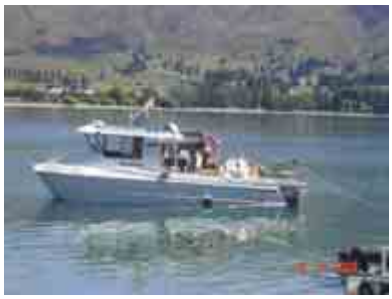

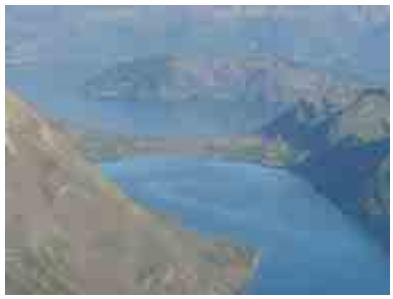

A 10 Year

Lagarosiphon Management Plan

for

Lake Wanaka:

2005 -2015

Lake Wanaka
Lagarosiphon Management Team
Approved 23 August 2005

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"Lake Wanaka - Lagarosiphon free"

1. INTRODUCTION

Lake Wanaka is too special to allow Lagarosiphon - an unwanted invader - to destroy the very values that make the lake a national treasure. This 10 Year Management Plan provides an opportunity for management agencies, research advisers and the community to take a long term view of Lagarosiphon control in Lake Wanaka. Developing and implementing a comprehensive management plan for the lake provides the best chance of making significant advances in reducing the extent and biomass of Lagarosiphon. The effort and expense of controlling Lagarosiphon in the lake will be negated however if areas are colonised or reinfected due to the spread of Lagarosiphon by boats/craft and fishing gear or the accidental introduction from fish ponds. Accordingly there are three major components to this long term plan: treating the weed, preventing spread by lake users and preventing accidental introductions. An adaptive management approach is being adopted to incorporate the results of control activities from previous years into the following year's management decisions. Such an approach gives the flexibility needed for this situation.

Within the framework of this 10 Year Management Plan, annual Lagarosiphon control programmes will be developed.

2. BACKGROUND

Lagarosiphon major (South African oxygen weed) is an introduced aquatic plant that first colonised Lake Wanaka in the early 1970s. Lagarosiphon can quickly establish in new waterways and is very difficult to eradicate. Rapid reproduction and dispersal of fragments allows it to become established in a water body within 12 - 18 months of the initial introduction. Regular weed control activities constrained the spread and increase of Lagarosiphon biomass in Lake Wanaka until recently when treatment was restricted to limited areas of the lake.

By 2003 the situation had deteriorated to the point where research and management expertise was bought together in a workshop to share information and discuss what was required to put in place an effective control programme. (Proceedings of the Lagarosiphon Workshop April 2003). Agreement was reached over the need for a comprehensive Lagarosiphon treatment programme, a management approach involving all the relevant organisations working together, and the use of all Lagarosiphon treatment methods that are appropriate for Lake Wanaka conditions.

The Ministers for Land and Information, Environment and Conservation supported this approach and additional funding was allocated to the Lake Wanaka Lagarosiphon Management Programme. In August 2004, Land Information New Zealand (LINZ),

Department of Conservation (DOC), Otago Regional Council (ORC), Queenstown Lakes District Council (QLDC) and the Guardians of Lake Wanaka agreed to a Memorandum of Understanding (MOU) about the control of Lagarosiphon in Lake Wanaka. A Management Team[1] comprising representatives from the participating organisations was established under the MOU and LINZ was assigned the lead role by the Minister for Land Information New Zealand.

Given that the summer season was approaching, an Interim Lagarosiphon Control Programme was designed for 2004/05. An open day held in August 2004 built on earlier opportunities for the community to learn more about the issue and make their views known. The interim programme can be viewed on both QLDC and LINZ websites.

3. RESPONSIBILITIES OF THE PARTIES TO THE MOU

Land Information New Zealand
Land Information New Zealand is the lead government agency and is responsible for the management of the bed of Lake Wanaka and associated weed and pest control programmes. LINZ represents the Crown as owner of the lakebed pursuant to the Land Act 1948.

Department of Conservation
The Department of Conservation has been responsible for implementing the freshwater biodiversity component of government's Biosecurity Strategy. However, responsibility for nationally led aquatic weed programmes (eg Hydrilla, hornwort) is being transferred to the new MAF Biosecurity Agency. Currently DOC retains a role in central government managing containment and exclusion of freshwater species, and this is exercised through both the aquatic life transfer controls under the Conservation Act and by the Chief Technical Officers (Conservation) appointed under the Biosecurity Act 1993.

Otago Regional Council
Otago Regional Council (ORC) has planning and regulatory functions under the Resource Management Act 1991 (RMA). ORC administers the Regional Pest Management Strategy (RPMS) that includes provisions for Lagarosiphon control. Monitoring the distribution of Lagarosiphon throughout the lake is a major function. Monitoring requirements under the Biosecurity Act 1993 are also an ORC role.

Queenstown Lakes District Council
Queenstown Lakes District Council (QLDC) administers the District Plan that regulates land use activities including activities on the shoreline, bed and surface of Lake Wanaka. Together with ORC, QLDC is responsible for RMA bylaws and consents in relation to activities and structures on the lake.

[1] The Management Team is comprised of representatives from each of the MOU parties. It is responsible for developing interim, 10 year and annual management plans and programmes and maintaining an overview on all aspects of the control programme. Members of the Management Team report respectively to their managers who are responsible for final decisions including funding.

Guardians of Lake Wanaka
The Lake Preservation Act 1973 defines the Guardians' responsibilities. These include the maintenance and improvement of water quality, protection of the shoreline and matters associated with the use of the lake for recreation.

4. GOALS

The Management Team has overall responsibility for developing and implementing a comprehensive 10 Year Lagarosiphon Management Plan whereby the area of Lagarosiphon infestation will be contained and progressively reduced.

Five goals are fundamental to the control of Lagarosiphon in Lake Wanaka, two of which are focused on human behaviour that spreads Lagarosiphon or accidentally causes new introductions.

Goal 1. Protect indigenous biodiversity

Lagarosiphon forms dense beds that smother native plant communities. Preventing further Lagarosiphon spread by eliminating outliers, controlling moderate growths and reducing the biomass of well established beds are all required to foster an increase in native aquatic plant communities and biodiversity.

Goal 2. Maintain natural heritage values

The protection of natural heritage values is incompatible with an aggressively invasive plant: Lagarosiphon must be tackled if Lake Wanaka is to continue being recognised as a national icon supporting outstanding natural heritage values.

Goal 3. Maintain and improve amenity values

Amenity and recreational values are being downgraded as the expansion of Lagarosiphon removes opportunities to access weed free areas of the lake for swimming, water skiing, fishing and picnicking. The perception of a pristine lake is also being compromised with lake-users expressing a reluctance to enter water over dense beds of Lagarosiphon. Apart from perceptions, safety around high biomass beds is an issue of increasing relevance and concern to lake-users. To maintain and improve amenity values, dense Lagarosiphon beds that have colonised suitable habitat must be reduced and controlled. Weed clearance around boat ramps, wharves and other amenity structures must take place.

Goal 4. Minimise the risk of transporting Lagarosiphon around Lake Wanaka and to other lakes

Goal 4 is made up of two components - treating the weed in the lake and working with lake users to minimise the spread of Lagarosiphon by boats.

1. High biomass and surface reaching weed beds need to be reduced and contained because they are a major source of Lagarosiphon that attaches to boats, trailers

and fishing equipment. Allowing Lagarosiphon to colonise wharves and launching ramps where boats can easily become carriers is unacceptable.

2. Boat/craft users and fishers need to recognise their role in transporting Lagarosiphon around the lake and adopt effective protocols to reduce the risk of transporting Lagarosiphon within Lake Wanaka and to other lakes.

Goal 5. Minimise the risk of Lagarosiphon being accidentally introduced to Lake Wanaka

Emptying fish bowls and having the contents of outdoor ponds go down stormwater drains into the lake during rainstorms represent the most insidious threat to the lake. Furthermore, the relatively common sale of Lagarosiphon is not only illegal but fosters accidental introductions. Despite the seriousness of this issue some members of the community appear largely unaware and indeed cavalier about the need to prevent Lagarosiphon from these sources from reaching the lake.

5. CONTROLLING LAGAROSIPHON IN LAKE WANAKA

Three major components are fundamental to controlling Lagarosiphon in Lake Wanaka: treating Lagarosiphon growth in the lake, preventing the spread of Lagarosiphon within and between lakes and minimising its accidental introduction. These three components are closely inter related but are considered separately in this section.

5.1 COMPONENT 1

Treating Lagarosiphon in the lake

5.1.1 Developing the approach

An approach to meet the goals of controlling and reducing Lagarosiphon in the lake initially evolved from an exercise conducted at the Lagarosiphon Workshop in 2003.

Step 1. Participants compiled a map of Lagarosiphon distribution in Lake Wanaka from the best available information (Workshop Proceedings 2003).

Step 2. The lake was subdivided into areas according to the distribution and state of Lagarosiphon, ranging from high biomass beds to sparsely scattered individual plants.

Step 3. All available treatment methods were considered and the combination of methods thought to be most appropriate for each area was identified.

Step 4. In 2004 the newly established Management Team and their advisers assigned priorities for treating each area on the basis of the current and potentially adverse impacts that Lagarosiphon could have on the lake.

Step 5. Areas were then grouped according to the following treatment objectives that relate specifically to delivering the four goals[2] (see 4 above):

Lagarosiphon treatment objectives:

1. Push back the northern Lagarosiphon front (Goals 1, 2, 4)
2. Clear amenity structures - boat ramps, wharves and marina (Goals 3, 4)
3. Suppress high biomass beds (Goals 1, 2, 3, 4)
4. Treat popular areas that have yet to reach high biomass status (Goals 1, 2, 3, 4)
5. Clear low density patches (Goals 1, 2, 3, 4)

In recognition of the need for development and improvement in control methods wherever they are used in the lake the following objective was added:

6. Maximise efficiency and cost effectiveness of control methods/approaches (Goals 1, 2, 3, 4, 5)

Step 6. Extensive deliberations about every Lagarosiphon control method resulted in agreement by the workshop and later the Management Team that the following methods are suitable for Lake Wanaka:

A herbicide (currently Diquat) kills the green part of the plant and reduces the biomass of large and dense beds.

Suction dredging can remove the roots and lower part of the stem where new growth takes place.

Hand weeding can remove the entire plant if plants are scattered and the substrate is suitable.

The state of Lagarosiphon growth determines which combination of methods is most appropriate. For instance high biomass beds require the application of a herbicide to reduce biomass so that suction dredging can target the lower parts of the plants. Whether beds are extensive, more scattered or clumped, herbicide application techniques such as aerial, from a boat, beneath the surface or directly onto the plants need to be investigated to determine the most effective technique. Contact time with the plant is a critical factor in herbicide success. The combination of herbicide followed by suction dredging is considered to be the most effective treatment for high biomass to clumped Lagarosiphon situations. Without application of herbicide to reduce the biomass, mechanical control methods are not likely to be effective.

Suction dredging is currently the most appropriate method for medium density to more sparsely distributed growths. Improved dredging and other mechanical technologies will be explored. Hand weeding is appropriate for sparsely distributed individual plants and as an important follow up method for other treatment techniques.

[2] Lake Wanaka Treatment areas shown in Appendix 1 are numbered consecutively around the lake.

Step 7. Priorities assigned to each area and treatment scenario were presented in "An Interim Control Programme for 2004/05". Highest priorities were awarded to pushing back the northern Lagarosiphon front, suppressing high biomass beds and clearing amenity structures. Expectations of the achievable level of control vary with treatment objectives. For instance, eradication might be the expected result of treating less extensive and lower density beds associated with pushing back the northern front. In contrast, a 90-95% reduction is more realistic for suppressing high biomass beds providing that Diquat application is carried out when both weather and weed conditions are suitable. Low key monitoring may then be the only follow up required.

Note: The 2004/2005 Interim Lagarosiphon control programme is described in Appendix 2. Experience gained during the interim control programme is being integrated into the ongoing Lagarosiphon control programme.

5.1.2 An adaptive management approach for Lagarosiphon control

Establishing a framework comprising the status of Lagarosiphon, treatment objectives and priority of treating Lagarosiphon in defined areas, provides the basis for an adaptive management approach - something that is flexible and desirable for the Lake Wanaka situation. Each year the success of control activities will be evaluated in different areas and for different objectives. When changes in distribution or biomass are detected, treatment will be adjusted to suit the new situation. This flexible year by year management approach requires an assessment of the state of the Lagarosiphon beds before treatment, soon after treatment and again in preparation for determining treatment for the following year. With this information, robust decisions can be made about the type of treatment and priority for each area. Furthermore, combining information from the treated areas will provide an overview of the extent to which Lagarosiphon is being reduced around the lake. An adaptive management approach is considered to be most appropriate where there is uncertainty about the cumulative effects of treatment on Lagarosiphon over time.

Management within designated areas: Targeting treatment of Lagarosiphon to specific locations within a designated area is potentially more effective, will achieve better results and expend fewer resources - in other words, deliver Objective 6 outcomes (p8). When the state of Lagarosiphon is not uniform within an area, focusing treatment onto the worst effected parts may make more sense than treating the whole area. For instance Lagarosiphon within Paddock Bay is not uniformly dense. The beds along the west and south-west shoreline are surface reaching and present the greatest risk of detachment by wind and waves, as well as attachment to boats. Treating this part of the bay rather than the whole bay has the potential of achieving effective results for least resources and not having to potentially exclude boats from the entire bay.

Micro management within a designated area: Greater weed control and cost efficiencies can be realised by micro managing particular situations. Flexibility in timing and frequency of follow up assessments within a treatment year (see 5.1.3, monitoring) can be used to determine the most appropriate scale and intensity of weed control activities for each site as the year proceeds. For management at this level

specialist advice is needed to evaluate the results of monitoring so they can be fed into both short term treatment possibilities and the following year's programme. Maximum flexibility and the ability to try new initiatives need to be built into the process.

Improving efficiencies in weed control methodology: As with micro management, significant gains in both efficiency and cost savings could be realised by advocating and participating in studies that improve various aspects of Lagarosiphon control methodology. For instance, the disposal of weed following suction dredging requires substantial time, effort and costs. Any improvement to this part of the process would not only reduce costs significantly but also allow substantially more weed to be cleared in an equivalent period of time. Both mulching weed and deep water disposal are being investigated. Similarly the development of improved herbicides, different control agents and hopefully a sought after systemic solution are desired advances in weed control technology. The Management Team recognises the importance of advocating and supporting the development of such initiatives.

Constraints on required flexibility: Acting against the flexibility required of adaptive management and micro management are administrative functions associated with funding and contracting. For instance, to be cost effective contractors need a detailed idea of what is involved before submitting tenders. Furthermore, contractors need to understand Lagarosiphon and the underwater conditions they are likely to have to operate in. Training and supervision of contractors is critical for a successful operation. Flexibility over the timing of treatment is also necessary for the most effective result. The timing of follow up treatment is critical. If this is not able to be funded within a financial year the entire value of the treatment and the funds will be wasted. Other outside influences such as public perceptions and contractual liabilities can also divert the focus from Lagarosiphon control.

From a different perspective, the need for suitable weather and weed related conditions can also be constraining. For instance winds, rain and rough surface conditions tend to prevail from late spring onwards. Such conditions are responsible for delivering sediment into the water and onto the weed, something that can significantly reduce the effectiveness of Diquat and interfere with suction dredging. Similarly the state of Lagarosiphon itself can determine how effective control methods are likely to be. Healthy growing plants take up Diquat most effectively, something that should be determined before treatment is undertaken. Improving the effectiveness of Diquat can be achieved by trials in different combinations of conditions. Trials to maximise the contact time between Diquat and Lagarosiphon are ongoing.

5.1.3 Monitoring - a fundamental component of adaptive management

Adequate monitoring is critical for evaluating the success of Lagarosiphon treatments. The state of Lagarosiphon and the habitat in treatment areas must be documented prior to treatment to provide a baseline. Measurements need to be repeated after 6-8 weeks to determine how effective treatment has been and what further steps need to be taken. Monitoring again before compiling the following year’s treatment is needed to produce a programme that is robust and realistic. This level of monitoring is dictated by the tenacity of Lagarosiphon and the speed at which it can show signs of

recovery. Establishing the baseline measurements and follow up conditions requires scientific and technical expertise.

For instance, 2-3 months after any type of treatment, fragments remaining in the water may have begun to re-establish. To hit the beds hard in the first instance and then follow up with repeat treatments is the most sensible way of knocking back growth in a significant way. Adequate monitoring carried out in or under the water is necessary to provide the information required for adaptive management.

Monitoring areas of the lake that are free of Lagarosiphon is also critical to adaptive management. Should Lagarosiphon establish in new areas it is vital to begin treatment while the growth is sparse and contained. The Otago Regional Council is committed to monitoring the entire lake on a two-yearly cycle for this purpose. Where monitoring includes routine observations by the ORC monitoring team they will contribute to an evaluation of treatment success.

Responsibility for monitoring different aspects of the programme:

- To detect new outbreaks of Lagarosiphon, ORC monitors the whole of the lake on a two yearly cycle.
- Monitoring the state of Lagarosiphon before treatment, 2-3 months afterward and before developing the following year's programme is needed to decide how effective treatment has been and whether, what, where and when further treatment is required. A commitment to this type of monitoring is critical for management decisions. Bringing together scientific and technical expertise to evaluate the treatment areas and provide advice about the monitoring results and future directions will assist the Management Team compile sensible and realistic control options.
- Monitoring whether the contractors have delivered on their contracts is an integral part of the LINZ weed control programme.

Water supply for human consumption: An additional monitoring role that is unrelated to Lagarosiphon control will be carried out where appropriate to provide reassurance that herbicide is not present in water surrounding the town water supply intake. Wherever water supply intakes are present for purposes other than human consumption land owners will be advised prior to application.

Achieving maximum efficiency with monitoring results: Given five organisations are party to the MOU, and scientific advisors as well as several contractors and subcontractors are involved in the monitoring programme, the monitoring carried out by each agency will be co-ordinated where appropriate. All monitoring information relevant to the team's ongoing management will be made available to all participants in the programme. The Management Team will provide a forum where results can be debated by all participants and ongoing weed control directions agreed.

5.1.4 Lagarosiphon control in Lake Wanaka: 2005/6 - 2014/15

There is currently no easy fix for Lagarosiphon. Indeed control treatments will take time to show significant results. Just how long is not certain. Treatment objectives, area priorities and combinations of methods enable various treatment packages to be

identified and costed. Monitoring the results of selected packages will provide the data for ongoing adaptive management choices. It is likely that several Diquat or suction dredging treatments will be necessary before high biomass beds are reduced. At that point suction dredging and hand weeding are likely to become the most appropriate methods. Finally when weed is reduced to a low level, suction dredging may be replaced with hand weeding.

The results of adaptive and micro management are expected to become increasingly relevant with time. Results from 2005/06 onwards will become progressively more important for determining the most effective ongoing treatment packages for achieving Lagarosiphon control.

5.2 COMPONENT 2

Preventing the spread of Lagarosiphon within Lake Wanaka and to other lakes

5.2.1. How Lagarosiphon is spread

It may come as an unpleasant surprise to many whose summertime activities are focused on Lake Wanaka that Lagarosiphon is primarily spread within the lake by boats, boat trailers, other craft and fishing equipment. Lagarosiphon is also spread naturally when fragments separate from established beds and drift with the wind or currents to other places. However, the recent pattern of weed growth around locations that have become popular clearly demonstrates how effective the spread by boat and other craft can be. For instance Mou Waho and Stevensons Island are being visited increasingly often and outbreaks of Lagarosiphon around the islands are mirroring this trend. Where Lagarosiphon habitat is suitable and an area becomes popular with boats/other craft the establishment of Lagarosiphon seems assured. Furthermore the trend of increasing numbers of craft on the water is expected to escalate.

Craft related spread of Lagarosiphon around the lake has the potential to negate much of the effort being invested by Government and local authorities in the Lagarosiphon Control Programme. Every opportunity, including consideration of boat registration, will be taken to address the serious biosecurity threat that Lagarosiphon presents.

As with boats, other craft and fishing gear can inadvertently become carriers of Lagarosiphon to other sites within Lake Wanaka. There is also the potential to transfer Lagarosiphon to other lakes. Much concern has been expressed about this possibility for Lake Wakatipu in particular, but also for lakes in the wider region. Recognising the extent of the problem Lagarosiphon is causing Lake Wanaka, it is crucial that every step is taken to prevent transfer to other lakes.

5.2.2 Prevention of Lagarosiphon spread (Goal 4)

The following linked elements are considered to be the minimum to prevent spread of Lagarosiphon by those who use the lake.

1. Inform lake users about Lagarosiphon and how to minimise their role in its spread.
2. Establish a working relationship with key lake users to foster an exchange of views and ideas about how they can minimise the spread of Lagarosiphon within the lake.
3. Evaluate and improve launching sites and provide facilities for removing Lagarosiphon from boats/craft.
4. Recognise the possibility that restricting lake users from certain areas of the lake that present a high risk of attachment might become necessary until Lagarosiphon treatment has been carried out.
5. Monitor the success of 1-4

5.2.3 Ensure that the spread of Lagarosiphon is controlled

Preventing spread of Lagarosiphon is all about behaviour. Boats and fishing lines do not spread weed - lake users do. Accordingly the following actions are mostly to do with lake users and we need to work together to reverse the spread of Lagarosiphon.

1. Information: Informing lake users about the risks of Lagarosiphon and advocating "vessel hygiene" will be the basis of this programme over the period of this 10 Year Plan. Each year the effectiveness of the programme in preventing the movement of Lagarosiphon will be assessed with input from the Management Team. Improvements will be incorporated into the programme on the basis of this annual review.

Components of the programme include wide distribution of informative material such as posters and pamphlets throughout Wanaka by ORC. Notices requesting boat/craft users to help look after the lake by inspecting their boats and trailers for Lagarosiphon will be erected at the major launching sites. Radio messages will be broadcast during the high use summer period and a range of novelty ways of spreading a strong message about boat hygiene will continue to be trialled. In the future, significant improvements are expected in getting the message out.

2. Lake users involvement and contribution: The knowledge and experience of those who regularly enjoy being on the lake is currently an untapped source of ideas about preventing Lagarosiphon spread. Accessing that knowledge provides the potential for innovative thinking and an important opportunity for lake users to be involved in developing solutions to combat the spread of Lagarosiphon.

Working with key boat/craft users and fishers to identify patterns and trends of lake-use and develop boat/craft/fishing protocols is considered to be a vital component in preventing the spread of Lagarosiphon around the lake and to other lakes. There is enormous potential for lake users to support the current initiative and help get the message out.

3. Rationalise/improve launching sites: Launching and landing boats/craft from recognised ramps has a number of significant advantages in ensuring that Lagarosiphon is not transferred around the lake. Lagarosiphon treatment at launching ramps is top priority. Lagarosiphon treatment should completely remove the weed from around the entire ramp area to prevent attachment to boats/craft. In comparison

launching from beaches has a high risk of attachment if Lagarosiphon has not been treated in that area.

Landing at ramps where Lagarosiphon has been treated has the advantage of minimising the risk of spread to the next water body the craft is launched in, be that Lake Wanaka or a neighbouring Lagarosiphon free lake. Improving boat ramps by installing wash facilities for trailer and boat/craft if used responsibly, is an effective way of further reducing the risk of transporting Lagarosiphon to other weed free lakes.

QLDC have developed a Boating Strategy that contains proposals for improving boat ramps to reduce the risk of spreading Lagarosiphon. The Council's strategy is entirely consistent with this 10 Year Lagarosiphon Management Plan.

4. Restrict lake users from parts of the lake: Lagarosiphon infestation in parts of Lake Wanaka is so great that the risk of attachment to craft is unacceptable. For instance, there is a very high risk that boats/craft using Paddock Bay will pick up Lagarosiphon and transport it back to Glendhu Bay or other parts of the lake. Accordingly, the possibility of restricting boats from the area needs to be recognised. If boats/craft avoid the worst affected parts of Paddock Bay the threat to other areas of the lake that have either been treated or have not yet been colonised from Paddock Bay weed will be minimised. Restricting boats or installing some type of barrier that isolates the highest biomass beds along the west shore of the bay could potentially prevent transport of Lagarosiphon out of Paddock Bay by lake users. However, further innovation is needed to prevent natural drift of Lagarosiphon out of Paddock Bay by wind and waves. Given the biomass and the expense of suction dredging, a holding pattern may be best for Paddock Bay until containment methods are developed.

5. Monitoring: Monitoring the success of activities in the "prevention of spread component" is an integral part of the whole programme. Whether lake-user activities are effective in preventing the transfer of Lagarosiphon further around the lake is fundamental. Ways of evaluating this need to be developed. So too is knowing whether lake users are abiding by voluntary protocols, whether recognised and improved boat ramps are being patronised by lake users and if any area restrictions are being observed. Preventing spread of Lagarosiphon by boats/craft and fishing equipment is absolutely dependent on the co-operation, leadership and active involvement of responsible boat owners/user associations.

5.3 COMPONENT 3

Preventing the accidental introduction of Lagarosiphon into Lake Wanaka

5.3.1 How Lagarosiphon gets into the lake accidentally

Despite Lagarosiphon's high profile, many in the community appear not to know what it looks like and why it should not be in their fish bowls or outside ponds.

Cleaning out a fish bowl or pond can result in Lagarosiphon fragments disappearing down a drain to the lake. Heavy rain can also cause fragments from ponds to be dislodged and transported down storm water drains to the lake.

Lagarosiphon can be found for sale in garden centres despite being a pest weed and illegal to possess (The sale of Lagarosiphon is an offence under Section 4.1 of the Biosecurity Act and Sections 5.2 and 5.3 of the Otago Regional Council's Pest Management Strategy). It is little wonder that the community has not fully recognised how serious a threat Lagarosiphon is to the lake.

5.3.2 Controlling accidental introductions

Controlling accidental introductions of Lagarosiphon into the lake will involve, at minimum, the following linked elements:

1. Information and education about the serious longer term consequences of Lagarosiphon for Lake Wanaka to the community and potential retail outlets.
2. Establish and publicise the legal status of selling, purchasing and possessing Lagarosiphon.
3. Ensure compliance of garden centres, pet shops and other potential commercial outlets with regulations in the ORC Pest Management Strategy
4. Ensure community compliance regarding fish ponds.
5. Produce educational material covering the issue of accidental introductions.
6. Monitor the programme.

6. ANNUAL PLANNING PROCESS

Each year a planning process will be undertaken by the Management Team and advisors. A number of components are involved, all of which contribute to the ongoing improvement of Lagarosiphon treatment and control. These are detailed below.

6.1 Lagarosiphon treatment and monitoring process

The Annual Planning process for treating Lagarosiphon in Lake Wanaka is part of a three year rolling programme.

For a robust treatment programme, monitoring is required at three points in the process

1. Prior to any weed control operations, sites will be established and baseline information collected.

2. Irrespective of which control methods are applied, areas need to be monitored soon after treatment to assess the state of Lagarosiphon when signs of regrowth are likely to be showing.

3. Monitoring that allows an evaluation of the previous year's control programme in time to develop the following year's programme.

Steps in the annual treatment and monitoring process

- The most appropriate time to apply herbicide is when the lake is low and clear. *March/September* is considered to be optimum because from October onward the Nor'westerly winds melt the snow, lake levels tend to rise and water clarity decreases.

  A further advantage of making an early application is to minimise disruption to lake users.

- About three months after treatment when signs of regrowth are likely, the state of Lagarosiphon should be checked in treated areas

- In areas where suction dredging is the only control method, there is more flexibility about when the method is carried out but the combination of calm conditions, low water levels and high water clarity make April to late September the most desirable period. In contrast an annual funding process is constraining because operations must be completed in time for developing and estimating costs for the following year's operational plan.

- Monitoring 50% of the lake shore in ORC's whole of lake monitoring programme will identify new outbreaks and provide information about the state of treated areas in the areas monitored *(December-March).*

- The Management Team and advisors will analyse the monitoring results from each programme, make a comparison with what was predicted and, taking into account the long term treatment framework, devise the following year's programme *(April/May).*

6.2 Lake users awareness process

- Providing information to raise lake-user awareness is best carried out over the busiest part of the summer *(December-February).*

- Involving key members of boating and fishing groups would be most effective during summer but could be facilitated at any time of the year depending on where members live.

- Improving launching facilities and investigating access restrictions could also be advanced at any time of the year.

6.3 Retail outlets and pond owners process

- An educational and publicity programme is relevant all year round.

- A programme of retail outlet inspections could be conducted throughout the year.

6.4 Public release of control programmes

The following parties will be individually notified of our Lagarosiphon control programmes:

- Te Runanga o Ngai Tahu,
- Te Runanga o Moeraki
- Te Runanga Otakou
- Kati Huirapa Runanga Ki Puketeraki
- Te Runanga Hokonui
- Wanaka Community Board
- QLDC Harbour Master
- Otago Fish and Game
- Affected adjoining land owners

The release of control programmes will be publicly notified and be available on both QLDC and LINZ websites as well as from the DOC and QLDC offices in Wanaka.

7. FUNDING

Adequate funding for treatment will have to be found if Lake Wanaka is to remain a national treasure. The values sustained by the lake that generate income for the region and the nation include tourism, fishing, boating, food and accommodation, water front property values - to name but a few. Comparing the funding and income relationship of other community facilities highlights the need to commit both a substantial effort and adequate funds to retain Lake Wanaka's outstanding values.

Realities of funding:

- Maintaining an adequate funding level is fundamental for Lagarosiphon control.
- No matter how comprehensive the Management Plan, it will fail if adequate funding and weed control are not maintained.
- The results of inadequate funding have been witnessed from 2000-2004 in uncontrolled weed spread.

7.1 Funding requirements: treatment of Lagarosiphon in the lake

Determining funding requirements for an effective long term Lagarosiphon control programme cannot take place in a vacuum. Having adopted an adaptive management approach with three key components (as described in this plan) annual cost estimates can be based on assumptions associated with each component. Once the level of required funding has been assessed the issue of sourcing funds can be addressed. In this section, the process of making funding estimates is outlined. We expect estimates will improve with a better understanding and experience of the programme.

7.1.1 The interim control programme

The experience gained from weed control operations to date will be integrated into the 2005/06 control programme. Available funding was not adequate to carry out the interim control programme despite LINZ, QLDC and ORC investing in excess of $250 000. A number of compromises were necessary including the removal of areas from the programme and a serious reduction in the amount of suction dredging planned. From these results cost efficiencies, particularly in suction dredging will be integrated into a more realistic and effective 2005/06 programme.

7.1.2 Funding from 2006/07 onwards

Assuming decisions from 2006/07 will be guided by treatment results and monitoring (adaptive management), funding estimates for the longer term become increasingly difficult at this time. However by making the following assumptions trends in funding requirements become apparent:

- A multi year treatment plan of Diquat application in areas where it is shown to be effective, and suction dredging will be necessary to make an impact on Lagarosiphon.
- As Lagarosiphon responds to treatment Diquat, if it is involved in treatments, will be the first control method to be removed.
- Suction dredging and hand weeding will then become the predominant treatment combination.
- Similarly, once Lagarosiphon is reduced to very low densities, diver monitoring and hand weeding will replace suction dredging.
- How quickly this sequence will occur will depend on the state of Lagarosiphon. High biomass beds are likely to take the most time to show a significant reduction.

7.1.3 Funding implications 2006/07 - 2014/15

As Diquat treatment is scaled down, suction dredging will become the predominant control method and Lagarosiphon treatment will still require substantial funding. Diquat application is relatively low cost compared to suction dredging and application may take place in only a few of the 17 treatment areas depending on the results of trials. Therefore, suction dredging without Diquat will not result in a significant reduction in costs.

As control of Lagarosiphon progresses, the combination of suction dredging followed by hand weeding will begin to prevail as the predominant methods. The cost of hand weeding increasingly extensive areas of the lake will increase the funding requirements of this method. The funding implications are not clear at this time.

Given the treatment scenario outlined above, the predominance of suction dredging throughout the entire control programme and the cost of this method, it seems unlikely that there will be a significant reduction in funding requirements in the early years of this plan. However it is reasonable to expect the development of improved

and more cost efficient control methods during the period and this could have a substantial influence on funding requirements.

7.2 Funding requirements: prevention of transport within Lake Wanaka and to other lakes

Informing lake users and managing activities and facilities around the lake are currently funded by ORC and QLDC. The five linked elements identified in this plan are essentially extensions of current programmes. Informing lake users, working with key members of boat and fishing clubs, improving launching sites and rationalising the use of the most problematic areas of the lake will require additional funding as will developing and implementing methods for evaluating the effectiveness of these lake users' components. To what extent will depend on the development of detailed annual programmes.

7.3 Funding requirements: prevention of accidental introductions

Checking retail outlets and ornamental ponds is funded by ORC under the Pest Management Strategy. The insidious nature of accidental introductions warrants an improved compliance response. Associated funding increases will depend on the type of programme adopted annually.

7.4 Funding sources

From the above discussion about funding needs, it is clear that a very significant increase in funding is required, together with a commitment from a variety of funding sources to implement an effective weed control programme over the next 10 years.

7.4.1 Government funding

LINZ is responsible for the management of the bed of Lake Wanaka and associated weed and pest control programmes. Given the high public profile of the issue, further Government funding may need to be made available.

DOC administers Biodiversity funding - an initial allocation of $187 million was made to projects and programmes that enhanced, maintained and restored indigenous biodiversity. That Lagarosiphon is threatening indigenous aquatic plant biodiversity in Lake Wanaka, a recognised national treasure, suggests that an allocation from the biodiversity fund is warranted.

BIOSECURITY NZ administers biosecurity funding, another source of funding that would be directly relevant for Lagarosiphon control in Lake Wanaka.

7.4.2 Local authority funding

ORC currently funds the "whole of lake" monitoring programme carried out over a two year period. This monitoring will become even more important as the treatment methods reduce Lagarosiphon to low levels. Given skills and experience of the conditions in Lake Wanaka, funding for the diver hand weeding and monitoring component of the programme may be available from this source.

ORC also funds a Lagarosiphon information/awareness programme targeted at boat/craft users each summer. This commitment will continue and could be increased to cover further involvement of boat/craft users and fishers.

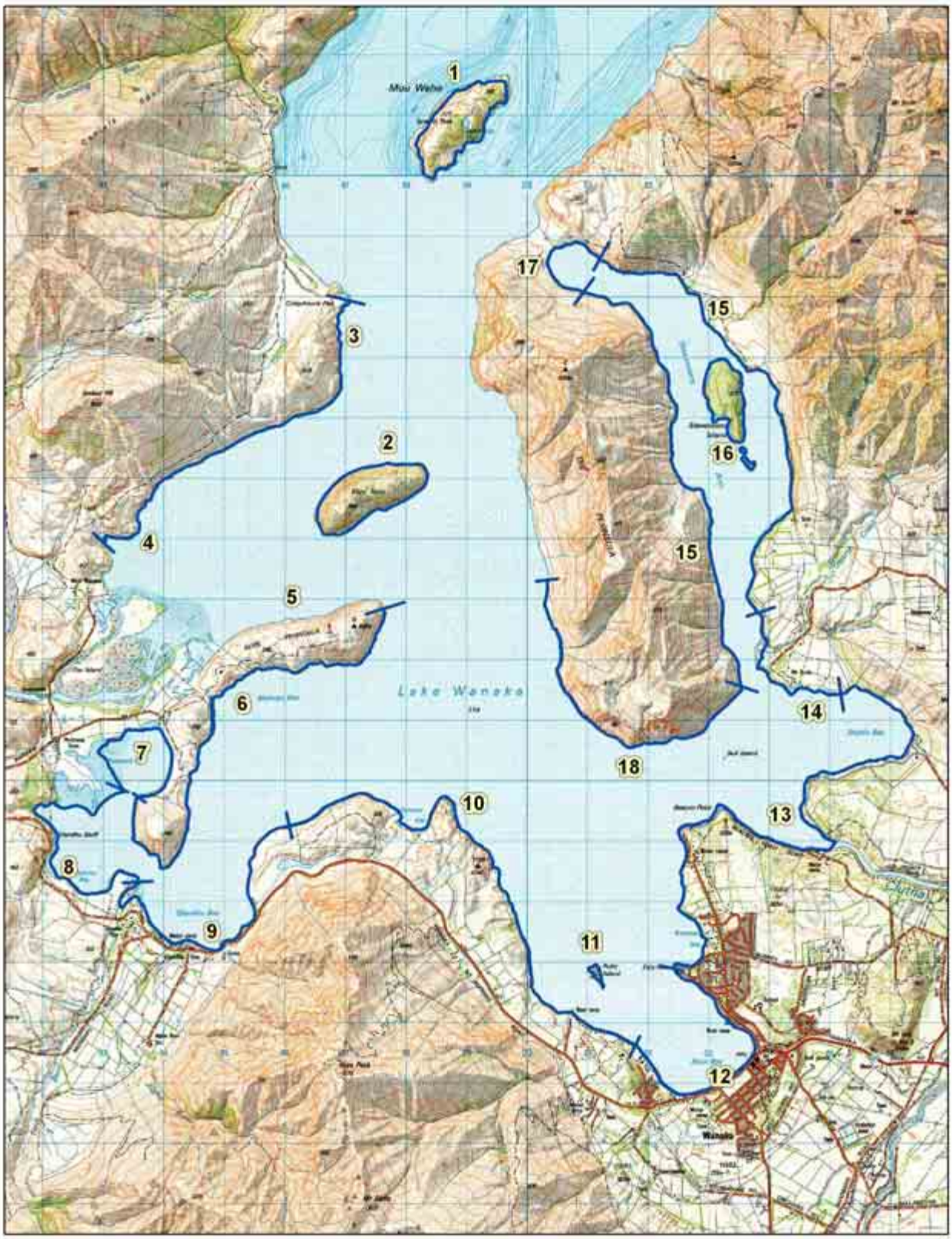
QLDC currently contributes to the Lagarosiphon control programme in addition to managing surface activities and services. Additional funds could come from rates or a lake users fee - both of which could be justified given the importance of Lake Wanaka to the region and the relationship between boats/craft and fishers and the spread of Lagarosiphon within and potentially beyond the lake.

The potential level of funding from boats, craft and fishers can be calculated by assuming the number of boats using the lake each year and multiplying by different levels of "Lagarosiphon control fees". Funds generated could provide important resources for Lagarosiphon control as well as administration and associated compliance costs and should be explored further

7.4.3 Combined central and local government funding

Should additional Government funding be found it is likely to be according to a central to local government funding ratio.

Appendix 1. Lagarosiphon Treatment Areas



Appendix 2. Interim Lagarosiphon control programme 2004/2005

Table 1. Lagarosiphon treatment in Lake Wanaka: the 2004/05 Interim Control Programme - what was planned/realised (areas arranged according to treatment objectives, priorities and treatment methods)

Treatment objective	Area	Ha	Priority	Interim Control Programme 2004/05	Methods applied 2004/05
Push back northern front	Mou Waho	0.05	1	Suction Dredge	Comprehensive treatment
	Mou Tapu	0.05	1	Suction Dredge	Comprehensive treatment
	Colquhouns - West Wanaka Bay	0.10	1	Herbicide (S)	Applied
Clear amenity structures*	Pembroke Pk-Eely Pt (Roys Bay)	0.60	1	Suction dredge + Hand weed	Limited to patches
Suppress high biomass beds	Paddock Bay	18.5	1	Herbicide (A)	Applied
	Glendhu Bay – Point	1.6	1	Suction Dredge	No suction dredging
	West Wanaka Bay	0.15	1	Herbicide (A)	Applied
	Bishop Bay Bluff - Paddock Bay Narrows	0.15	2	Herbicide (S)	Applied
	Parkins Bay	8.2	2	Herbicide (A)	Applied
	Mt Burke - Quartz Creek	2.0	2	Herbicide (A) + Suction Dr	Applied To be suction dredged 2005
	The Isthmus	0.05	2	Herbicide (A)	Applied
	Stevensons Island	0.03	2	Herbicide (A)	Applied
Treat popular medium biomass areas	Stevensons Arm (excl Isthmus)	0.3	2	Herbicide (S)	Applied
	Ruby Island	0.02	2	Suction Dredge + Hand weed	Limited to the pier area
	Roys Penin - Bishop Bay Bluff	0.15	3	Herbicide (S)	Applied
Treat low density areas	The Point - Pembroke Park	0.65	3	Suction Dredge	Small trial area
	The Peninsula (Stevensons Arm - Point opp Roys Penin)	0.15	3	Treatment deferred	No treatment
	West Wanaka Bay - Nth shore Roys Penin	0.01	2	Treatment deferred	No treatment
	Eely Point - Mt Burke Station	1.0	3	Diver Monitor + Hand Weed	Applied
Detect new growth	Colquhouns to Makarora R. to point opp. Roys Peninsula		1	Monitor only (50% shoreline)	Planned February 2005

Table 1 lists areas of Lake Wanaka, according to treatment objectives, priority status, and treatment methods for 2004/05 together with methods successfully implemented.

A number of compromises were necessary when selecting methods and implementing the interim control programme (2004/05).

- *Cost of suction dredging:* Despite a three-fold increase in funding over and above 2003/04, funds were not sufficient to carry out control activities in all areas of the lake. The cost of suction dredging is very significant compared to other control methods and the amount of suction dredging needed resulted in decisions to defer work in two low density, lower priority areas. Accordingly West Wanaka Bay to the north shore of Roys Peninsula and The Peninsula, from Stevensons Arm to a point opposite Roys Peninsula, were removed from the 2004/05 programme.

  When suction dredging began, the density of Lagarosiphon was found to be higher than expected in all but one area. Funding constraints only allowed Mou Waho and Mou Tapu to be treated comprehensively; the remaining areas receiving limited or no treatment. A combination of Diquat and suction dredging was planned for a test case area within the Quartz Creek to Mt Burke shoreline, but Diquat proved ineffective so suction dredging was not carried out.

- *Use of Diquat:* High biomass beds from Pembroke Park to Eely Point and Glendhu Bay were initially to be reduced by the application of Diquat and then removed by suction dredging. Despite the very significant national and international research effort and long experience in the safe use of Diquat the Management Team was put into a position of withdrawing plans to use Diquat in these priority areas during the interim control programme. Delays in implementing the control programme pushed Diquat treatment into the early summer, a period of increasing use by swimmers. Having adopted the most conservative international safety protocols, preventing access to the water for swimmers in those two popular areas would have been difficult.

  Accordingly suction dredging took place along the high biomass Roys Bay - Eely Point lake shore in December 2004. Only a relatively small area could be treated cost effectively because of the quantity of weed present. As a result of this a length of the highest use shore remained heavily infested. For two areas that sustain the highest boat/craft launching and landings there are very serious implications of transferring Lagarosiphon to other places in the lake during 2004/05. In the absence of effective weed control methods, the only way of preventing spread is restricting boat/craft usage along this area - something that will need to be considered.

The interim and the "ideal" treatment scenarios for 2004/05

A comparison between the 2004/05 programme and the "Ideal Treatment Scenario" for all areas is presented in Table 2.

Table 2. Treatment of Lagarosiphon in Lake Wanaka: The actual and "ideal" treatment programmes for 2004/05 (areas arranged according to treatment objectives, priorities and treatment methods as in Table 1).

Treatment objective	Area	Ha	Priority	Interim Treatment 2004/05	Ideal Treatment Approach
Push back northern front	Mou Waho	0.05	1	Suction Dredge	Suction Dredge + Hand weed
	Mou Tapu	0.05	1	Suction Dredge	Suction Dredge + Hand weed
	Colquhouns - West Wanaka Bay	0.10	1	Herbicide (S)	Herbicide (S) + Suction Dredge
Clear amenity structures*	Pembroke Pk-Eely Pt (Roys Bay)	0.60	1	Suction Dredge (patches)	Herbicide (S) + Suction Dredge
Suppress high biomass beds	Paddock Bay	18.5	1	Herbicide (A)	Herbicide (A) + Suction Dredge
	Glendhu Bay – Point	1.6	1	Suction Dredge (None)	Herbicide (S) + Suction Dredge
	West Wanaka Bay	0.15	1	Herbicide (A)	Herbicide (A) + Suction Dredge
	Bishop Bay Bluff - Paddock Bay Narrows	0.15	2	Herbicide (S)	Herbicide (S) + Suction Dredge
	Parkins Bay	8.2	2	Herbicide (A)	Herbicide (A) + Suction Dredge
	Mt Burke - Quartz Creek	2.0	2	Herbicide (A) + Suction Dredge	Herbicide (A) + Suction Dredge
	The Isthmus	0.05	2	Herbicide (A)	Herbicide (A) + Suction Dredge
	Stevensons Island	0.03	2	Herbicide (A)	Herbicide (A) + Suction Dredge
Treat popular medium biomass areas	Stevensons Arm (excl Isthmus)	0.3	2	Herbicide (S)	Herbicide (S) + Suction Dredge
	Ruby Island	0.02	2	Suction Dredge (pier)	Suction Dredge + Hand weed
	Roys Penin - Bishop Bay Bluff	0.15	3	Herbicide (S)	Suction Dredge
Treat low density areas	The Point - Pembroke Park	0.65	3	Suction Dredge (patch)	Suction Dredge
	The Peninsula (Stevensons Arm - Point opp Roys Penin)	0.15	3	Treatment deferred	Suction Dredge
	West Wanaka Bay - Nth shore Roys Penin	0.01	2	Treatment deferred	Hand Weed
	Eely Point - Mt Burke Station	1.0	3	Diver Monitoring + Hand Weed	
Detect new growth	Colquhouns to Makarora R. to point opp. Roys Peninsula		1	Monitor only (50% shoreline)	Monitor only (Other 50% shoreline)
Total Cost				**$250 000+**	**$1 400 000**

Currently the “ideal” treatment scenario for high biomass weed beds is reduction in biomass followed by removal of the lower parts of the plant. Table 2 highlights just how critical suction dredging is to the control plan. It is also the most expensive part of the programme, costing approximately 12 times that of surface herbicide application, and double that of aerial application. Comparing the two scenarios shows that the “ideal” treatment scenario requires significantly greater resources than were available during 2004/05. Whilst the “ideal” scenario is not realistic at this time it does highlight the need for a very substantial increase in funding or more effective control applications and technologies if our goal of controlling Lagarosiphon is to be met.