STRATEGIC PLAN FOR THE INTEGRATED CONTROL OF

AQUATIC WEEDS IN ROODEPLAAT DAM

SECOND DRAFT

31/10/2014

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environmental affairs
Department:
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EXECUTIVE SUMMARY

Department of Water Sanitation (DWS) is responsible, under the National Water Act, to control aquatic weeds and invader plants on all open water systems, excluding privately owned reservoirs. The Natural Resource Management (NRM) Programmes, under Department of Environmental Affairs (DEA), is responsible for implementing the control activities and operations.

There are ten categorized invasive aquatic weed species in South Africa (Henderson, 2001), but most widely distributed aquatic weeds on Roodeplaat dam, and those with the higher priority are Water hyacinth (*Eichhornia crassipes*), Red water fern (*Azolla filiculoides*), Kariba weed (*Salvinia molesta*), Water lettuce (*Pistia stratoides*) and Parrots feather (*Myriophyllum aquaticum*). The emerging aquatic weeds such as Dense aquatic weed (*Egeria densa*), Pickerel weed (*Pontederia cordata*), Giant Spanish weed (*Arundo donax*), Spiked water milfoil (*Myriophyllum spicatum*), Watercress (*Rorippa nasturtium-aquaticum*), Alligator weed (*Alternanthera philoxeroides*) and Duckweed (*Lemna* sp.) need to be considered.

This strategy will be developed to assist the aquatic weeds manager in adopting the most effective method (s) for the control of invasive aquatic plant species on Roodeplaat dam. The main focus of this document is water hyacinth; however, control methods for Water lettuce, Salvinia, Azolla and Parrot's feather are discussed. Further, emerging aquatic weed species, most notably submerged species are highlighted, with emphasis on spiked water milfoil. This document arose from a need to coordinate water weed control efforts on Roodeplaat dam. The decision support system presented here should be regarded as flexible and should be adjusted as conditions alter or new technologies are developed.

The objective of this programme is to ensure that an integrated control strategy is developed and correctly implemented on Roodeplaat dam, which forms part of Water Management Area (WMA) 3 – Crocodile west/ Marico. The programme forms a part of an overall integrated weed management programme, where biocontrol is seen working alongside traditional chemical and mechanical control methods.

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INTRODUCTION

Aquatic weeds have become an increasing concern in all water use types. There are ten known invasive aquatic weed species in South Africa (Table 1) (Henderson, 2001), but most widely distributed aquatic weeds on Roodeplaat dam, and those with the most priority are Water hyacinth (*Eichhornia crassipes*), Red water fern (*Azolla filiculoides*), Kariba weed (*Salvinia molesta*), Water lettuce (*Pistia stratoides*) and Parrots feather (*Myriophyllum aquaticum*). All are native to South America and, with the exception of parrot's feather, are free-floating macrophytes.
Water hyacinth disrupts all normal activities associated with water use, and causes substantially increased water losses through transpiration. If left uncontrolled, it can disrupt water abstraction, destroy fishing grounds, prevent ships from docking, cause rapid siltation of water bodies, block irrigation channels and hydro-electric turbine coolant intakes (Navarro and Phiri 2000) and devastate aquatic biodiversity (Midgely et al 2006). Water hyacinth infestations threaten economic development in many resource poor countries of the world (Hill 1999). Water hyacinth has been a major problem on Roodeplaat dam since the early 1990's. Methods employed include manual and mechanical harvesting, herbicide application, biological control and several attempts to integrate all available control methods. One of the perennial problems with Roodeplaat dam has been the lack of coordination, especially given the fact that there are so many interested and affected parties involved.

The control of emerging aquatic weeds are becoming an increasing concern and Spiked water milfoil (*Myriophyllum spicatum*) is an example in the more temperate regions.
An Advisory Committee is a crucial aspect to facilitate the coordination of the operational activities on this system. The Terms of Reference for this committee is found in Appendix I.

Eutrophication is the process of excessive nutrient enrichment of waters that typically results in problems associated with aquatic plants, algal and cyanobacterial growth (Gerber *et al*., 2004). The exponential growth of aquatic weeds is directly related to the eutrophication of the aquatic system. There are two forms of eutrophication. Natural eutrophication depends only on the local geology and natural features of the catchment. Cultural eutrophication is associated with human activities that accelerate the eutrophication process beyond the natural rate of eutrophication by increasing the nutrient loads into the aquatic systems (Gerber *et al*., 2004). Increased nutrient

enrichment can arise from both point source and non point sources such as pollution points or internal sources such as the system's own sediments that can release phosphates. The National Eutrophication Monitoring Programme (NEMP) specifically addresses the monitoring requirement in respect of eutrophication (Gerber *et al*., 2004).

Table 1. The invasive aquatic weed species found in South Africa (ex Henderson, 2001)

Scientific name	Common name	Family	Origin	NEM:BA	CARA Act
Azolla filiculoides	Red water fern	Azollaceae	Tropical S. America	1b	Category 1
Egeria densa	Dense aquatic weed	Hydrocharitaceae	South America	1b	Category 1
Eichhornia crassipes	Water hyacinth	Pontederiaceae	Tropical S. America	1b	Category 1
Elodea canadensis	Canadian aquatic weed	Hydrocharitaceae	Temperate N. America	1b	Category 1
Hydrilla verticillata	Hydrilla	Hydrocharitaceae	Asia	1a	Not categorised
Lemna sp.	Duckweed	Lemnaceae	Unknown	Not listed	Unknown
Myriophyllum aquaticum	Parrots feather	Haloragaceae	South America	1b	Category 1
Myriophyllum spicatum	Spiked water-milfoil	Haloragaceae	N. America, Europe, Asia and N. Africa	1b	Category 1
Pistia stratoites	Water lettuce	Araceae	S. America (Brazil)	1b	Category 1
Pontederia cordata	Pickerel weed	Pontederiaceae	N., C. And S. America	1b	Category 3
Nasturtium officinale	Watercress	Brassicaceae	Europe	2	Category 2
Salvinia molesta	Kariba weed	Salviniaceae	S. America (Brazil)	1b	Category 1
Vallisneria spiralis	Tapeweed	Hydrocharitaceae	S. America	Not listed	Not categorised

OBJECTIVES

The objective of this programme is to ensure that an integrated control strategy is developed and correctly implemented to address current haphazard control methods on Roodeplaat to ensure efficient utilization of resources and protection and

enhancement of the natural environment. The programme forms a part of an overall integrated weed management programme, where biocontrol is seen working alongside traditional chemical, hydrological and mechanical control techniques. The water quality monitoring programme data will be utilised to inform an early warning system to support the control operations.

AQUATIC WEEDS

1. *Eichhornia crassipes* (Water hyacinth)

Water hyacinth is the most important aquatic weed in South Africa and it was first recorded in the country around 1900 (Plate 1). This invasive alien plant grows in all types of freshwater systems. Water hyacinths vary in size from a few centimetres to over a metre tall. They have purple flowers. Water hyacinth leaves are rounded and leathery, attached to spongy and sometimes inflated stalks. The plant has dark feathery roots (Henderson, 2001).

Three control methods have been implemented against water hyacinth, manual removal and mechanical control, the application of herbicides and biological control and more recent attempts have been made to integrate these control methods (Jones 2001).

The prior lack of enemies and the presence of nutrient enriched waters have facilitated its spread throughout South Africa. Its first biocontrol agent, *Neochetina eichhorniae* Warner, was released in 1974 (Henderson, 2001). However, *N. Eichhorniae* was deemed unlikely (by Plant Protection Research Institute (PPRI)) to achieve the desired level of control on its own, and thus three additional biocontrol agents were later released and established. There has been considerable work done on biocontrol of water hyacinth by PPRI due to public and environmental pressure to address the problem of the quick invading aquatic weed. All five the agents are considered established by PPRI in the areas where they have been released. The agents are listed in Table 2. Refer to map of distribution and existing release sites (Appendix II). The spread, impact and control of water hyacinth have been summarised in proceedings of several workshops (e.g. Greathead and de Groot 1993, Charudattan et al. 1996, Hill et al. 1999, Julien et al. 2001) book chapters (e.g. Center et al. 2002, Cilliers et al. 2003) and several review papers (e.g. Cilliers 1991, Hill and Cilliers 1999, Hill, 2003).

Plate 1. *Eichhornia crassipes* showing flower (a) and a dense mat of water hyacinth (b).

Table 2. The biological control agents available for Water hyacinth (Olckers and Hill, 1999; Henderson and Cilliers, 2002).

Biocontrol agent	**Degree of control**	**Established**	**Agent type**	**Main feeding guild**	**Damage to weed**
1. *Cercospora rodmanii*	Substantial	Yes	Fungus	Causes leaf spots	Considerable
2. *Cercospora piaropi*	Considerable	Yes	Fungus	Causes leaf spots	
2. *Eccritotarsus catarinensis*	Substantial	Yes	Mirid	Sap sucker	Considerable
3. *Neochetina bruchi*	Substantial	Yes	Bruchid	Stem borer	Considerable
4. *Neochetina eichhorniae*	Substantial	Yes	Bruchid	Stem borer	Considerable
5. *Niphograpta albiguttalis*	Substantial	Yes	Moth	Petiole borer	Considerable
6. *Orthagalumna terebrantis*	Substantial	Yes	Mite	Leaf miner	Considerable
7. *Cornops aquaticum*	Substantial	No	Hopper	Leaf chewer	Considerable
8. *Megamelus scuttularis*	Substantial	No	Mirid	Sap sucker	Considerable

2*. Azolla filiculoides* (Red water fern)

Red water fern (Plate 2) was introduced into South Africa from South America in 1947 as a fish pond plant. The lack of natural enemies and the presence of enriched waters, however, lead to its inevitable spread by man, waterfowl and flooding. By 1998, the National Botanical Institute had recorded the weed at over 180 localities throughout the country. There has been considerable work done on biocontrol of red water fern by PPRI, due to public and environmental pressure to address the problem of the quick invading aquatic weed. There is a very successful biocontrol agent available for red water fern. The frond feeding weevil, *Stenopelmus rufinasus*, was collected in Florida in the USA and imported into quarantine in South Africa in late 1995. Following host specificity testing, the weevil was released in December 1997 and is now fairly widespread. The weevil is available from the various biological control agent rearing stations. The weevils should be introduced between September and end of April. No other control methods are necessary for this weed. Refer to map of distribution and existing release sites (Appendix II).

Plate 2. *Azolla filiculoides* close up (a) showing the biocontrol agent and a dam (b) covered by a dense mat of red water fern.

3. *Salvinia molesta* (Kariba weed)

There has been considerable work done on biocontrol of Kariba weed due to public and environmental pressure to address the problem of the quick invading aquatic weed. Kariba weed is a floating, rootless aquatic fern that consists of horizontal stems that float just below the water surface, and produce at each node, a pair of

floating or emergent leaves (Plate 3). Floating and emergent leaves are green in color and ovate to oblong in shape. Plants bear a third leaf that is brown, highly divided and dangle underwater. Submersed leaves are commonly mistaken as roots. They may grow to great lengths, and by creating drag, act to stabilize the plant. There is a very successful biocontrol agent available Kariba weed, it is a weevil called *Cyrtobagous salviniae.* The weevil is available from the various mass rearing stations in South Africa. The weevils should be introduced between September and end of April. No other control methods are necessary for this weed.

Refer to map of distribution and existing release sites (Appendix II).

Plate 3. *Salvinia molesta* (a) forms dense mats in rivers (b) and dams

4. *Pistia stratiotes* (Water lettuce)

Water lettuce is a floating plant. Water lettuce occurs in lakes, rivers and canals, forming large dense mats. As its name implies, water lettuce resembles a floating open head of lettuce (Plate 4). Water lettuce has very thick leaves. The leaves are light dull green, are hairy, and are ridged. There are no leaf stalks. Water lettuce roots are light-colored and feathery. Its flowers are inconspicuous. There is a very successful biocontrol agent available water lettuce, it is a weevil called *Neohydronomus affinis.* The weevils should be introduced between September and end of April. These weevils are available from numerous mass rearing facilities in South Africa. No other control options are necessary. Refer to map of distribution and existing release sites (Appendix II).

Plate 4. *Pistia stratoites* (a) can form dense mats (b).

5. *Myriophyllum aquaticum* (Parrots feather)

Parrots feather is an emersed plant that trails along the ground or water surface (Plate 5). It is easy to see why this plant is called parrot feather: its delicate, feathery, bright green leaves grow in profusion. Parrot feather leaves are oblong, deeply cut and feathery looking. The leaf color is bright blue-green. Like most water milfoils, parrot feather leaves are arranged in whorls about the stem. Its leaves are in whorls of four to six. The stems can be five feet long and trail along the ground or water surface, becoming erect and leafy at the ends. There is a very successful biocontrol agent available parrot's feather*;* it is a *Lysathia* sp. Beetle. The biological control of this weed takes considerably longer (3-4 years) than the above three species where control can be expected within two years. The beetle is available from the various mass rearing stations in South Africa. No other control methods are necessary for this weed. Refer to map of distribution and existing release sites (Appendix II).

Plate 5. *Myriophyllum aquaticum* (a) looks like a parrots feather and can form dense mats (b).

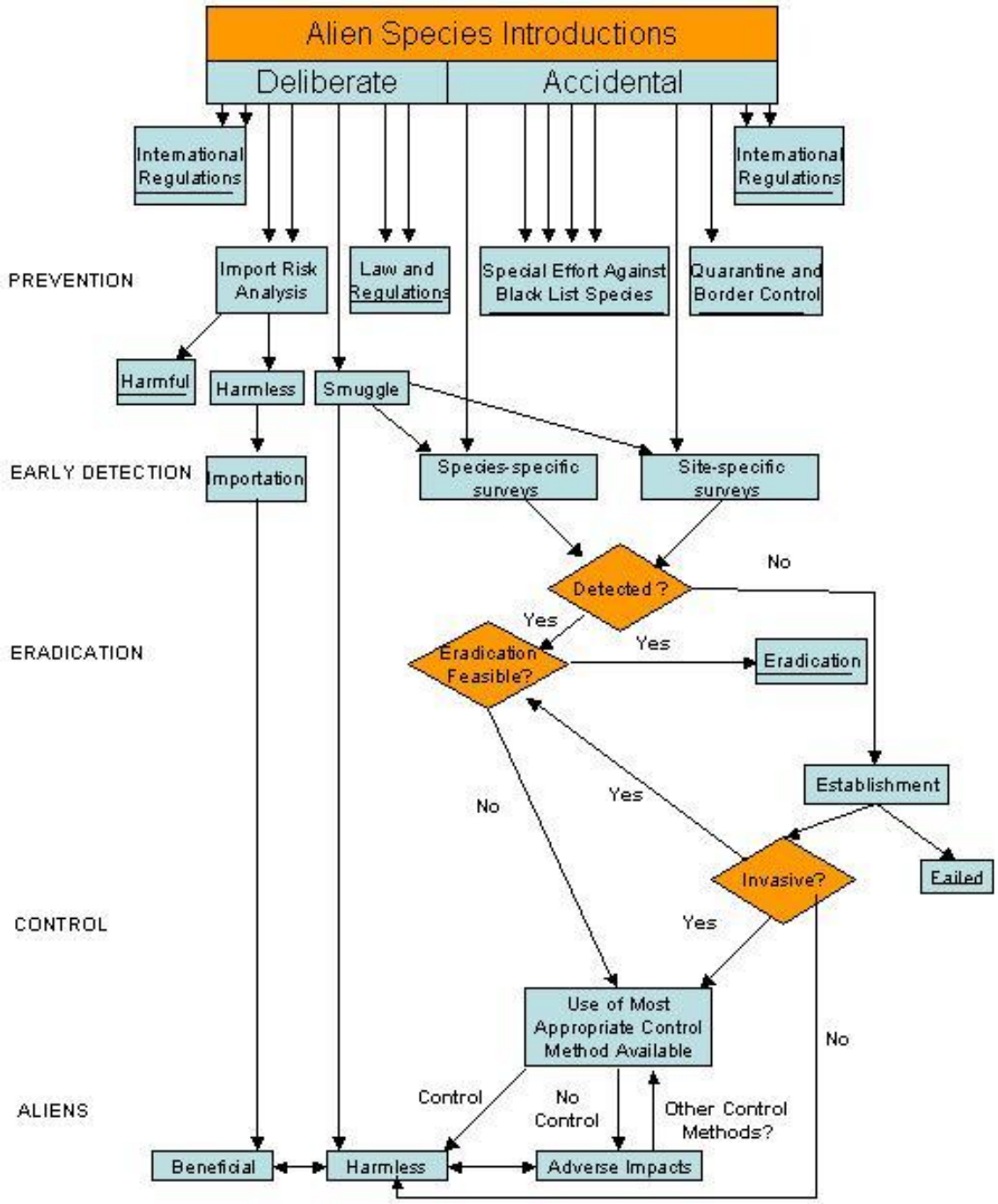


Figure 1. Summary of options to consider when addressing aquatic invasive alien species. Orange diamonds represent decision points.

EMERGING AQUATIC WEEDS

There are some emerging aquatic weeds that are starting to show a potential of becoming aggressive invaders and thus research and monitoring are being done so as to curb their invasive potential. Some examples of these are Duckweed (*Lemna* sp.), Pickerel weed (*Pontederia cordata*), Alligator weed (*Alternanthera philoxeroides*), Spiked water milfoil (*Myriophyllum spicatum*), Hydrilla (*Hydrilla verticillata)* and *Elodea* sp. Monitoring, research and best control options are being developed through the Emerging weeds rapid response strategy. Recently spiked water milfoil has been recorded on the Vaal River ans severalo other systems. This species can often be confused with *Ceratophyllum demersum*. Submerged aquatic species are becoming more abundant; all plants encountered should be collected, pressed in newspaper and sent to SANBI for identification. This is vital if the Early Detection and Rapid Response approach is going to work.

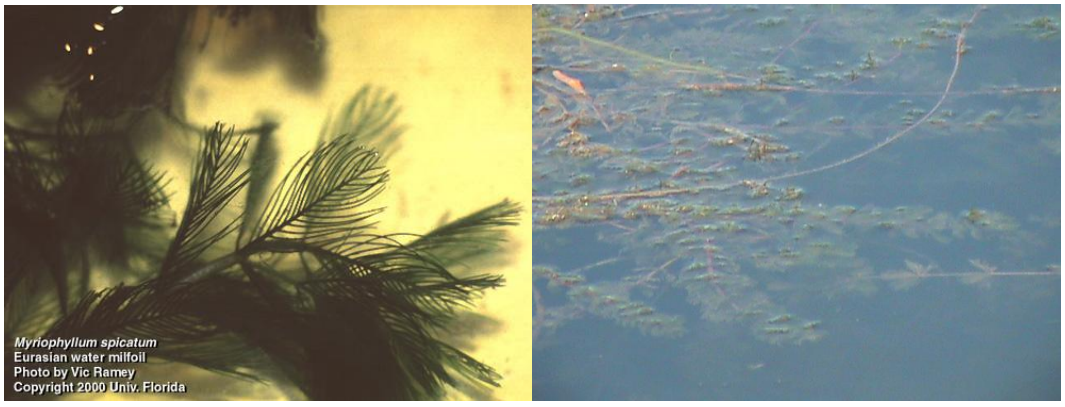


Plate 6 : *Myriophyllum spicatum* close up (a) and a dense mat at Barkly West (b).

Watercress (*Nasturtium officinale*) is a mat forming , rooted aquatic plant with erect, creeping or floating stems up to 1m long. The stems and leaves are soft.
This species was introduced from Europe and cultivated for its edible stems and leaves. It is part of the mustard family and is widely cultivated as a vegetable. This species invades riverbanks and the edges of dams and streams (Henderson and Cilliers, 2002). Watercress grows best in fairly fast flowing, nutrient rich but clear streams or rivers.
This species has become problematic on sections of the Vaal River, Spioenkop dam and several rivers in the KZN Midlands. Currently, this species is not being controlled, but will be controlled chemically once there is a registered herbicide for

watercress. In the meantime, it will be controlled manually. The problem with watercress is that it can clog waterways, reduce waterfowl, compete with indigenous riverbank species and obstruct access to the water's edge. This would then cause problems and interfere with recreational watercraft.

Plate 7 : *Nasturtium officinale* (Watercress) in the Vaal River (a) and close up and flowering (b).

OPPORTUNISTIC SPECIES

Opportunistic species can flourish in disturbed environments, often becoming the dominant species to the detriment of the other species. This group includes indigenous and cosmopolitan (world-wide) species. These species respond to various disturbances and are usually symptomatic of a problem and not the problem itself. The disturbances range from nutrient enrichment through agricultural run off and sewerage contamination to manipulations of river flow and water levels, including destruction of wetland vegetation (Henderson and Cilliers, 2002).
A list of the opportunistic aquatic species is highlighted in Appendix IV with their photographs.

PRIVATE LANDOWNERS

Private landowners have dams on their properties that could pose a threat to the larger bodies of water under DWA control as these dams could harbour invasive aquatic plants. It is essential that private landowners are involved, as they will be engaged to broaden the database and the extent of infestation within the system and highlight the potential of private dams on their property acting as a source of further infestation. Landowners will receive training on the identification of aquatic weeds so

as to be able to identify the aquatic weed present on their dams. A standard landowner agreement is needed and must be signed by the private landowner before any invasive alien plant control work can start on private dams. This will be used as an incentive to private landowners.
It is envisioned that private landowners will be responsible for the containment strategy on Roodeplaat dam. The washing down of all boats entering and exiting the dam.

LEGAL ISSUES

The control of aquatic weeds is governed by 4 sections of legislation, namely; 1) the Conservation of Agricultural resources Act 43 of 1983 (CARA) which identifies the different categorized species, 2) the National Environmental Management Biodiversity Act 1 of 2004 (NEM:BA) that says that all landowners have a responsibility to remove all category 1a and 1b species, 3) the National Water Act 36 of 1998 (NWA) that states that DWS is the custodian for water bodies in this country and that the control methods that maximize water gain/production will be used and 4) the Environment Conservation Act 73 of 1989.

AQUATIC WEED INFESTATIONS

DEA NRM has compiled a database of the aquatic weed infestations and the control methods for each management unit on Roodeplaat dam (Table 3). This database forms the basis for this strategic plan. New information can be incorporated into this database to provide an overall picture of the aquatic weed infestation in the system.

CONTROL OPTIONS

There are four direct control options available for use in this strategy, namely; chemical, mechanical, manual (harvesting) and biocontrol (Table 2). Hydrological strategies are important, water quality improvement needs to be addressed. Biocontrol can be used widely in small dams and rivers that are not major water supply dams. There should be a zero tolerance on all dams which are potable water supply dams, and thus the aquatic weeds here will be controlled chemically by either aerial spraying or from boats and from the shore. Manual methods can be used on some systems elsewhere in an integrated approach and in areas where subsistence use is to being trialled. Harvesting management units were considered but it was

decided that this would not be feasible on this dam however, manual removal in winter will be incorporated. These control options will be integrated per management unit.

There are some management units on the system that will be sprayed from the shore and boats by trained personnel. However, some sites are either inaccessible or dangerous for ground teams and thus these sites will be aerially sprayed, or as a last resort.

Manual removal and mechanical control

Manual removal through hand pulling or using pitch forks is used in a number of developing countries such as South Africa and China. This method is very labour intensive, only effective for small infestations and essentially used as an employment creation exercise. Zimbabwe initiated a manual removal programme on Lake Chivero, in the early 1980s (Chikwenhere and Phiri 1999). Mechanical control has also been implemented around Port Bell and Owen Falls Dam on Lake Victoria with limited success (Mailu, 2001) and on the Liwonde Barrage in Malawi. Furthermore, the remoteness of many infestations makes mechanical control unfeasible. Booms and cables have been used to prevent water hyacinth from entering water abstraction pumps and hydro-power coolant intakes. Further, cables have been used to allow the weed to build up behind them, making herbicide applications more efficient (Jones 2001). Management unit 6 was trialled as a harvesting area, however, this turned out not to be feasible or supported by the stakeholders around the dam.

Integrated control

Despite biological control having been highly successful in some regions of the world, in others (e.g. the temperate areas of southern Africa, the USA and China) acceptable levels of control have not been achieved through this method, or biological control is perceived to be too slow acting. In these regions the emphasis has shifted from a purely biological to a more integrated management approach, which includes aspects of biological control, herbicide applications, manual removal and possibly most importantly, the management of nutrients entering the aquatic ecosystem (Hill and Olckers 2001). Jones and Cilliers (1999) and Jones (2001) developed an integrated management programme for the Nseleni River system in the

more tropical region of South Africa. The key elements of this approach were primarily the appointment of a champion to drive the control programme, the involvement of all interested and affected parties on the river system, the division of the river system into management units and the implementation of appropriate control methods for each of these management units. Using this integrated approach, some 19km of river that was previously 100% covered by water hyacinth was initially cleared using mainly herbicide application and is maintained at 5% weed cover through biological control with occasional follow-up herbicide application around sensitive sites (water abstraction localities) when necessary. The time scale for this control operation was between 1995 and 2000 (Jones 2001) and represents an example where a river has been returned from being heavily impacted by water hyacinth to a fully functioning aquatic ecosystem through appropriate management. An integrated management plan for water hyacinth could be summarised under the broad points highlighted in figure 2.

Natural manipulations of Roodeplaat dam can also be used to the benefit of the control programme. The floods can be used to bank the water hyacinth up against the cables where the chemical control can then be done. This can only be used in mild floods. The manager will then be in a position to be ready to be able to handle the situation. This would also reduce any safety risks of any teams currently working on the system that might be caught unaware of the approaching waters.

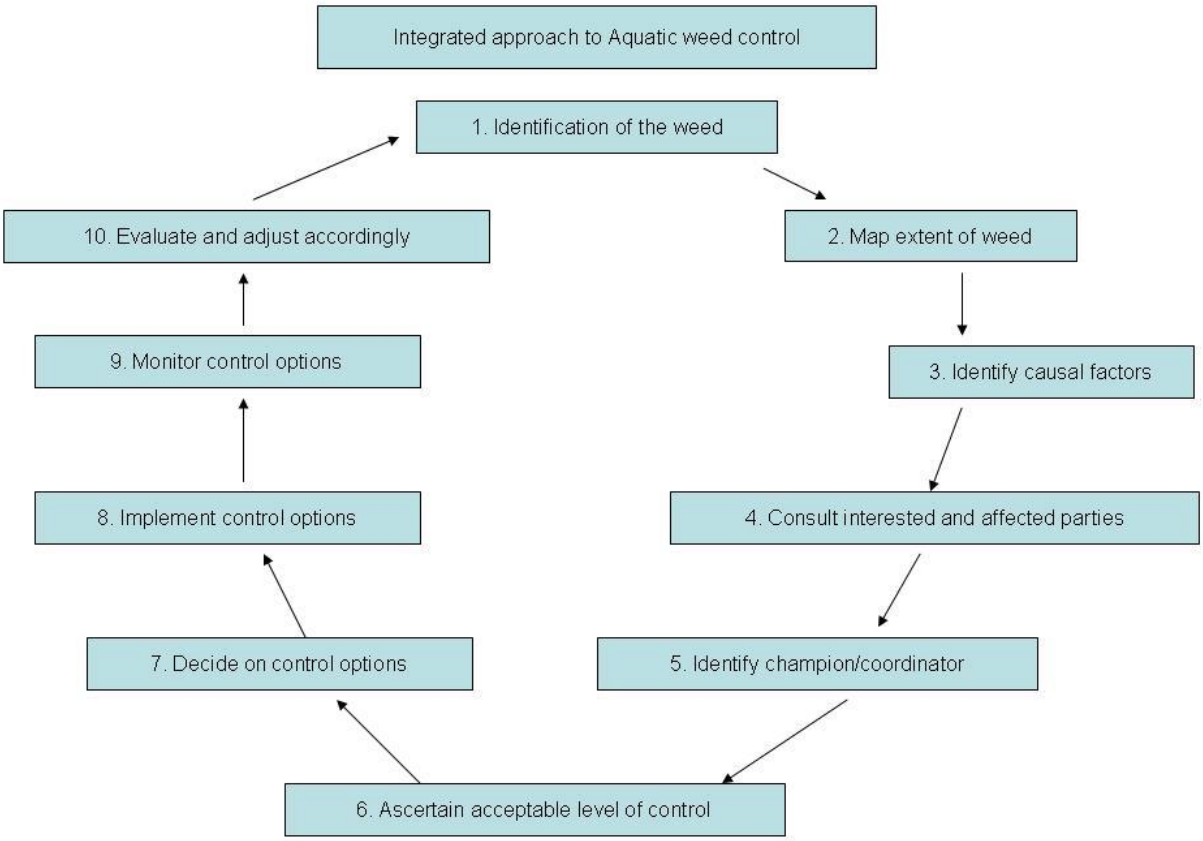


Figure 2. Flowchart highlighting the control process to aquatic weed control

Biocontrol

The biocontrol agents are the most active in the summer months and releases of these agents would take place from September-March. Additional seasonal workers will be employed during this period to help with the rearing of the biocontrol agents. Refer to the action table for the proposed aquatic weeds programme. The sites will only be monitored once the releases have taken place and this would be at the end of the current financial year, stretching into the next financial year. The section below the dam wall will be demarcated as a biocontrol reserve.

Table 2. The action table for the aquatic weed biocontrol programme

Action	**Person/Organisation responsible**	**Time ***
Purchase of materials for rearing		October – pending approval
Set up materials		October onwards
Mass rear aquatic weed agents		October onwards
Manage nursery site		October onwards
Distribute site selection criteria forms to interested persons (Appendix III)		October onwards
Release aquatic weed agents		October – March
Identify release sites		June-August
Monitor release sites		February - April

Monitoring

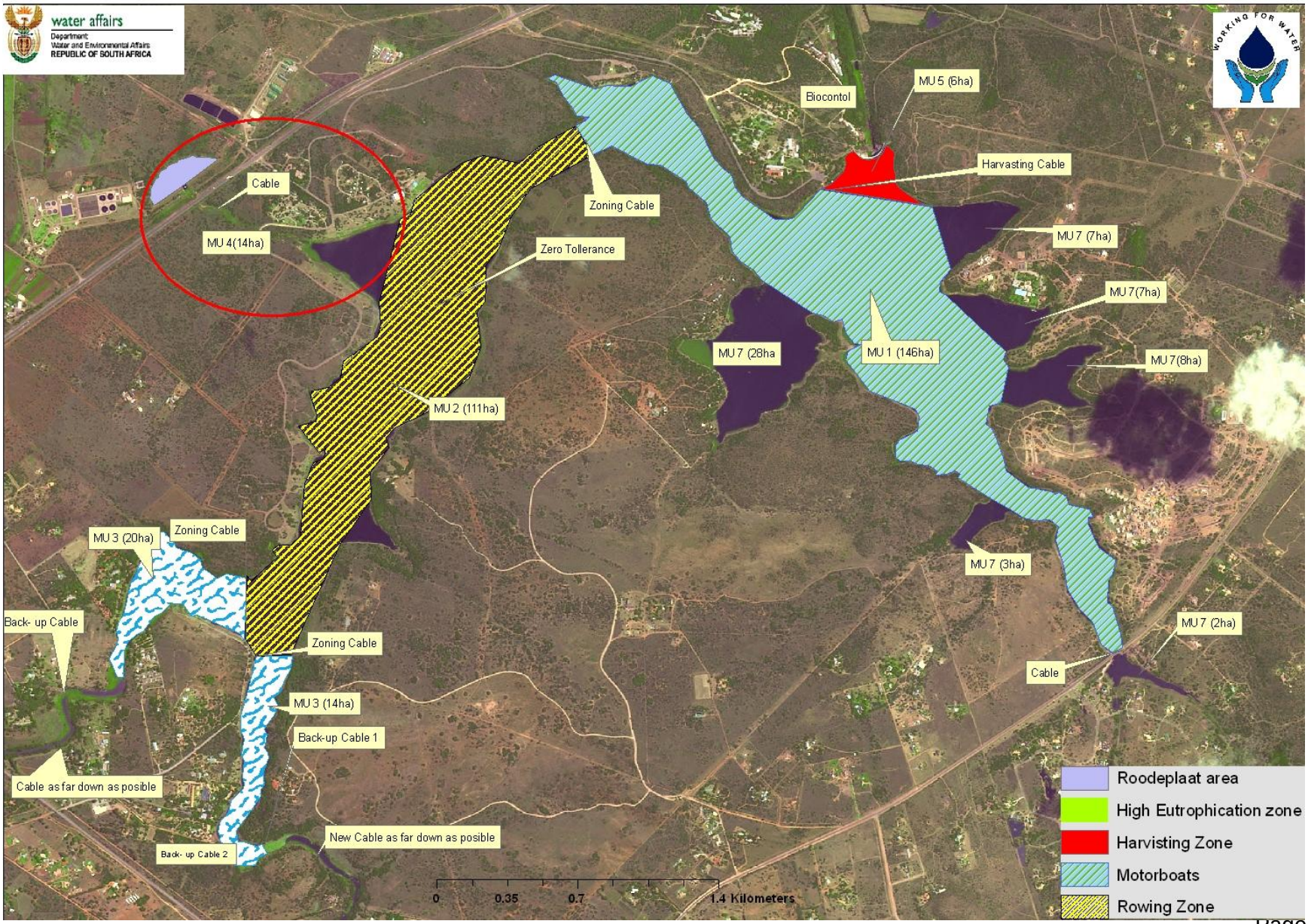
DWS is responsible for the water systems and monitoring thereof in this province, excluding private systems and thus monitoring of water quality and infestation levels is the responsibility of DWS. The Aquatic weeds project officer will monitor all sites on the dam. The biocontrol sites will be the responsibility of the Biocontrol Officer in the WMA, where applicable. This decision will be at the discretion of the WMA. PPRI is engaged to monitor and assist in the technical biocontrol implementation as well as provide advice and research on other control options.

Water monitoring

The monitoring of the water quality on the dam will be the responsibility of the DWS water quality section. The data collected will be made available to the committee on the dam to peruse.

Table 3. The aquatic weed sites on Roodeplaat dam to be controlled

WMA	MU no.	Description	Grid Reference	Submerged aquatic weed species	Emerged Aquatic weed species	Control method	Other points	Comments	Priority	Score	Approximate area (in Ha)
3	3.1	Motor boat section		None yet	Water hyacinth	Aerial and boat spraying	Access points	Aerial applications and spraying from boats and shore	4	5	146 ha
	3.2	Rowing section		None yet	Water hyacinth	Aerial and boat spraying	Access points	Aerial applications and spraying from boats and shore Fishing from shore	5	4	111 ha
	3.3	Fishing section including Molenaarspuit and Pienaars rivers		None yet	Water hyacinth	Boat spraying	Fishing access points	Aerial application if necessary , boat spraying	4	5	34 ha
	3.4	WWTW and stream		None yet	Water hyacinth	Boat spraying	Fishing access points	Aerial application if necessary , boat spraying	3	1	14 ha
	3.5	Bay near dam wall		None yet	Water hyacinth	Harvesting	Access point for harvester	Manual removal by Invader Destroyers	2	3	6 ha
	3.6	River section from the dam wall		None yet	Water hyacinth	Biocontrol reserve		Biocontrol reserve for a back up for Roodeplaat dam	3	5	4 ha
	3.7	All off flow bays		None yet	Water hyacinth	Boat spraying		Consider harvesting in winter	1	3	52 ha


water affairs
Department:
Water and Environmental Affairs
REPUBLIC OF SOUTH AFRICA
WORKING FOR WATER
Biocontol
MU 5 (6ha)
Harvasting Cable
Cable
Zoning Cable
MU 4(14ha)
Zero Tollerance
MU 7 (7ha)
MU 7(7ha)
MU 7 (28ha
MU 1 (146ha)
MU 7(8ha)
MU 2 (111ha)
MU 3 (20ha)
Zoning Cable
MU 7 (3ha)
Back- up Cable
MU 7 (2ha)
Zoning Cable
Cable
MU 3 (14ha)
Back-up Cable 1
Cable as far down as posible
New Cable as far down as posible
Back- up Cable 2
0
0.35
0.7
1.4 Kilometers
Roodeplaat area
High Eutrophication zone
Harvisting Zone
Motorboats
Rowing Zone

Priority is rated from 1-5 with 5 being the highest. The score is a measure of infestation levels with 5 being the highest and 0 being not present.

FINANCE

The funding for Roodeplaat dam will be sourced from WMA 3 the trading account.

PUBLIC AWARENESS

Public awareness programmes will be started to target private landowners affected by aquatic weed infestations and encourage their participation in implementing an integrated control strategy through various means. This is

i) Supplementary in local newspapers highlighting the aquatic weeds found on Roodeplaat dam
ii) Posters and leaflets (obtainable from WfW) displayed in DWS water quality, DAFF extension officers and nurseries etc.

OPPORTUNISTIC SPECIES

Opportunistic aquatic plants can flourish in biologically disturbed aquatic environments, often becoming the dominant plants to the detriment of other aquatic species (Glen *et al*., 1999). This group includes many indigenous and cosmopolitan (worldwide) species (Henderson and Cilliers, 2002). Refer to Appendix IV for a list of these species.

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APPENDIX I. THE TERMS OF REFERENCE FOR THE ROODEPLAAT DAM ADVISORY COMMITTEE

Terms of Reference for the Roodeplaat Dam Advisory Committee

The Roodeplaat dam Committee may include:

- Chairperson –
- Secretary –
- Budget controller –
- Communication –
- Co-ordinator –
- Private landowners
- Aquatic weeds Project officer
- Water quality representative
- Dept. Public Works
- DAFF representative –
- National Aquatic Weeds Co-ordinator
- Other Partners / stakeholders to be represented
- DD's when necessary

Venue: Roodeplaat dam – Public Works boardroom

The role of the RDAC is to implement an integrated control strategy through:

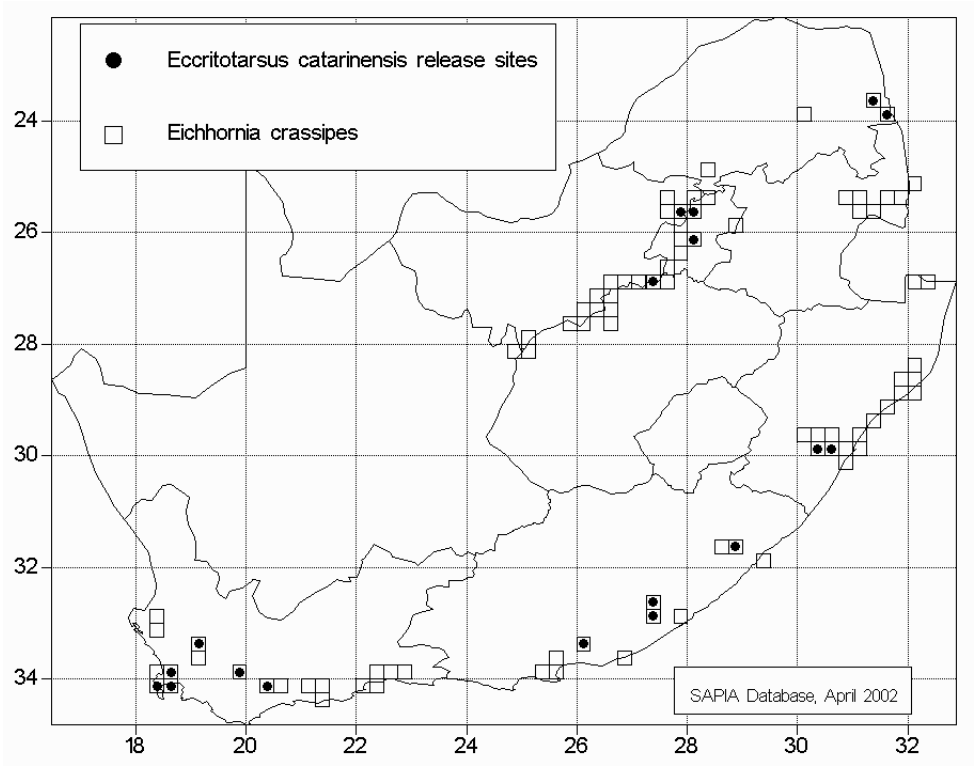
- Formalized liaison between roleplayers
- Facilitating integrated strategy development
- Coordinating the implementation of control tools
- Prioritizing activities
- Identifying workload and required resources
- Evaluating achievements of control methods against key performance areas
- Facilitating technical information flow
- Addressing reporting requirements
- Addressing training requirements

- Furthering the programme through awareness and cooperation
- Communicating the objectives of DEA NRM, DWS and other stakeholders to achieve a broad benefit
- Ensure that control implementation complies with statutory legal requirements

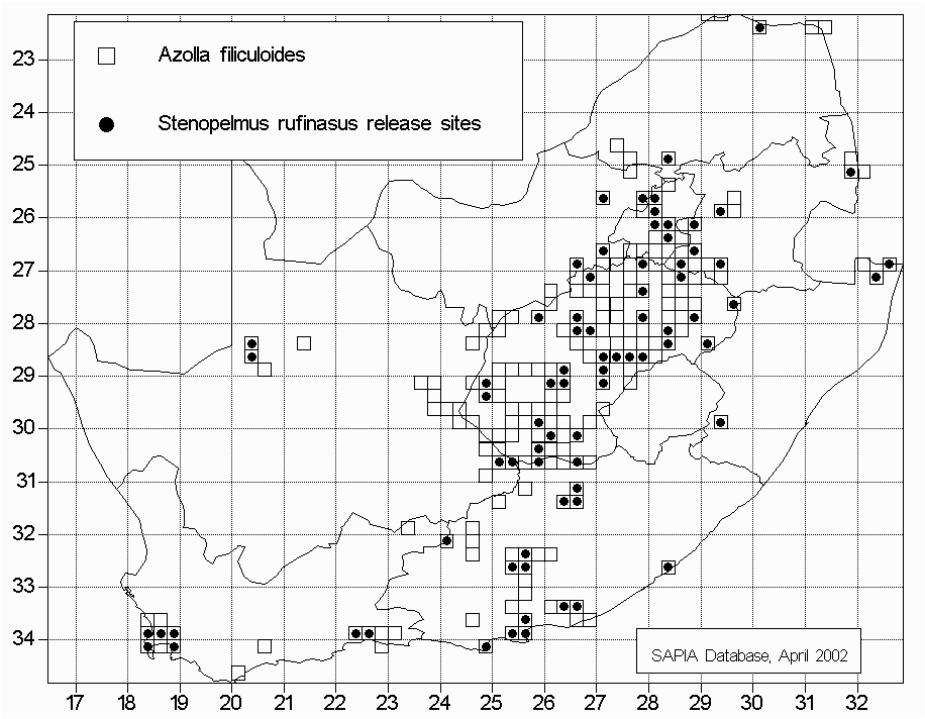
It is envisaged that the RDAC will meet more frequently initially, during the transition, with a view to quarterly meetings. The members will be chosen by the meeting.

APPENDIX II. THE MAP OF DISTRIBUTION AND EXISTING RELEASE SITES

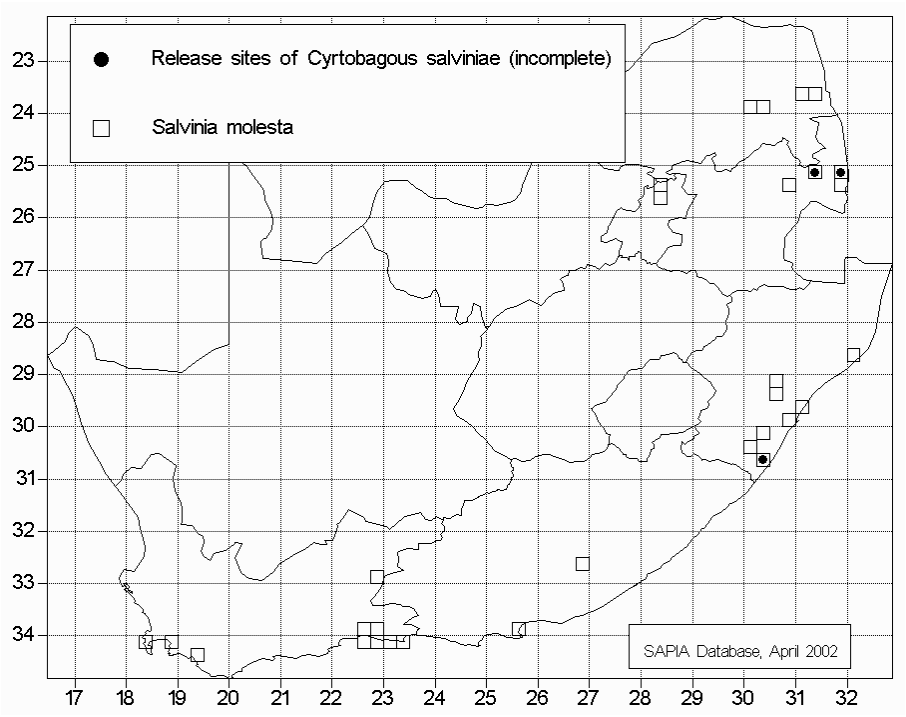
***Eichhornia crassipes* (water hyacinth)**



***Azolla filiculoides* (red water fern)**



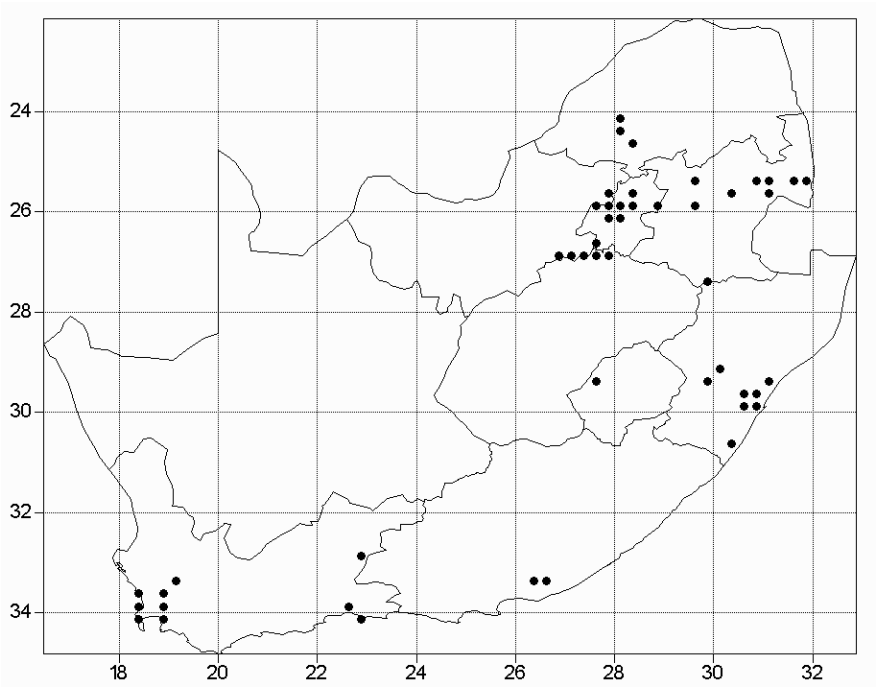
***Salvinia molesta* (Kariba weed)**



***Pistia stratoites* (water lettuce)**

Not available

***Myriophyllum aquaticum* (Parrots feather)**



APPENDIX III. SITE SELECTION CRITERIA FORMS FOR BIOCONTROL AGENTS

Date: Site Selection Criteria Record Number……..(Official use only)

Site Selection Criteria for biological control agents (*Working for Water* Programme (WfW))

Details of interested person

Name (Mr/Ms)	
District / Farm/ Reserve name	
Province	
Nearest town	
Physical address	
Actual position of site	
Latitude (°S)(of site)	Longitude (°E)(of site)
Telephone number	Fax number
Organisation (conservancy, farming community , FS Wildlife)	E-mail address

Land type/use (Tick appropriate box)

1. State land		2. Private land		3. Municipal land	
Reserve		Reserve		Reserve	
Forestry		Forestry		Suburban	
Tribal		Grazing		Open plot	
Other (eg. Farm)		Crop/ Orchard		Park	

Habitat of site (Tick appropriate box(es))

1. Aspect of slope		5. Road type (to the site)		7. Do the plants touch each other?			
Direction – N		Tar		Yes		No	
S		Gravel		8. Is the site accessible? If yes, give distance from road			
E		Dirt		Yes		No	
W		Loose sand		Distance			
2. Incline of slope		6. Shade type		9. Is the site prone to getting much dust?			
Steep >20%		None		Yes		No	
Gentle < 20%		Full shade (under canopy)		10. Is the site protected from fire and/or other disturbance?			
3. Does the site get frost?		Half shade (under canopy)		Yes		No	
Yes	No	<30% shade		11. Is the site likely to be cleared in future (within 5 years)?			
4. Road type (at the site)		7. Area of site		Yes		No	
Tar		<10m		If so, when			
Gravel		>10m<100m		12. Who is responsible for conserving the site? (give name)			
Dirt		<100m<1 ha					
Loose sand		> 1ha					

Alien Plant History (Tick appropriate box(es))

1. Do you have a clearing programme?				4. If no, is there another party involved? Name them			
Yes		No					
2. If yes, state the type				5. Target aliens			
Manual clearing				Bugweed		Pereskia	
Herbicide				Lantana		Water hyacinth	
Both				Chromolaena		Kariba weed	
3. Is WfW involved?				Mauritius thorn		Other (name)	

Yes		No		Black wattle		

Biocontrol History (Tick the appropriate box(es)) Fill in one table per alien plant

1. Why has the proposed site been selected for biocontrol?				4. Name of agent and plant			
				Plant		Agent	
				5. When was the BC agent released? (Give date)			
2. Any existing BC releases on your land?				6. Did the BC agent establish?			
Yes		No		Yes		No	
3. Proximity to nearest release from this site (in km)							

E.2

1. Why has the proposed site been selected for biocontrol?				4. Name of agent and plant			
				Plant		Agent	
				5. When was the BC agent released? (Give date)			
2. Any existing BC releases on your land?				6. Did the BC agent establish?			
Yes		No		Yes		No	
3. Proximity to nearest release from from this site (in km)							

E.3

1. Why has the proposed site been selected for biocontrol?				4. Name of agent and plant			
				Plant		Agent	
				5. When was the BC agent released? (Give date)			
2. Any existing BC releases on your land?				6. Did the BC agent establish?			
Yes		No		Yes		No	
3. Proximity to nearest release from from this site (in km)							

E.4

1. Why has the proposed site been selected for biocontrol?				4. Name of agent and plant			
				Plant		Agent	
				5. When was the BC agent released? (Give date)			
2. Any existing BC releases on your land?				6. Did the BC agent establish?			
Yes		No		Yes		No	
3. Proximity to nearest release from from this site (in km)							

E.5

1. Why has the proposed site been selected for biocontrol?				4. Name of agent and plant			
				Plant		Agent	
				5. When was the BC agent released? (Give date)			
2. Any existing BC releases on your land?				6. Did the BC agent establish?			
Yes		No		Yes		No	
3. Proximity to nearest release from from this site (in km)							

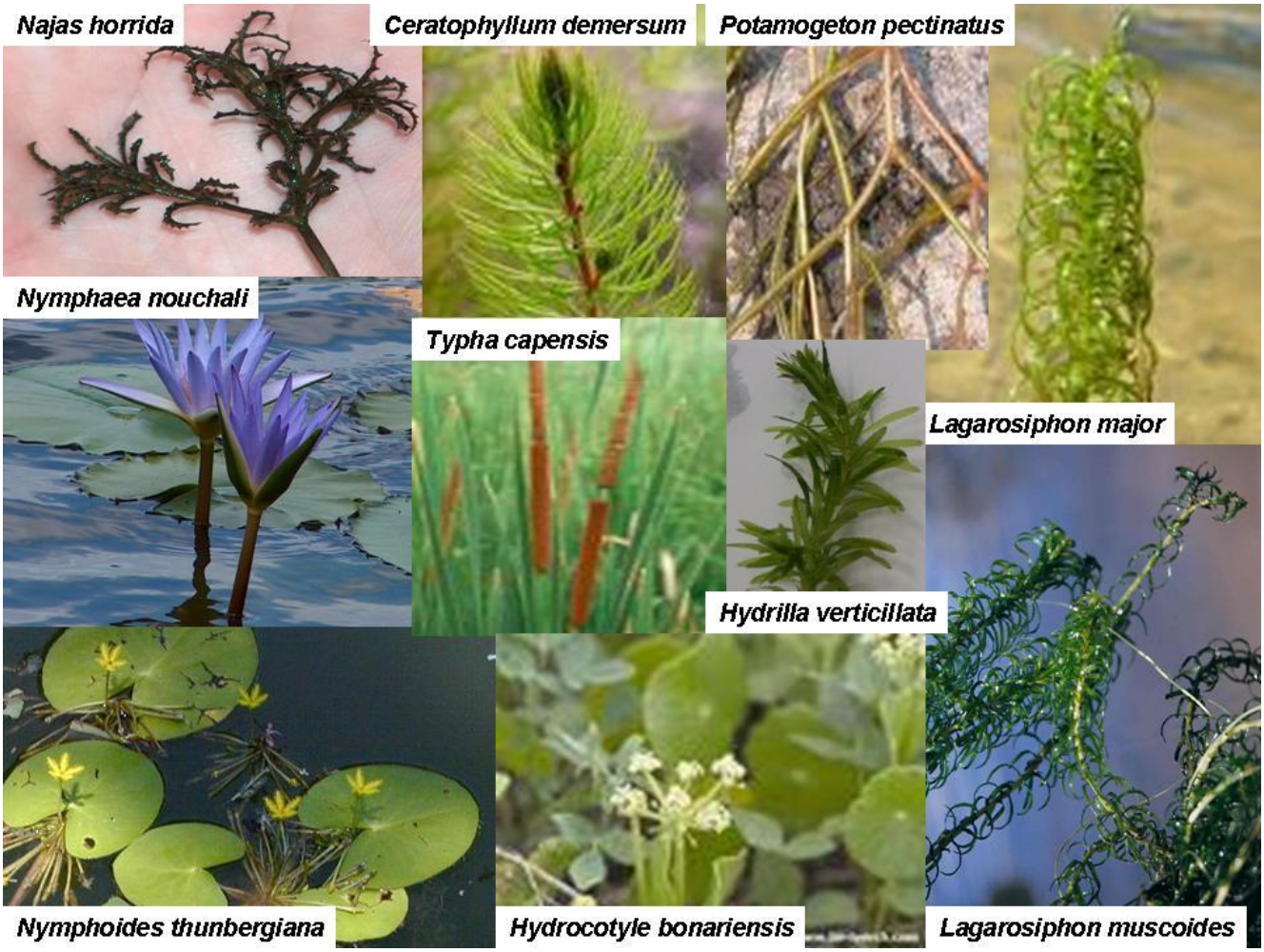
Contributors:WfW (Debbie Muir), PPRI (T. Olckers and C. Zachariades) and sappi (W. Lotter)

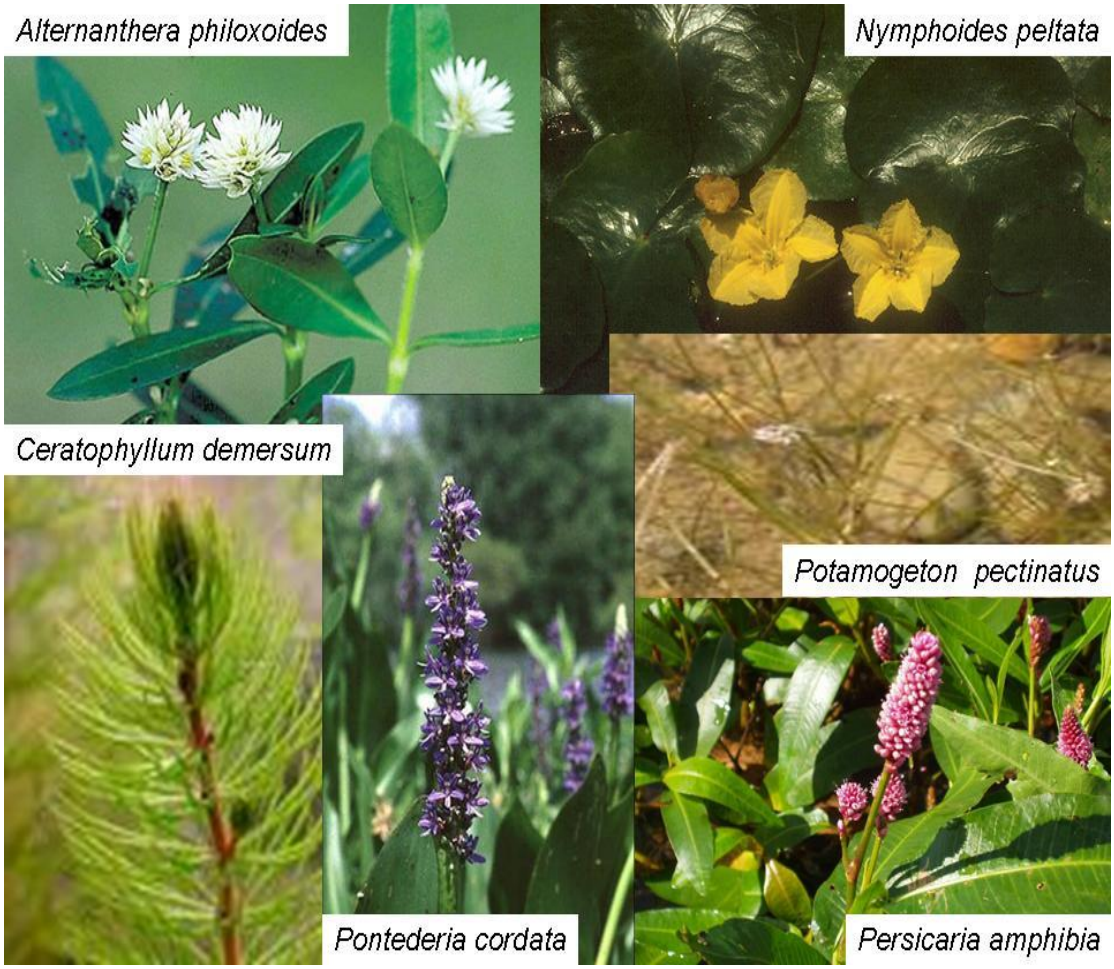
Please return copies of this sheet (post or fax) to Debbie Muir, WfW Programme, C/o ARC – PPRI, Private bag X6006, Hilton, 3245. Fax (033) 3559423 Cell: 082 462 1584

APPENDIX IV: LIST OF OPPORTUNISTIC AQUATIC PLANTS

Table 4. List of Opportunistic aquatic plants

Common Name	**Scientific name**
Fennel-leaved pondweed	*Potamogeton pectinatus*
Saw-weed	*Najas horrida*
Water hornwort	*Ceratophyllum demersum*
Coarse oxygen weed	*Lagarosiphon major*
Fine oxygen weed	*Lagarosiphon muscoides*
Willow-herb	*Lugwigia stolonifera*
'Blue' water lily	*Nymphaea nouchali*
Floating heart	*Nymphoides thunbergiana*
Bulrush	*Typha capensis*
Water pennywort	*Hydrocotyle bonariensis*




Alternanthera philoxoides
Nymphoides peltata
Ceratophyllum demersum
Potamogeton pectinatus
Pontederia cordata
Persicaria amphibia