeds to promote native species. The management of each site is designed to restore the mainly perennial native plant community. This should reduce invasion by annual weeds to manageable levels in the longer term.

3.2.2 Grazing

L. limitanea appears to be highly susceptible to grazing by domestic stock (TPAG pers. comm. 2005). The subpopulation outside Saddleworth is believed to have become extinct as a result of grazing pressure and the Gulnare translocation was unsuccessful due to the delay in erecting a

stock fence. At the Yakkalo subpopulation, plants colonising the edges of a cropping paddock on private land adjacent to the reserve do not survive stock grazing in summer, indicating that continued exclusion of stock is needed to protect the site. The Yakkalo and Tarlee subpopulations are currently fenced; however maintenance work is needed on the fence line at Tarlee. The Logan's Creek site is currently unfenced and is therefore threatened by grazing in the immediate future. Grazing is likely to be the single biggest threat to any unidentified and unmanaged subpopulations.

3.2.3 Lack of formal protection

Currently there are no known subpopulations of *L. limitanea* occurring within any areas formally protected for conservation. The Yakkalo site is a water reserve under the control of the Northern Areas Council, while the Tarlee site is a rail reserve owned by Department of Transport, Energy and Infrastructure and managed by Australian Rail Group. The Riverton site is located on the Mawson Trail, which is managed by the Office of Recreation and Sport. The Logan's Creek subpopulation is on private land, which is not currently subjected to any formal conservation agreements.

The lack of formal protection of any subpopulation of this species is a threat to its long-term survival, and the recovery effort is largely dependent on the continued support of landowners and managers.

3.2.4 Small isolated populations

L. limitanea is classified as Critically Endangered because of its limited population size (< 5,000 plants in total), small area of occupancy (<1 hectare) and small number of subpopulations (four). *L. limitanea* is known to have historically occurred in at least one other location and therefore may have had a much wider distribution than is currently known. As a result of habitat modification for agriculture, the species is now found in four small, isolated subpopulations. Such subpopulations are more vulnerable to extinction by a single catastrophic event. Extinction of any of the remaining subpopulations would have a significant impact on the species potential for long-term survival. Small isolated subpopulations also have a high edge to area ratio and are more susceptible to factors such as exposure to fertiliser drift, grazing and weed invasion. Small, isolated subpopulations are also particularly at risk by genetic problems such as inbreeding depression.

3.2.5 Genetics

The genetic relationships within and between subpopulations of L. *limitanea* was examined by Jusaitis *et al* (2007). The study demonstrated that:

a) All four subpopulations were genetically distinct;
b) The three smaller subpopulations show no within-site variability;
c) Most of the genetic diversity resides within the largest natural subpopulation (Yakkalo);
d) Inbreeding is the most likely cause of severe lack of genetic variability in the Logan's Creek, Riverton and Tarlee subpopulations.

3.2.6 Lack of knowledge

Knowledge of the ecological requirements and tolerances of *L. limitanea* is incomplete. In future this may impact on the ability of the Recovery Team to make appropriate management decisions. There is a particular lack of knowledge on the species' hydrological requirements and salinity tolerances. It will, therefore, be difficult to identify if these factors become a greater threat in the future. The response of this species to disturbances such as fire is also largely unknown. It is unknown whether cross-breeding will be successful, or if outbreeding depression will result.

3.2.7 Altered hydrology

It is unknown whether changes to agricultural practices and/or diversion of water from natural streams has resulted in altered hydrology and/or salinity levels at each of the wild subpopulations. Developments upstream could have significant impact, even if occurring at some distance from the subpopulations. There is currently incomplete knowledge of the species

ecological requirements and tolerances; therefore it is difficult to determine the impacts of altering the hydrology of upstream development.

3.2.8 Climate change

The nature of the impacts of potential climate change on this species is currently unknown, but may be devastating. *L. limitanea* is confined to moist habitats; if the climate becomes much drier and/or more erratic, the habitat occupied by the species may become unsuitable. A drier climate may also reduce the number of potential translocation sites, within the species' current range. It is difficult to protect this species against the threats of climate change. At present the best insurance against the risk of climate induced extinction is to conserve seed ex-situ, maximise the number of subpopulations, increase genetic diversity within sites to maximise adaptive potential and identify potential future translocation sites outside the species' current range (as indicated by regional climatic change models).

3.3 Areas and subpopulations under threat

All subpopulations of *L. limitanea* are endangered by the threats discussed above, although these may manifest themselves in different ways at each of the four locations.

3.3.1Yakkalo

The Yakkalo subpopulation is threatened by invasion of Phalaris (**Phalaris aquatica*) and other weeds and is dependent on a continuing management program to abate this threat. The site is fenced to protect it from stock grazing and inadvertent disturbance by maintenance activities and vehicles. Plants colonising the edges of the cropping paddock on private land adjacent to the reserve do not survive stock grazing in summer, indicating that continued exclusion of stock is required to protect the subpopulation.

3.3.2 Tarlee

The Tarlee subpopulation is vulnerable to chemical spray drift from adjacent farmland and the spraying of herbicide along the operational railway line. The area is dominated by alien species, including Tall Wheat-grass (**Lophopyrum elongatum*) which is threatening the site. The subpopulation at Tarlee is particularly vulnerable to competition from alien species and weed invasion due to its small size, the narrowness of the site and the dominance at the site of non-native species. It may also suffer from the effects of inbreeding depression, because the subpopulation was reduced to only three individuals in the mid 1990's.

The Tarlee subpopulation is also under threat from occasional stock grazing. The fencing around the site is currently inadequate, with a number of gaps, and it fails to completely exclude cattle from the site during the occasional stock movement along the road.

3.3.3 Riverton

The most obvious and immediate threat to the subpopulation at Riverton is competition from weeds. Many of the weeds typically associated with disturbed grasslands in the Mid North occur at this site. *L. limitanea* is also threatened by a dense stand of *Casuarina glauca*, which is invading the rail corridor from the western side. Neighbouring agricultural practices may also leave the subpopulation vulnerable to weed invasion.

As the *L. limitanea* plants are located along a public walking/cycling trail there is an increased potential for disturbance of the site by members of the public and the introduction of new weed species. There is also a potential for the subpopulation at this site to be affected by in-breeding depression, due to the extremely small number of individuals (two).

3.3.4 Logan's Creek

As this subpopulation has only recently been re-discovered, the threats to the species at the site are yet to be fully assessed. The most obvious and immediate threat is grazing by sheep and cattle. This site is also threatened by weed invasion. To date, only a single *L. limitanea* individual has been located at this site. If other individuals cannot be found, this subpopulation will suffer on-going threats relating to reproductive potential and inbreeding depression.

PART 4: OBJECTIVES, PERFORMANCE CRITERIA AND ACTIONS

4.1 Recovery objectives and timelines

The recovery objective is to improve the conservation status of *L. limitanea*, with the ultimate long-term goal being the removal of the species from the threatened species schedules. The effective implementation of this plan will be an initial stage in the species' long-term recovery. The goal of this document is to ensure that the total population, number of subpopulations, area of occupancy and extent of occurrence are increased over the next 5 years.

To increase the probability of survival of *L. limitanea*, the recovery objectives over the next five years are:

1. Prevent total extinction by *ex situ* storage of seed.
2. Abate threats from weed invasion and competition to the subpopulations in the wild, through appropriate weed control and restoration of habitat.
3. Increase the number of subpopulations, genetic variability, area of occupancy and abundance of the species.

4.2 Performance criteria

The criteria by which this recovery plan should be regarded as successful in reaching its desired objectives are: (1) the total population of *L. limitanea* should increase from approximately 4,120 ±500 individuals to at least 7,000 individuals, in the next five years and (2) no wild subpopulations should become extinct.

Since its discovery in 1989, the main subpopulation at Yakkalo has increased in size, through expansion into areas not previously occupied. The areas that the Yakkalo subpopulation has expanded into are under threat from stock grazing and pasture grass competition. The mitigation of these threats would significantly increase the abundance of the species at this site. Increases of 100% or more in the size of the small subpopulations at Tarlee, Riverton and Logan's Creek would not significantly increase the total population of *L. limitanea*. However, increased viability of these secondary wild subpopulations will improve the long-term survival prospects for the species. The establishment of additional subpopulations through translocation is not likely to significantly increase the total number of *L. limitanea* individuals, however the establishment of new subpopulations will decrease the probability of extinction in the longer term.

Additionally for the recovery planning process to be deemed a success, the co-operative management of the species must be maintained or enhanced. Currently this co-operative approach incorporates a diverse range of stakeholders, who have input into the recovery planning process through the Spalding Blown Grass Recovery Team, and through the division of implementation responsibilities between the Department for Environment and Heritage and the Threatened Plant Action Group. For the recovery effort to succeed, good communication must be maintained between these parties at all times, particularly in regards to the sharing of resources and information. A sense of ownership for *L. limitanea* by the local community is also critical for the long-term survival of the species. As such, the success of the recovery plan relies on the ability to foster community involvement.

The following performance criteria will be used to gauge whether the objectives have been achieved:

1. The main subpopulation (Yakkalo) has increased its area of occupancy through colonisation into the neighbouring private property. Abundance has increased to over 7,000 individuals within five years.
2. The Tarlee subpopulation is protected from major threats through continued weed management and fencing and has increased its abundance to from 117 to 300 plants within five years.
3. The Riverton subpopulation has been protected from major threats, through liaison with the landholders and the subpopulation size has increased to at least 50 individuals within five years.

4. The Logan's Creek site has been thoroughly surveyed for the presence of *L. limitanea* and the subpopulation size determined within two years. All *L. limitanea* individuals are protected from major threats, in cooperation with the landholders, within five years.
5. Seed from all known subpopulations is collected within one year and stored long term through the Seed Conservation Centre of DEH.
6. A mixed-gene translocation is to be undertaken ensuring site is fenced and an agreement on management is achieved with land owner/community groups. New subpopulations of at least 100 individuals established within five years.
7. Co-operative joint management of the project, including the sharing of resources and information, and involvement of a wide range of stakeholders is maintained, or increased within five years.
8. There is active involvement of the local community in the implementation, monitoring and promotion of recovery actions within five years.

4.3 Evaluation of success or failure

4.3.1 Evaluation of this recovery plan

The Recovery Team will play an active role in planning and implementing all actions, and monitoring the success of the project. The Recovery Team provides linkages between local and non-local workers and its membership includes: Spalding Community Management Committee, Threatened Plant Action Group, Northern Areas Council, Department for Environment and Heritage, Department of Transport, Energy and Infrastructure, Greening Australia regional representatives, and private landowners. The Recovery Team meets twice a year in the Mid North. Contact between TPAG, DEH and the local community is maintained between meetings.

The progress of the *L. limitanea* recovery project will be assessed against the recovery plan at each meeting of the Spalding Blown Grass Recovery Team. The recovery plan should be thoroughly reviewed in 2012 and will need to be revised and updated.

4.3.2 Evaluation of the previous recovery plan

The success or failure of the initial recovery plan (Robertson & Steed 2000) can be evaluated under Parts 1.5 and 4.1 of the 2000 plan, where a recovery criterion is provided. This first phase of recovery was partly achieved, in that both natural subpopulations were protected from weed invasion and increased in population size and area of occupancy, thereby increasing the total population size and area of occupancy (Criteria 1, 2, 5 and 6). Seed from the Tarlee subpopulation has been collected by TPAG; this has been propagated and used to restock the site (Criterion 3). Translocation was attempted at the Gulnare site and some site preparation has occurred for an anticipated second trial, however no new subpopulations of *L. limitanea* have been successfully established (Criterion 4). Criterion 7 of the 2000 recovery plan, which has regard to the involvement of the local community, was only partially achieved. Although the level of local community involvement in the recovery process was maintained, it did not increase. This was largely attributable to a lack of resources.

4.4 Recovery actions

Actions included in the revised 2007-2012 recovery plan extend the actions implemented under the previous recovery plan (Robertson & Steed 2000).

Habitat protection plans have been prepared and are being implemented at the Yakkalo and Tarlee sites to maintain the extent of occurrence. Extrinsic threats (weeds, road grading, herbivory) will be controlled to stabilise and increase both subpopulations and their area of occupancy. Options for protecting additional areas of known subpopulations on adjacent agricultural land are being explored. A translocation program is currently being developed to increase abundance and number of subpopulations. Genetic studies will be conducted, to assess the level of genetic diversity across all subpopulations.

Actions needed and prioritised

Required actions are listed below in priority order. All actions are to be co-ordinated by and managed through the Threatened Flora Ecologist for the DEH Northern & Yorke Region and the Spalding Blown Grass Recovery Team.

1. Collect and store seed from all wild subpopulations to minimise loss of genetic variation and prevent extinction.
2. Continued threat abatement and site management for all known subpopulations.
   - 2.1. Encourage landholders to manage the area for conservation.
   - 2.2. Control weeds through continuing use of selective techniques and restoration of the native plant community at all sites (see DEH 2005 for details).
   - 2.3. Maintain/erect fencing and signage as required.
   - 2.4. Enhance the three small subpopulations (Tarlee, Riverton & Logan's Creek) by planting seedlings raised *ex situ*.
   - 2.5. Monitor the extant subpopulations to ensure actions taken to reduce threats are effective.
3. Increase area of occupancy through protecting suitable habitat adjacent to extant subpopulations.
   - 3.1. Negotiate with landholders adjacent to existing subpopulations.
   - 3.2. Protect extended subpopulations from stock and weeds.
   - 3.3. Monitor any increases in the area of occupancy.
4. Establish new subpopulations through translocation into suitable habitat.
   - 4.1. Select sites with suitable environmental conditions and management. Prepare translocation plan.
   - 4.2. Collect and germinate seed.
   - 4.3. Prepare and maintain sites by fencing, weed control and management agreements. Introduce propagules.
   - 4.4. Monitor the translocated subpopulations to determine the survival of these subpopulations and to identify any arising threats.
   - 4.5. Undertake genetic analysis on the mixed-gene translocated subpopulation.
5. Maintain stakeholder participation in the Recovery Team and increase the involvement of the local community in the recovery process.
   - 5.1. Maintain stakeholder involvement in Recovery Team.
   - 5.2. Increase community participation in the recovery process.
6. Identify existing unknown subpopulations.
   - 6.1. Increase community awareness.
   - 6.2. Search for new subpopulations.
   - 6.3. Manage any newly discovered subpopulations.
   - 6.4. Monitor any newly discovered subpopulations.
7. Conduct research into the ecology and biology of L. limitanea in order to better manage the species
   - 7.1. Life history studies.
   - 7.2. Research into ecological requirements and tolerances.

The above actions are described below. All management action will be appropriately recorded and documented.

1. Collect and store seed

To secure the genetic variability of the species and provide a last defence against extinction, seed will be collected for long-term storage in the Seed Conservation Centre of the Botanic Gardens of Adelaide. Members of the TPAG and regional DEH staff will collect the seed in conjunction with the Seed Conservation Centre.

Once at the Seed Conservation Centre, seed will be processed, tested for viability and stored. Testing of the seed to ensure its viability will take place after the first and fifth year. A further collection may be required if the stored seed stored is not viable. This process will need to be repeated for each new subpopulation located.

2. Threat abatement for existing known subpopulations

The aim is to improve the quality of *L. limitanea* habitat in order to minimise the possibility of a reduction in species abundance and/or extinction. This will be achieved by increasing the potential habitat for this species, through: liaison with landholders, reducing competition from weeds, minimising herbivory and spray damage and reducing the impacts of rail or pipeline maintenance activities. Site Action Plans have been prepared for each subpopulation.

The expansion of the subpopulation at Yakkalo has shown that the species has the potential to increase in abundance and area of occupancy where suitable habitat is available. All of the known subpopulations occupy a very small area and weed invasion has resulted, partly from past disturbance. Liaison with land managers is essential to minimise the risk of deleterious activities, and to ensure these agencies/individuals support threat abatement.

2.1. Encourage landholders to manage the area for conservation

The Recovery Team will liaise with the relevant landowners/managers to encourage them to manage sites for conservation, and ultimately consider the merits of placing the sites under Heritage Agreements. The Tarlee site provides an example where liaison with owners/managers of the adjacent railway has resulted in the subpopulation being managed for conservation. The area has been fenced and signage erected to limit impact of rail maintenance operations. Annual weeds are slashed, or sprayed, to ensure that fuel levels are controlled and the need for grading does not arise. Such liaison and integrated management will continue to minimise the risk from railway maintenance activities.

2.2. Weed control

All known subpopulations are threatened by alien species, which need to be controlled selectively. Large perennial species are removed by hand and direct application of herbicide. Annual weed species are controlled by slashing (timed to prevent seed set), hand pulling and spot spraying. Weeding progresses outwards from the subpopulation and the area of habitat under active management increases each year with an equivalent amount of effort. The Site Action Plans (DEH 2005) list the most suitable treatments for the major weeds occurring within L. *limitanea* habitat.

2.3. Fencing and signage

The fences at Yakkalo will be maintained and any new subpopulations threatened by stock grazing will be fenced as required. Fencing at the Tarlee site is currently inadequate and the site is occasionally grazed when stock are moved along the adjacent road. Department of Transport, Energy and Infrastructure, Australian Rail Group, DEH and TPAG will act co-operatively to ensure the fence is repaired. The Logan's Creek subpopulation is currently grazed by stock and will require protection. The size of such a fence cannot be estimated at this stage, as it will depend on whether any additional *L. limitanea* plants are located, and also on the outcome of on-going negotiations with the landholder. The Riverton subpopulation lies along the Mawson Trail, a public recreation area. This site will require interpretative signage to ensure the general

public does not negatively impact on the species and to increase awareness of the Spalding Blown Grass Recovery Project.

2.4. Enhance population
Although the number of individual plants at Tarlee is increasing, the subpopulation is still very small, due to low levels of natural recruitment. Seed will be harvested in years when production is sufficient and seedlings will be raised *ex situ* for establishment in suitable habitat at the site (not in the immediate vicinity of existing plants).

2.5. Monitor extant subpopulations
All extant subpopulations will be monitored yearly to gauge the effectiveness of management actions and to assess population trends. A monitoring plan has been developed and all future monitoring will be undertaken in accordance with this protocol, to ensure consistency. Data from all surveys and monitoring will be entered into the DEH Biological Databases.

The following will be monitored:
- Number of mature plants and seedlings
- Area of occupancy
- The number of plants flowering or in seed
- Levels of herbivory
- Extent of weed invasion or re-invasion

3. Increase area of occupancy through extending existing subpopulations

3.1. Negotiate with landholders adjacent to existing subpopulations
The subpopulation at Yakkalo has expanded into adjacent agricultural land along the creek, where it is affected by competition with pasture weeds and sheep grazing during the summer. Liaison with the landowners, to explore options for fencing and weeding the extended subpopulation on private property, will continue.

Known subpopulations will be expanded into suitable habitat on adjacent farmland and by encouraging conservation agreements (both legally binding and voluntary) and the removal of threats.

3.2. Protect and manage additional areas of existing subpopulations
The expansion of existing subpopulations will necessitate the establishment of new fences and/or the modification of existing fences, to abate threats from stock and weeds.

3.3 Monitor any increase in the area of occupancy
Any increase in the area of occupancy will be monitored in accordance with the *L.* limitanea monitoring plan.

4. Establish new mixed-gene subpopulations through translocation
The genetic study by Jusaitis et al (2007) recommends translocating seedlings of each subpopulation into all other subpopulations. A more cautious approach would be to undertake a mixed–gene translocation at a new non-historic site, as a controlled experiment. The species will be translocated to a site where conditions are suitable and where appropriate protection and management can be implemented. The Recovery Team will need to reassess the need for additional translocations, based on the success of the experimental mixed-gene translocation efforts and results of the surveys for additional subpopulations. If the mixed-gene translocation proves successful, intermixing will take place at the four extant subpopulation sites. The aim is to establish self-sustaining subpopulations.

4.1. Site selection and planning
Suitable sites will be selected in the Mid North region, on flood plains and adjacent reedy watercourses, where the land is not otherwise required for incompatible land uses. In choosing sites, emphasis will be placed on areas of historical occurrence and land subjected to

conservation agreements. The Spalding Bridges site has been chosen as the most suitable site for the mixed-gene translocation. A detailed translocation plan has been developed, in line with the guidelines developed by the Australian Network for Plant Conservation (Vallee et al 2004).

4.2. Collect and prepare propagules

Seeds will be sourced from all four extant subpopulations (providing adequate material is available without threatening the wild subpopulation) or from existing cultivated plants.

4.3. Site preparation, planting and maintenance

Suitable sites for translocation will be prepared through fencing, weeding, signage and the planting of other native species, as appropriate. A management program and translocation proposal will be prepared for each site prior to the introduction of propagules.

4.4. Monitor translocation subpopulations

Translocated subpopulations will be monitored in accordance with the *L. limitanea* monitoring plan (Action 2.5).

4.5. Genetic analysis

Samples from any germinants appearing in 2008 will be taken for genetic analysis (allozyme electrophoresis) to determine if cross-population pollination has occurred and its effects on genetic diversity. Follow up monitoring will occur beyond the life of this project to determine the survivorship, growth and vigour of the resulting offspring and their parent plants. This information will be used to guide future translocation efforts and inform management strategies for the existing sites. Genetic analysis will also be undertaken on any progeny.

5. Maintain stakeholder participation in the Recovery Team and increase community involvement in the recovery process

5.1. Maintain stakeholder participation in the Recovery Team

The *L. limitanea* Recovery Project is currently overseen by a Recovery Team whose membership comprises representatives from a number of stakeholder groups (See Part 4.3). The continued involvement of all these groups is essential to achieving the goals of this plan.

Through the Recovery Team, landholders (both public and private) will be encouraged to recognise the sites under their control, and to build appropriate management strategies into their management plans.

5.2. Increase community involvement in the recovery process

The Recovery Team will seek involvement of the local community, through councils, schools and interested individuals and community groups. The Recovery Team will promote the project locally, through regional media and field days. A targeted promotional campaign will be undertaken to raise interest among landholders and to help identify potential translocation sites and unknown subpopulations.

The Threatened Species Community Liaison Officer for the DEH in the Northern and Yorke Region has established a community group (Biodiversity and Endangered Species Team) based in the Mid North to assist in implementing recovery actions. Members of TPAG will assist in these activities, including training volunteers in site management techniques.

6. Identify existing unknown subpopulations

Due to the small number of extant subpopulations (four), the identification of additional subpopulations would be beneficial to the recovery effort. It is also imperative to identify any unknown subpopulations, especially those on private land, due to the species high susceptibility to grazing and potential need for weed control efforts. Unknown subpopulations may be identified by increasing public awareness to encourage community members to report sightings and by active searching.

6.1. Increase community awareness

Landowners know their properties best and they will be encouraged to identify areas of suitable habitat on their land. The Threatened Flora Ecologist and Threatened Species Community Liaison Officer will develop and circulate information on habitats where *L. limitanea* might be found, diagnostic characters of the species, and how to send in a herbarium specimen for identification. The Threatened Flora Ecologist and the Recovery Team will offer assistance with identifying specimens and habitat and follow up any contacts.

6.2. Search for new subpopulations

Previous surveys for new subpopulations have been undertaken on public lands, e.g. road, rail, water and other minor reserves belonging to local councils or the Crown. There is a need to extend the survey effort to private lands. Areas of potential habitat on private land will be identified and DEH will liaise with landholders to gain permission to access their properties in order to conduct searches. In particular there is a need to continue to conduct regular thorough searches of the private property at Logan's Creek, in order to conclusively determine the status of *L. limitanea* at the site.

Records of any newly discovered subpopulations will be entered into the DEH Biological Databases and herbarium specimens lodged in the State Herbarium. Efficient communication within DEH, and between DEH and TPAG, is required to ensure that all those involved in the recovery effort are made aware of any new discoveries. The Threatened Flora Ecologist will perform periodic (every 6-12 months) searches of the herbarium database to ensure no collections have been made without the knowledge of the Recovery Team.

6.3. Manage any newly discovered subpopulations

A Site Action Plan will be written for any newly discovered subpopulations in order to identify threatening processes and to determine appropriate management actions. Necessary actions are likely to be in the form of weed control and fencing, to exclude grazing. Responsibilities for managing any newly discovered populations would be shared between DEH and TPAG, with landholders and the local community encouraged playing an active role.

6.4. Monitor any newly discovered subpopulations

Monitoring of any newly discovered subpopulations will follow standard protocols and results will be entered in the DEH Biological Databases, as above

7. Conduct research

Research into various aspects of the ecology and biology of *L. limitanea* needs to be conducted in order to increase scientific understanding of the species and to assist the Recovery Team in making appropriate management decisions. Whilst some of these studies can be performed utilising the existing skills of the Recovery Team, and can be incorporated into existing management activities, other projects will require additional funding. Alternatively, university students and researchers could conduct this research.

7.1. Life history studies

DEH will conduct a study to collect information regarding the life history of the species. A sample of the germinants appearing in 2007 at all of the known subpopulations will be tagged and life history information recorded. This can be performed in conjunction with the annual population monitoring and observations taken during routine site visits.

7.2. Ecological requirements and tolerances

A study into the ecological requirements and tolerances of *L. limitanea* is needed in order to guide management actions at the existing sites. This information may also be used to focus search efforts on the most suitable habitats and to allow developments or activities with the potential to impact on *L. limitanea*, to be more accurately identified.

PART 5: MANAGEMENT PRACTICES

Management prescriptions

Management required for wild and translocated populations of *L. limitanea*, described above, can be integrated and summarised as follows:

- Fence each subpopulation and maintain liaison with management authorities to protect them from grazing and other physical disturbance such as grading.
- Integrate management to reduce fuel hazard and weed invasion and competition.
- Manage weeds using techniques and timing that minimise impact on all native species to improve habitat (See DEH 2005).
- Liaise with adjoining landholders to minimise spray drift.
- Maintain hydrology – soil moisture levels throughout the year are sufficient at all sites to support common reeds (*Phragmites australis*) and other wetland species. Some upstream developments may impact on the species through changing hydrology or altering water quality. Such developments need to be avoided and the associated approval process needs to consider the potential impact on *L. limitanea* and its habitat.
- Restore habitat through appropriate establishment of locally indigenous grassland or wetland species.

PART 6: DURATION AND COSTS

6.1 Duration, responsibilities and estimated costs of recovery actions

This recovery plan covers recovery actions for the next five years (2007-2011), these actions are costed below.

Table 4: Duration, responsibilities and estimated costs of recovery actions

Action	Description	Responsible Party	2007		2008		2009		2010		2011		TOTAL
			Project Costs	Project Officers Salary Costs	Project Costs	Project Officers Salary Costs	Project Costs	Project Officers Salary Costs	Project Costs	Project Officers Salary Costs	Project Costs	Project Officers Salary Costs	
1	**Collect and store seed***	DEH	1500	356.80	100	356.80	100	0	100.00	0	1000	0	**3513.60**
2	**Threat abatement & site management**												
2.1	Landholder liaison	DEH	0	1783.99	0	1783.99	0	1783.99	0	1783.99	0	1783.99	**8919.96**
2.2	Weed control	TPAG, DEH, NAC/DTEI, OSR	11800	2854.39	12670	2854.39	12715.50	2854.39	13351.28	2854.39	14018.84	2854.39	**78827.54**
2.3	Maintain/erect fencing & signage	DEH, NAC/ORS/DTEI	6700	1070.40	500	356.80	525	356.80	551.25	356.80	578.81	356.80	**11352.65**
2.4	Population enhancement	TPAG, DEH	200	713.60	210	356.80	220.50	356.80	231.53	356.80	243.10	356.80	**3245.92**
2.5	Monitor populations	DEH, TPAG	400	2497.59	100	1783.99	105	1783.99	110.25	1783.99	115.76	1783.99	**10464.56**

3	**Increase area of existing populations**												
3.1	Landholder liaison/approval	DEH	0	713.60	0	356.80	0	356.80	0	356.80	0	356.80	**2140.79**
3.2	Protect extended population	DEH, TPAG	4750	2497.59	787.5	1427.19	787.50	1427.19	826.88	1427.19	868.22	1427.19	**16226.45**
3.3	Monitor any increases	DEH	0	1070.40	0	713.60	0	713.60	0	713.60	0	713.60	**3924.78**
4	**Establish additional populations (2)**												
4.1	Site selection & planning	Rec Team	3150	4638.38	500	4638.38	0	0	0	0	0	0	**12926.75**
4.2	Collect & prepare propagules	DEH, TPAG	320	1070.40	560	1070.40	0	0	0	0	0	0	**3020.79**
4.3	Site preparation, planting & maintenance	DEH, TPAG	5000	2497.59	7250	4281.58	2200	3567.98	2310.00	3567.98	2425.50	3567.98	**36668.61**
4.4	Monitor translocated populations	DEH	200	713.60	100	1427.19	105	1427.19	110.25	1427.19	115.76	1427.19	**7053.38**
5	**Genetic studies**	DEH	10273	2497.59	5000	1783.99	0	0	0.00	0	0	0	**19554.58**
6	**Stakeholder & community involvement in recovery process**												
6.1	Stakeholder involvement in Recovery Team	DEH/Rec Team	6300	2497.59	6615	2497.59	6945.75	2497.59	7293.04	2497.59	7657.69	2497.59	**47299.41**

6.2	Community awareness & involvement	DEH/Rec Team	1000	6422.37	1050	6422.37	1102.5	3567.98	1157.63	3567.98	1215.51	3567.98	**29074.31**
7	**Identify unknown extant populations**												
7.1	Increase public awareness	DEH, Rec Team	1000	5351.97	1050	5708.77	1102.5	2854.39	1157.63	2854.39	1215.51	2854.39	**25149.53**
7.2	Searches	TPAG, DEH, SCMC	2380	2497.59	4998	4995.18	2623.95	2497.58	2755.15	2497.59	2892.90	2497.59	**30635.53**
7.3	Manage newly discovered populations	TPAG, DEH	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	
7.4	Monitor new populations	DEH	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	Unknown **	
8	**Research**												
8.1	Life histories	DEH	100	2854.39	105	1783.99	110.25	1783.99	115.76	1783.99	121.55	1783.99	**10542.91**
8.2	Ecological requirements & tolerances	DEH	0	1783.99	3000	1783.99	0	0	0.00	0	0	0	**6567.98**
	TOTAL		**55073.00**	**46383.77**	**44595.50**	**46383.77**	**28643.45**	**27830.26**	**30070.62**	**27830.26**	**32469.15**	**27830.26**	**367110.05**

Note: The successful implementation of this recovery plan will require one-third of the time of a regional threatened flora project officer and one-sixth the time of a community liaison officer, at a cost of $30,923 and $15,467 respectively, per year (including on-costs, office and operating expenses) for the first two years. After the first two years a smaller percentage of these two officers time should be required to implement this plan. These salary costs have been broken down and for each recovery action and are included under the salaries component.

* Cost estimate for storing the four currently known populations. If further populations are located additional funding may be required.

** Costs cannot currently be accurately estimated as it will depend on the number of additional populations found, their location and the habitat condition at the site/s.

6.2 Resource allocation

The recovery of *L. limitanea* has been identified as a conservation priority in Northern & Yorke Biodiversity Plan (Graham *et al* 2001) and the Northern & Yorke Agricultural District Integrated Natural Resource Management Plan (NYAD INRMC 2003). Investment in this project will also deliver gains in relation to other NRM objectives, such as weed control and the protection of grassland habitat. The implementation of this plan will also contribute to *No Species Loss*: *A Biodiversity Strategy for South Australia* 2006-2016 (DEH 2006).

While the objectives and actions from the recovery plan complement other regional biodiversity and natural resource management initiatives, the limited extent and site-specific nature of *L. limitanea* recovery has meant that work at these sites will only occur through implementation of the recovery plan. Regional/landscape scale vegetation management approaches are highly desirable in many situations however the conservation of this species can only be achieved through a species recovery approach. Support for this work is being sought through state sources and the Northern & Yorke Natural Resource Management Board.

The involvement of SA Department for Environment and Heritage staff, the local council and local community members (including those associated with regional natural resource management planning and implementation) through the Recovery Team ensures that resources are used efficiently, unnecessary duplications are avoided and opportunities to coordinate regional activities are realised.

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